VII—CHEMICAL WEED CONTROL

Chemical Weed Control in Field Corn

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NOTES: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10A, Herbicide Modes of Action, for details.

Control of witchweed is part of the State/Federal Quarantine Program. Contact the North Carolina Department of Agriculture, Plant Industry Division, at 1-800-206-9333.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
No-Till Burndown, Emerged annual weeds, top-kill and suppression of perennials			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.55 (lb a.e.)	Glyphosate is available as an isopropylamine salt, a potassium salt, and a dimethylamine salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. The rate in the preceding column is expressed as a.e. See TABLE 7-9 for glyphosate rate conversions. Apply before crop emerges. Glyphosate rate depends on weed species and weed size; see labels for suggested rates. See comments on labels concerning nitrogen as the carrier. Weed control may be decreased when nitrogen or other liquid fertilizers are used as carriers. Apply in 10 to 20 gallons of water per acre using flat fan nozzles. For residual grass and broadleaf weed control, glyphosate can be tank mixed with most preemergence corn herbicides and herbicide combinations. See the section on Corn—Preemergence. Refer to specific product labels for application rates, weeds controlled, application directions, and precautions. Adjuvant recommendations vary according to the glyphosate product used. See label of brand used for specific recommendations. May tank mix glyphosate with a thifensulfuron-containing product to improve control of curly dock, Carolina geranium, henbit, and wild garlic. Tank mix can be applied any time prior to corn emergence. See labels for details. May tank mix Resolve Q with glyphosate for improved control of henbit. Glyphosate and the above glyphosate tank mixes will not control field pansy. A tank mix of Gramoxone plus atrazine should be used where field pansy is present. Glyphosate-resistant horseweed (marestail) is now common in many North Carolina counties. A tank mix of glyphosate or Gramoxone plus either 1.5 to 2 pints of 2,4-D or 0.5 pint of Clarity is suggested. Apply these tank mixes 7 to 14 days ahead of planting. If horseweed is present at planting time, a tank mix of Gramoxone plus atrazine is suggested.
paraquat, MOA 22 (Gramoxone) 3 SL (numerous brands) 3 SL	1.33 to 2.67 pt	0.5 to 1.0	Apply before, during, or after planting but before crop emerges using clean water or clear fertilizer solution as the carrier. Apply in a minimum of 10 GPA (20 to 40 preferred) using flat fan nozzles. Add either a nonionic surfactant at 1 pint per 100 gallons or a crop oil concentrate at 1 gallon per 100 gallons. Use 0.5 to 0.64 pound a.e. on weeds 1 to 3 inches, 0.75 pound a.e. on weeds 3 to 6 inches, and 1 pound a.e. on weeds 6 inches or taller. Use 0.5 pound a.e. for rye cover crop or 0.75 pound a.e. for wheat cover crop. Rainfast within 30 minutes. For residual grass and broadleaf weed control, paraquat can be tank mixed with most preemergence corn herbicides and herbicide combinations. See the section on Corn—Preemergence. Refer to specific product labels for application rates, weeds controlled, application directions, and precautions. Better and more consistent burndown will be achieved with mixtures of paraquat plus atrazine than with paraquat alone. Additional brands include Devour, Helmquat, Paraquat 43.2% SL, Paraquat Concentrate, ParaShot 3.0, Quik-Quat, Jurgatory 3 SL, and Willowood Paraquat 3 SL. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.**
glufosinate-ammonium, MOA 10 (Liberty) 2.34 SL (numerous brands) 2.34 SL	32 to 43 fl oz	0.59 to 0.79	Glufosinate can be applied prior to emergence of transgenic or non-transgenic hybrids to control emerged weeds. See label for adjuvant use. If applied preplant, one application of glufosinate at 29 to 43 fl oz per acre may be applied in-season to LibertyLink varieties only. Total for the year is not to exceed 87 fl oz per acre. For best results, warm temperatures, high humidity, and bright sunlight improve glufosinate performance. Thorough spray coverage is necessary: a minimum of 20 GPA with flat fan nozzles is suggested. Additional brands include Fever, Forfeit 280, Glufosinate 280SL, Inflame 280SL, Noventa, Reckon 280SL, Refer 280SL, Surmise, Tide Glufosinate, and Total.
carfentrazone-ethyl, MOA 14 (Aim EC)	1.0 to 2.0 oz	0.016 to 0.031	Apply alone or with other herbicides or fertilizers as a burndown to control or suppress weeds. For optimum performance apply to actively growing weeds. Coverage is essential for good control. Broad-spectrum control of annual and perennial weeds requires a tank mix with herbicides such as glyphosate, Liberty, Gramoxone, 2,4-D or dicamba. Add either a nonionic surfactant at 2 pints per 100 gallons, or crop oil concentrate at 1 to 2 gallons per 100 gallons, or methylated seed oil.
pyraflufen-ethyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015	ET can be used for suppression of small, emerged summer annual and winter weeds. See label for adjuvant and spray volume recommendations. Research with ET is limited in North Carolina.
oxyfluorfen, MOA 14 (Goal 2XL) 2L (GoalTender) 4L	1.0 to 2.0 pt 0.5 to 1.0 pt	0.25 to 0.5	Goal 2XL can be applied at 30 days or more prior to corn planting to control common winter and summer annual weed species. After application but prior to corn planting, at least three significant rainfalls (0.25 inch or greater) must occur, otherwise Goal 2XL must be incorporated into the soil to a depth of 2.5 inches to avoid crop injury. A tank mix combination with glyphosate, paraquat, glufosinate, 2,4-D, or dicamba is recommended. See label for tank mix recommendations. Do not use corn plants from a treated field for green chop, ensilage, forage, or fodder.
No-Till Burndown, Glyphosate-resistant horseweed (marestail)			
flumioxazin, MOA 14 (Valor SX) 51% WDG + paraquat, MOA 22 (Gramoxone) 3 SL	2.0 oz 1.33 to 2.67 pt	0.063 0.5 to 1.0	Corn may be planted 7 days after application if a minimum of 25% of the soil surface is covered with residue and a minimum of ¼ inch of rainfall has occurred between application and planting, otherwise corn must be planted 14 to 30 days after application. Can be applied with other herbicides, including Clarity, 2,4-D and atrazine. Apply with non-ionic surfactant at 1 quart per 100 gallons. Carefully follow label directions for sprayer cleaning after each day's use. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.**

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
No-Till Burndown, Glyphosate-resistant horseweed (marestail) (continued)			
flumioxazin, MOA 14 + pyroxasulfone, MOA 15 (Fierce) 76% WDG + paraquat, MOA 22 (Gramoxone) 3 SL	 3.0 oz 1.33 to 2.67 pt	0.063 + 0.08 0.5 to 1.0	Corn may be planted 7 days after application if a minimum of 25% of the soil surface is covered with residue and a minimum of ¼ inch of rainfall has occurred between application and planting, otherwise corn must be planted 14 to 30 days after application. Can be applied with other herbicides, including Clarity, 2,4-D and atrazine. Apply with non-ionic surfactant at 1 quart per 100 gallons. Carefully follow label directions for sprayer cleaning after each day's use. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.**
saflufenacil, MOA 14 (Sharpen) 2.85 SC + glyphosate, MOA 9 (numerous brands and formulations)	 1.0 fl oz + See label	 0.022 + 0.75 to 1.55 (lb a.e.)	May be applied any time before corn emergence. Rate can be increased 2.0 to 2.5 oz for coarse-, 2.5 to 3.0 oz for medium-, or 3.0 to 3.5 oz for fine-textured soils if additional residual activity is desired. For optimum burndown activity, add methylated seed oil (MSO) at 1% by volume (1 gal per 100 gal solution) plus ammonium sulfate (AMS) at 1 to 2% by volume (8.5 to 17 lb per 100 gal solution) or urea ammonium nitrate (UAN) at 1.25 to 2.5% by volume (1.25 to 2.5 gal per 100 gal solution). See Sharpen label for specifics on use in seed corn. Do not apply where an organophosphate or carbamate insecticide has been applied.
tiafenacil, MOA 14 (Reviton) 2.83 SC + glyphosate, MOA 9 (numerous brands and formulations)	 1.0 to 3.0 fl oz + See label	 0.022 to 0.067 + 0.75 to 1.55 (lb a.e.)	May be applied any time before corn emergence. Add either methylated seed oil/crop oil concentrate at 1% by volume (1 gal per 100 gal). May also add urea ammonium nitrate at 2.5% by volume (2.5 gal per 100 gal) or spray grade ammonium sulfate at 8.5 lb product per 100 gal spray solution. DO NOT use liquid nitrogen fertilizer as the total carrier solution.
glyphosate, MOA 9 (numerous brands and formulations) + atrazine, MOA 5 (numerous brands) + 2,4-D, MOA 4 (numerous brands)	See labels	 0.75 to 1.55 (lb a.e.) + 1.0 to 2.0 + 0.75 to 1.0	See comments for glyphosate alone. Apply mixtures containing 2,4-D at least 7 to 14 days ahead of corn planting.
glyphosate, MOA 9 (numerous brands and formulations) + atrazine, MOA 5 (numerous brands) + dicamba, MOA 4 (numerous brands)	See labels	 0.75 to 1.55 (lb a.e.) + 1.0 to 2.0 + 0.25	See comments for glyphosate alone. Mixtures containing dicamba may be applied to medium- to fine-textured soils before or during planting. Do not apply to coarse-textured soils with less than 2.5% organic matter. Avoid contact of the herbicide with the seed by planting corn at least 1.5 inches deep and ensuring the furrow is closed.
glufosinate-ammonium, MOA 10 (Liberty 280 SL) + atrazine, MOA 5 (numerous brands)	29.0 fl oz + 1.0 to 2.0 qt	0.53 + 1.0 to 2.0	If applied preplant, one application of Liberty at 29 to 43 fl oz per acre may be applied in-season to LibertyLink varieties only. Total for the year is not to exceed 87 fl oz per acre. For best results, warm temperatures, high humidity, and bright sunlight improve glufosinate performance. Thorough spray coverage is necessary: a minimum of 20 GPA with flat fan nozzles is suggested.
No-Till Burndown or Preemergence			
saflufenacil, MOA 14 (Sharpen) 2.85 SC	2.0 to 3.5 fl oz	0.045 to 0.078	May be applied any time before corn emergence. Use 2.0 to 2.5 oz for coarse-, 2.5 to 3.0 oz for medium-, or 3.0 to 3.5 oz for fine-textured soils. To optimize burndown activity, add methylated seed oil at 1% by volume (1 gal per 100 gal solution) plus ammonium sulfate at 1 to 2% by volume (8.5 to 17 lb per 100 gal solution) or urea ammonium nitrate at 1.25 to 2.5% by volume (1.25 to 2.5 gal per 100 gal solution). See Sharpen label for specifics on use in seed corn. Do not apply where an organophosphate or carbamate insecticide has been applied.
tiafenacil, MOA 14 (Reviton) 2.83 SC	1.0 to 3.0 fl oz	0.22 to 0.067	May be applied any time before corn emergence. To optimize burndown activity, add methylated seed oil at 1% by volume (1 gal per 100 gal solution) plus ammonium sulfate at 1 to 2% by volume (8.5 lb per 100 gal solution) or urea ammonium nitrate at 2.5% by volume (1.25 to 2.5 gal per 100 gal solution).
dimethenamid-p, MOA 15 + saflufenacil, MOA 14 (Verdict) 5.57 EC	 10.0 to 16.0 oz	 0.44 to 0.65	Verdict can be used to control a range of grass and broadleaf weeds, including glyphosate-resistant horseweed. See label for adjuvant selection (burndown) and application rate based on soil texture and organic matter content. Corn injury from Verdict can occur when organophosphate or carbamate insecticides are applied to corn.
rimsulfuron, MOA 2 + thifensulfuron-methyl, MOA 2 (Leadoff) 33.4% WDG (Leopard) 33.4% WDG	1.5 to 2.7 oz	0.031 to 0.056	Leadoff or Leopard can be applied from fall up to planting to control a range of grass and broadleaf weeds. Including a non-selective herbicide to provide additional control of emerged weeds is recommended. See label for recommended adjuvants. The addition of atrazine will provide added residual and burndown activity.
thifensulfuron, MOA 2 + tribenuron, MOA 2 (FirstShot SG with TotalSol) 50% WDG	0.5 to 0.8 oz	0.008 to 0.013 + 0.008 to 0.013	FirstShot can be applied from fall up to 14 days before corn planting to control a range of broadleaf weeds. Including a non-selective herbicide to provide additional control of emerged weeds is recommended. See label for recommended adjuvants. The addition of atrazine will provide added residual and burndown activity.
pyroxasulfone, MOA 15 + carfentrazone, MOA 14 (Anthem Flex) 4 SC	 2.75 to 7.28 fl oz	0.08 to 0.212 + 0.006 to 0.015	Anthem Flex may be applied early preplant 15 to 45 days ahead of planting or PRE. Use 3.5 to 4.5 ounces per acre for coarse soils, 4.5 to 5.5 ounces for medium soils, and 5.0 to 7.28 for fine soils. When used PRE, use 2.75 to 5 ounces per acre for coarse soils, 3 to 6 ounces for medium soils, and 3.5 to 7.28 for fine soils. See label for rate adjustments according to organic matter content. Controls most annual grasses, pigweed, and nightshade. Provides suppression of Texas panicum, seedling johnsongrass, and shattercane. Will provide control of some small emerged broadleaf weeds (<2"). See label for tank mix options. For optimum burndown control, use 1 quart nonionic surfactant (NIS) per 100 gallons spray solution or 1 to 2 pints per acre crop oil concentrate (COC) or methylated seed oil (MSO); also add 1 to 2 quarts per acre UAN or spray grade AMS. See label for tank mix options.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, Small-seeded broadleaf weeds, annual grasses; control or suppression of yellow nutsedge			
acetochlor, MOA 15 (Harness) 7 EC (Surpass NXT) 7 EC (Warrant) 3 ME (Enversa) 3 CS	 1.25 to 3.0 pt 1.5 to 3.0 pt 3.0 to 6.0 pt 3.0 to 6.0 pt	 1.09 to 2.63 1.2 to 2.63 1.13 to 2.25 1.13 to 2.25	Controls most annual grasses, pigweed, and nightshade. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Controls yellow nutsedge when incorporated; suppresses yellow nutsedge if applied preemergence. Do not apply acetochlor within 50 ft of any well where the depth to ground water is 30 ft or less on the following soil types: sands with less than 3% organic matter, loamy sands with less than 2% organic matter, or sandy loams with less than 1% organic matter. Read label and adjust rates for soil texture, organic matter, and tillage system. Slightly higher rates can be used for no-till or minimum-till systems. On conventionally tilled soils, Harness and Surpass NXT can be used at rates of 2.5 to 3.4 pints on soils with 6% to 10% organic matter and 3.4 pints on soils with greater than 10% organic matter. Surpass can be used at rates up to 3.75 pints on soils with greater than 7% organic matter. These herbicides can be shallowly incorporated; see labels for details. See labels for rotational crops. May be tank mixed with atrazine or simazine for broadleaf weed control. Surpass and TopNotch contain the safener dichlormid. May be applied to emerged corn up to 11 inches tall. Does not control emerged weeds. See labels for tank mix options to control emerged weeds.
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	12.0 to 21.0 fl oz	0.56 to 1.0	Use 12 to 18 fluid ounces on soils with less than 3% organic matter and 14 to 21 fluid ounces on soils with greater than 3% organic matter. Controls most annual grasses and pigweed. At higher rates, controls nightshade and yellow nutsedge. Better yellow nutsedge control if incorporated; see label for incorporation details. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Read label and adjust rates for soil texture and organic matter. May be mixed with atrazine or simazine for broadleaf weed control. Do not apply to sandy soil with less than 3% organic matter where depth to groundwater is 30 ft or less. May be applied over the top of corn up to 12 inches tall or with drop or directed nozzles up to 36-inch-tall corn. Does not control emerged weeds. See labels for tank mix options to control emerged weeds.
metolachlor, MOA 15 (Me-Too-Lachlor II) 7.8 EC (Parallel) 7.8 EC	1.0 to 2.0 pt	0.98 to 1.95	See comments for *S*-metolachlor products. Products containing *S*-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pints of a metolachlor product to get the activity one would get from 1 pint of an *S*-metolachlor product.
S-metolachlor, MOA 15 (Brawl II) 7.64 EC (Dual II Magnum) 7.64 EC (Medal II) 7.64 EC	1.0 to 2.0 pt	0.96 to 1.91	Controls most annual grasses and pigweed. At higher rates, controls nightshade and yellow nutsedge. Better yellow nutsedge control if incorporated; see label for incorporation details. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Read labels and adjust rates for soil texture and organic matter. May be mixed with atrazine or simazine for broadleaf weed control. May be applied to emerged corn up to 40 inches tall. Direct if corn is taller than 5 inches. Does not control emerged weeds. See labels for tank mix options to control emerged weeds.
pyroxasulfone, MOA 15 (Zidua SC) 4.17 SC	2.5 to 6.5 fl oz	0.08 to 0.212	Use 2.5 to 4.5 fluid ounces of Zidua SC per acre on coarse soils, 3.25 to 5 fluid ounces of Zidua SC on medium soils, and up to 6.5 fluid ounces of Zidua SC per acre on fine-textured soils. Controls most annual grasses, pigweed, and nightshade. Provides suppression of Texas panicum, seedling johnsongrass, and shattercane. May be mixed with atrazine or Sharpen for broadleaf weed control. May be applied to emerged corn up to the V4 stage. Does not control emerged weeds. See label for tank mix options to control emerged weeds.
pyroxasulfone, MOA 15 + fluthiacet-methyl, MOA 14 (Anthem Maxx) 4.3 SC	2.5 to 6.5 fl oz	0.082 to 0.212 + 0.002 to 0.006	Use 2.5 to 4 ounces per acre on coarse soils, 2.5 to 5.5 ounces for medium soils, and 3 to 6.5 ounces on fine-textured soils. See label for rate adjustments according to organic matter content. Controls most annual grasses, pigweed, and nightshade. Provides suppression of Texas panicum, seedling johnsongrass, and shattercane. May be applied to emerged corn through V4 stage. Will provide control of some small emerged broadleaf weeds (<2"). See label for tank mix options.
pyroxasulfone, MOA 15 + carfentrazone, MOA 14 (Anthem Flex) 4 SC	2.75 to 7.28 fl oz	0.08 to 0.212 + 0.006 to 0.015	For Anthem Flex, use 2.75 to 5 ounces per acre for coarse soils, 3 to 6 ounces for medium soils, and 3.5 to 7.28 for fine soils. See label for rate adjustments according to organic matter content. Controls most annual grasses, pigweed, and nightshade. Provides suppression of Texas panicum, seedling johnsongrass, and shattercane. Will provide control of some small emerged broadleaf weeds (<2"). See label for tank mix options.
pyroxasulfone, MOA 15 + saflufenacil, MOA 14 (Surtain) 4 SC	9.2 to 17 fl oz	0.07 to 0.13 + 0.045 to 0.08	Surtain includes an encapsulated formulation of saflufenacil. Controls most broadleaf weeds and grasses. Provides suppression of Texas panicum. Use 9.2 to 11 fl oz/A on coarse soils, 11 to 14 fl oz/A on medium soils and 11 to 17 fl oz/A on fine soils. May be applied postemergence up to V3 corn. Will need a tank mix partner like atrazine and/or glyphosate to control emerged weeds. Do not mix with glufosinate when applied postemergence. Do not apply with MSO when applied postemergence.
Preemergence, Annual broadleaf weeds			
atrazine, MOA 5 (AAtrex 4L) 4 F (AAtrex Nine-O) 90% WDG	 1.0 to 2.0 qt 1.1 to 2.2 lb	1.0 to 2.0	Do not exceed 1.6 pounds a.i. on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. Do not exceed 2 pounds a.i. on any soil. See labels for comments on rotational crops. May be applied preplant incorporated; see labels for details. May be tank mixed with preemergence grass control herbicides. Generic brands of atrazine are available, including products containing 5 pounds per gallon. See label for details on setback requirements from streams and lakes.
isoxaflutole, MOA 27 (Balance FLEXX) 2 L	3.0 to 6.0 fl oz	0.047 to 0.09	Controls most broadleaf weeds, some annual grasses. Do not exceed 3 fluid ounces on coarse soils with 1.5% organic matter or less. May be tank mixed with preemergence grass control herbicides. Addition of atrazine will help extend residual control of broadleaf weeds such as morningglory species. May be applied postemergence up to 2-leaf collar corn. See labels for comments on rotational crops. May be applied preplant incorporated; see labels for details. See label for pH, groundwater, and soil texture recommendations.
mesotrione, MOA 27 (Callisto) 4 F	6.0 to 7.7 oz	0.19 to 0.24	Controls pigweed, lambsquarters, jimsonweed, common ragweed, smartweed, velvetleaf, and nightshade. Does not control sicklepod or prickly sida. Not adequately effective on cocklebur or morningglory. Callisto is generally more effective when applied postemergence. No rotational restrictions for small grains or for other crops planted the following spring. Can mix with various preemergence grass control herbicides or with atrazine or atrazine-containing products. See precautions on label concerning use of Counter and Lorsban.
Preemergence, Most annual grasses and broadleaf weeds			
acetochlor, MOA 15 + atrazine, MOA 5 (Degree Xtra) 4.04 FME (FulTime NXT) 4.04 FME	2.9 to 3.7 qt	2.0 to 2.5 + 1.0 to 1.25	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane Do not apply acetochlor within 50 ft of any well where the depth to ground water is 30 ft or less on the following soil types: sands with less than 3% organic matter, loamy sands with less than 2% organic matter, or sandy loams with less than 1% organic matter. Read labels and adjust rates for soil texture and organic matter. See labels for comments on rotational crops. May be incorporated; see labels for details. See labels for details on setback requirements from streams and lakes. Do not exceed 1.6 pounds a.i. atrazine on highly erodible soils (as defined by NRCS) with less than 30% plant residue cover. Degree Xtra and FulTime NXT contains 2.7 pounds acetochlor and 1.34 pounds atrazine per gallon. Harness Xtra and Keystone NXT contain 3.1 pounds acetochlor and 2.5 pounds atrazine per gallon. FulTime contains 2.4 pounds acetochlor and 1.6 pounds atrazine per gallon. These products and certain tank mixes may also be applied early postemergence; see labels for details.
acetochlor, MOA 15 + atrazine, MOA 5 (Harness Xtra) 5.6 SE (Keystone NXT) 5.6 F	1.4 to 3.0 qt	1.1 to 2.3 + 0.9 to 1.9	
acetochlor, MOA 15 + mesotrione, MOA 27 (Harness MAX) 3.85 SE	55.0 to 88.0 fl oz	1.51 to 2.42 + 0.142 to 0.227	Controls pigweed, lambsquarters, jimsonweed, common ragweed, smartweed, velvetleaf, nightshade, and most annual grasses. Does not control Texas panicum, sicklepod or prickly sida. Not adequately effective on cocklebur or morningglory. Use lower rates on coarse-textured soils with less than 3% organic matter and higher rates on finer textured soils with more than 3% organic matter. See label for specific details on use rates according to soil texture and organic matter content. On medium- and fine-textured soils, up to 95 fl oz per acre may be used in areas of heavy weed infestations. On soils with 6 to 10% organic matter use 81 to 95 fl oz per acre and on soils with more than 10% organic matter use 95 fl oz per acre.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, Most annual grasses and broadleaf weeds (continued)			
atrazine, MOA 5 (AAtrex 4L) 4 F (AAtrex Nine-O) 90% WDG + simazine, MOA 5 (Princep 4L) 4 F (Princep Caliber 90) 90% WDG	2.0 to 3.0 pt 1.1 to 1.6 lb + 1 to 1.44 qt 1.1 to 1.6 lb	1.0 to 1.5 1.0 to 1.44 + 1.0 to 1.44	Controls most annual broadleaf weeds plus crabgrass, goosegrass, fall panicum, and foxtails. Does not control Texas panicum, broadleaf signalgrass, seedling johnsongrass, or shattercane. Can be incorporated; see labels for details. Can use a 1:2 ratio of atrazine to simazine on more severe annual grass problems. If using 1:2 ratio, atrazine rates are 0.66 to 0.96 pound a.i. and simazine rates are 1.34 to 1.92 pounds a.i. Read label and adjust rates to soil texture. See labels for rotational restrictions and other precautions. Generic brands of simazine and atrazine are available, including atrazine products containing 5 pounds per gallon. See atrazine label for details on setback requirements from streams and lakes.
metolachlor, MOA 15 + atrazine, MOA 5 (Parallel Plus) 5.5 F	1.4 to 2.83 qt	0.95 to 1.9 + 1.0 to 2.0	See below comments for *S*-metolachlor plus atrazine. Products containing *S*-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor.
S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 F (Brawl II ATZ) 5.5 F (Cinch ATZ) 5.5 F (Medal II AT) 5.5 F	1.3 to 2.6 qt	0.78 to 1.56 + 1.0 to 2.0	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. Rates for coarse-textured soils may not give sufficient control of heavy fall panicum, broadleaf signalgrass, and other grassy weeds. Cultivation or an additional herbicide application may be needed. Read label and adjust rates for soil texture and organic matter. Do not exceed 2.1 quarts on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. See labels for comments on rotational crops. May be applied preplant incorporated; see labels for details. See label for details on setback requirements from streams and lakes. These products contain 2.4 pounds of *S*-metolachlor and 3.1 pounds atrazine per gallon. May be applied early postemergence; see label for details.
S-metolachlor, MOA 15 + atrazine, MOA 5 + mesotrione, MOA 27 (Lexar EZ) 3.7 L	3.0 to 3.5 qt	1.3 to 1.5 + 1.3 to 1.5 + 0.17 to 0.20	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. May not adequately control cocklebur, morningglory, or sicklepod. Use 3 quarts on soils with less than 3% organic matter; use 3.5 quarts on soils with greater than 3% organic matter. Not recommended on soils with greater than 10% organic matter. See label for setback requirements from streams and lakes. May be applied postemergence to corn up to 12 inches tall; see label for tank mixes to control grasses when applying postemergence. Lexar EZ contains 1.74 pounds S-metolachlor, 1.74 pounds atrazine, and 0.224 pound mesotrione per gallon. Lumax EZ contains 2.49 pounds S-metolachlor, 0.935 pound atrazine, and 0.249 pound mesotrione per gallon. Lexar EZ and Lumax EZ include an enhanced capsule-suspension formulation for better handling.
S-metolachlor, MOA 15 + atrazine, MOA 5 + mesotrione, MOA 27 (Lumax EZ) 3.67 L	2.7 to 3.25 qt	1.68 to 2.02 + 0.63 + 0.76 + 0.168 + 0.202	
S-metolachlor, MOA 15 + tolpyralate, MOA 27 (Empyros) 3.82 EC	0.75 to 1.4 qt	0.7 to 1.3 + 0.019 to 0.035	May applied up to 14 days preplant or preemergence. Contains the safener benoxacor. In a two-pass program that includes Halex GT applied postemergence, apply Empyros at 0.75 qt per acre on soils with <3% organic matter and 1 qt per acre on soils with >3% organic matter. Apply to actively growing weeds before weeds exceed 3 inches in height. Add either 1 quart nonionic surfactant per 100 gallons spray solution or 1 gallon crop oil concentrate or 1 gallon methylated seed oil per 100 gallons spray solution. The use of crop oil concentrate or methylated seed oil will provide more consistent weed control. In addition to nonionic surfactant or crop oil concentrate or methylated seed oil, a nitrogen-based adjuvant (AMS or UAN) may be added to improve weed control. Do not use methylated seed oil if corn has emerged. Does not control sicklepod and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. Research on Empyros applied preemergence is limited in North Carolina.
isoxaflutole, MOA 27 + thiencarbazone-methyl, MOA 2 (Corvus) 2.63 SC	3.33 to 5.6 fl oz	0.0489 to 0.0823 + 0.0195 to 0.0328	Controls most broadleaf weeds and annual grasses. Do not exceed 3.33 fluid ounces on coarse soils with 2.0% organic matter or less. The addition of atrazine will help extend residual control of broadleaf weeds such as morningglory species. May be applied postemergence up to 2-leaf collar corn. See label for pH, groundwater, and soil texture specific recommendations.
S-metolachlor, MOA 15 + atrazine, MOA 5 + mesotrione, MOA 27 + bicyclopyrone, MOA 27 (Acuron) 3.44 L	2.5 to 3.0 qt	1.34 to 1.61 + 0.625 to 0.75 + 0.15 to 0.18 + 0.038 to 0.045	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. May need a tank-mix for control of heavy infestations of broadleaf signalgrass. Use 2.5 quarts on soils with less than 3% organic matter; use 3.0 quarts on soils with greater than 3% organic matter. Not recommended on soils with greater than 10% organic matter. See label for setback requirements from streams and lakes. May be applied postemergence to corn up to 12 inches tall; see label for tank mixes to control grasses when applying postemergence. Acuron contains 2.14 pounds S-metolachlor, 1.0 pound atrazine, 0.24 pound mesotrione, and 0.06 pounds bicyclopyrone per gallon.
S-metolachlor, MOA 15 + mesotrione, MOA 27 + bicyclopyrone, MOA 27 (Acuron Flexi) 3.26 L	2.0 to 2.25 qt	1.43 to 1.61 + 0.16 to 0.18 + 0.04 to 0.045	Acuron Flexi does not contain atrazine. Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. May need a tank-mix for control of heavy infestations of broadleaf signalgrass. Use 2 quarts on soils with less than 3% organic matter; use 2.25 quarts on soils with greater than 3% organic matter. Not recommended on soils with greater than 10% organic matter. See label for setback requirements from streams and lakes. May be applied postemergence to corn up to 30 inches tall or 8-leaf growth stage; see label for tank mixes to control grasses when applying postemergence. Acuron Flexi contains 2.86 pounds S-metolachlor, 0.32 pound mesotrione, and 0.08 pound bicyclopyrone per gallon.
acetochlor, MOA 15 + flumetsulam, MOA 2 + clopyralid, MOA 4 (SureStart II) 4.25 L (TripleFLEX II) 4.25 L	1.5 to 3.0 pt	0.7 to 1.41 + 0.023 to 0.045 + 0.07 to 0.143	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. Do not apply to sands with less than 3% organic matter, loamy sands with less than 2% organic matter, or sandy loams with less than 1% organic matter if groundwater depth is 30 feet or less. Read label and adjust rates for soil texture and organic matter. Tobacco, cotton, and peanuts cannot be planted for 18 to 26 months after application of SureStart II or TripleFLEX II; see label for comments on rotational crops. May be incorporated; see labels for details. This product and certain tank mixes may also be applied early postemergence; see label for details.
acetochlor, MOA 15 + mesotrione, MOA 27 + clopyralid, MOA 4 (Resicore) 3.29 L	2.25 to 3.0 qt	1.58 to 2.1 + 0.169 to 0.225 + 0.107 to 0.143	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. A tank mix with atrazine is preferred. Do not apply to sands with less than 3% organic matter, loamy sands with less than 2% organic matter, or sandy loams with less than 1% organic matter if groundwater depth is 30 ft or less. Read label and adjust rates for soil texture and organic matter. The addition of atrazine will improve weed control. Cotton may be planted 12 months after application of Resicore; tobacco and peanuts can be planted after 18 months. See label for comments on rotational crops. May be incorporated; see labels for details. This product and certain tank mixes may also be applied early postemergence; see label for details.
acetochlor, MOA 15 + mesotrione, MOA 27 + clopyralid, MOA 4 (Resicore XL) 3.26 L	2.25 to 3.0 qt	1.58 to 2.1 + 0.152 to 0.203 + 0.107 to 0.143	Resicore XL has slightly less mesotrione compared to Resicore. Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. A tank mix with atrazine is preferred. Do not apply to sands with less than 3% organic matter, loamy sands with less than 2% organic matter, or sandy loams with less than 1% organic matter if groundwater depth is 30 ft or less. Read label and adjust rates for soil texture and organic matter. The addition of atrazine will improve weed control. Cotton may be planted 12 months after application of Resicore XL; tobacco and peanuts can be planted after 18 months. See label for comments on rotational crops. May be incorporated; see labels for details. This product and certain tank mixes may also be applied early postemergence; see label for details.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, Most annual grasses and broadleaf weeds (continued)			
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 L + atrazine, MOA 5 (AAtrex 4L) 4 F (AAtrex Nine-O) 90% WDG	 1.8 to 3.6 pt 2.0 to 4.0 pt + 1.0 to 2.0 qt 1.1 to 2.2 lb	 0.75 to 1.5 0.95 to 1.9 + 1.0 to 2.0	Annual grass control is more variable and sometimes less acceptable with this combination than with alternatives. Suggested for use only on fields with light annual grass pressure. Do not apply to excessively wet soils. Read label and adjust rates to soil texture and organic matter. Do not exceed 1.6 pounds a.i. atrazine on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. See labels for comments on rotational crops. Do NOT incorporate. See atrazine label for details on setback requirements from streams and lakes. Generic brands of atrazine (including products containing 5 pounds/gallon) and pendimethalin (such as Acumen, Helena Pendimethalin, Pendant, Pendimax, and Stealth, all containing 3.3 pounds/gallon) are available.
Early Postemergence, Small annual broadleaf and grass weeds			
atrazine, MOA 5 (AAtrex 4L) 4 F (AAtrex Nine-O) 90% WDG	 2.0 qt 2.2 lb	2.0	Atrazine can be sprayed overtop of corn as an early postemergence treatment. Must be applied before weeds are over 1.5 inches tall to be effective and before corn exceeds 12 inches tall. Not effective during drought. Add 1 quart per acre of crop oil concentrate. If an earlier application was made, the total atrazine applied may not exceed 2.5 pounds a.i. per acre per year. See label for details on setback requirements from streams and lakes. May be tank mixed with preemergence grass control herbicides. When tank mixing, check respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands are available, including products containing 5 pounds per gallon.
acetochlor, MOA 15 + atrazine, MOA 5 (Degree Xtra) 4.04 FME (FulTime NXT) 4.04 FME	 2.9 to 3.7 qt	2.0 to 2.5 + 1.0 to 1.25	Apply as a very early postemergence application to weeds no larger than 2 leaves and before corn exceeds 11 inches. Adjust rates for soil types as specified on labels. See remarks concerning soil type limitations, setback requirements from streams and lakes, and rotational crops under Field Corn—Preemergence. May be tank mixed with several other herbicides to control emerged weeds. If an atrazine-containing herbicide was applied earlier, the total amount of atrazine per acre per season should not exceed 2.5 pounds a.i.
acetochlor, MOA 15 + atrazine, MOA 5 (Harness Xtra) 5.6 SE (Keystone NXT) 5.6 L	 1.4 to 3.0 qt	1.1 to 2.3 + 0.9 to 1.9	
acetochlor, MOA 15 + mesotrione, MOA 27 (Harness MAX) 3.85 SE	 40.0 to 75.0 fl oz	1.1 to 2.06 + 0.103 to 0.193	May be applied to corn up to 11 inches in height. Apply to actively growing weeds before weeds exceed 3 inches in height. Add either 1 quart nonionic surfactant per 100 gallons spray solution or 1 gallon crop oil concentrate per 100 gallons spray solution. Controls most broadleaf weeds. Partial control of common ragweed and morningglory. Does not control sicklepod or prickly sida. Use lower rates on coarse-textured soils with less than 3% organic matter and higher rates on finer textured soils with more than 3% organic matter. See label for specific details on use rates according to soil texture and organic matter content. On medium- and fine-textured soils, up to 75 fl oz per acre may be used in areas of heavy weed infestations. On soils with more than 6% organic matter use 75 fl oz per acre. Do not make a second application of Harness MAX within 14 days of the first application. See label for specified tank mixtures.
acetochlor, MOA 15 + tolpyralate, MOA 27 (Restraint) 6.498 EC	 30 to 48 fl oz	1.5 to 2.4 + 0.022 to 0.035	May be applied preplant (no more than 30 days before planting), preemergence, or postemergence to corn up to 11 inches in height. Use lower rates for coarse-textured soils with < 3% organic matter and higher rates for finer-textured soils with > 3% organic matter. Add either 1 gallon crop oil concentrate per 100 gallons spray solution or 1 quart nonionic surfactant per 100 gallons spray solution. Occasional corn leaf burn may result, but this will not affect later growth or corn yield. Research on Restraint is limited in North Carolina.
S-metolachlor, MOA 15 + tolpyralate, MOA 27 (Empyros) 3.82 EC	 1.4 qt	1.3 + 0.035	May be applied to corn up to 20 inches in height or up to the V6 stage; application prior to 12-inch corn preferred. May also be applied up to 14 days preplant or preemergence. Contains the safener benoxacor. Apply to actively growing weeds before weeds exceed 3 inches in height. Add either 1 quart nonionic surfactant per 100 gallons spray solution or 1 gallon crop oil concentrate per 100 gallons spray solution. The use of crop oil concentrate will provide more consistent weed control but may also result in temporary crop injury. In addition to nonionic surfactant or crop oil concentrate, a nitrogen-based adjuvant (AMS or UAN) may be added to improve weed control but increases risk of crop injury. Do not use methylated seed oil. Does not control sicklepod and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. Occasional corn leaf burn may result, but this will not affect later growth or corn yield.
acetochlor, MOA 15 + flumetsulam, MOA 2 + clopyralid, MOA 4 (SureStart II) 4.25 L (TripleFLEX II) 4.25 L	 1.5 to 3.0 pt	0.7 to 1.41 + 0.023 to 0.045 + 0.07 to 0.143	Apply as a very early postemergence application to broadleaf weeds no larger than 2 inches and before corn exceeds 11 inches. Established or germinated grass weeds present at application will not be controlled. May be tank mixed with several other herbicides to control emerged weeds. Adjust rates for soil types as specified on label. See remarks concerning soil type limitations and rotational crops under Field Corn—Preemergence. Tobacco, cotton, and peanuts cannot be planted for 18 to 26 months after application of SureStart II or TripleFLEX II, see label for comments on rotational crops. See label for organophosphate or carbamate restrictions/precautions.
metolachlor, MOA 15 + atrazine, MOA 5 (Parallel Plus) 5.5 F	 1.4 to 2.83 qt	0.95 to 1.9 + 1.0 to 2.0	See below comments for *S*-metolachlor plus atrazine products. Products containing *S*-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor.
S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 L (Brawl II ATZ) 5.5 F (Cinch ATZ) 5.5 L (Medal II AT) 5.5 F	 1.6 to 2.6 qt	0.96 to 1.56 + 1.24 to 2.0	Apply as a very early postemergence application to weeds no larger than two leaves and before corn exceeds 5 inches. See remarks for these products under Field Corn—Preemergence. If an atrazine-containing herbicide was applied earlier, the total amount of atrazine per acre per season should not exceed 2.5 pounds a.i. See label for details on setback requirements from streams and lakes.
mesotrione, MOA 27 + atrazine, MOA 5 (Callisto Xtra) 3.7 L	 20.0 to 24.0 fl oz	0.078 to 0.093 + 0.5 to 0.6	May be applied to corn up to 12 inches tall. Add nonionic surfactant at 1 quart per 100 gallons spray solution or crop oil concentrate at 1 gallon per 100 gallons spray solution. In addition, a spray grade urea ammonium nitrate or ammonium sulfate is also recommended. Do not use methylated seed oil or adjuvant blends containing methylated seed oil or severe crop injury may occur. Can be mixed with Liberty on LibertyLink corn or glyphosate on Roundup Ready corn.
topramezone, MOA 27 + atrazine, MOA 5 (ImpactZ) 4.26 L	 8.0 to 10.7 fl oz	0.0163 to 0.0217 + 0.25 to 0.334	May be applied to corn up to 12 inches tall. Label suggests methylated seed oil or high surfactant methylated oil concentrate at 1 to 1.5 gallons per 100 gallons spray solution; however, nonionic surfactant at 1 quart per 100 gallons spray solution can be substituted when corn is tender early in the season. Also add UAN at 1.25 to 2.5 gallons per 100 gallons spray solution or AMS at 8.5 to 17 pounds per 100 gallons spray solution. Corn response is greater when tank mixed with oil-based residual herbicides. In this situation, a reduced adjuvant rate is recommended to minimize injury. Do not exceed 10.7 fl oz ImpactZ per acre per season.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Early Postemergence, Small annual broadleaf and grass weeds (continued)			
topramezone, MOA 27 + acetochlor, MOA 15 (Impact CORE) 7.15 EC	20 to 40 fl oz	0.011 to 0.022 + 1.11 to 2.21	May be applied to corn from emergence up to 11 inches tall. Label suggests methylated seed oil at 0.25 to 0.5% by volume (1 to 2 quarts per 100 gallons spray solution) or high surfactant methylated oil concentrate at 0.125 to 0.25% by volume (1 to 2 pints per 100 gallons spray solution); however, nonionic surfactant at 0.25% by volume (1 quart per 100 gallons spray solution) is recommended when tank-mixing with glyphosate-containing herbicides. Also add urea ammonium nitrate at 1.25 to 2.5 gallons per 100 gallons spray solution or spray grade ammonium sulfate at 1.5 to 2.5 pounds per acre. Use lower rates (20 to 24 fl oz per acre) on coarse-textured soils with < 3% organic matter and higher rates (34 to 40 fl oz per acre) on fine-textured soils with > 3% organic matter. Leaf burn and occasional leaf bleaching may occur; however, corn development and yield are not affected. Research on Impact CORE is limited in North Carolina.
topramezone, MOA 27 + acetochlor, MOA 15 + clopyralid, MOA 4 (Kyro) 3.073 ME	35 to 60 fl oz	0.0126 to 0.0216 + 0.76 to 1.3 + 0.068 to 0.116	May be applied to corn from emergence up to 24 inches tall. When used alone, label suggests methylated seed oil or high surfactant methylated oil concentrate at 0.5 to 1% by volume (0.5 to 1 gallon per 100 gallons spray solution); however, nonionic surfactant at 0.25 to 0.5% by volume (1 to 2 quart per 100 gallons spray solution) is recommended when tank-mixing with other pesticides. Also add urea ammonium nitrate at 1.25 to 2.5 gallons per 100 gallons spray solution or spray grade ammonium sulfate at 8.5 to 17 pounds per 100 gallons spray solution. If mixing with glyphosate or glufosinate including an adjuvant system, only spray-grade AMS at 8.5 pounds per 100 gallons spray solution is needed. If the glyphosate product calls for an adjuvant use a nonionic surfactant at 0.25% by volume (1 quart per 100 gallons spray solution) and AMS. **DO NOT** add urea ammonium nitrate or crop oil concentrate when mixing with glufosinate. Leaf burn and occasional leaf bleaching may occur; however, corn development and yield are not affected. Adding atrazine is recommended to improve postemergence and residual activity. For postemergence control of most grasses (4 inches or less in height), a minimum use rate of 45 fl oz per acre is suggested. To control broadleaf weeds larger than 4 inches in height and/or provide extended residual control, apply 45 to 60 fl oz per acre. Research on Kyro is limited in North Carolina.
S-metolachlor, MOA 15 + atrazine, MOA 5 + mesotrione, MOA 27 (Lexar EZ) 3.7 L	3.0 to 3.5 qt	1.3 to 1.5 + 1.3 to 1.5 + 0.17 to 0.20	May be applied to corn up to 12 inches tall. Add nonionic surfactant according to label directions. Do not apply to Counter-treated corn. Application to corn treated with other organophosphate insecticides may cause injury. Do not apply in liquid fertilizer or severe crop injury may occur. Lumax EZ has less atrazine per gallon of product than Lexar EZ. For this reason, postemergence control may not be as consistent.
S-metolachlor, MOA 15 + atrazine, MOA 5 + mesotrione, MOA 27 (Lumax EZ) 3.67 L	2.7 to 3.25 qt	1.68 to 2.02 + 0.63 + 0.76 + 0.168 + 0.202	
S-metolachlor, MOA 15 + atrazine, MOA 5 + mesotrione, MOA 27 + bicyclopyrone, MOA 27 (Acuron) 3.44 L	2.5 to 3.0 qt	1.34 to 1.61 + 0.625 to 0.75 + 0.15 to 0.18 + 0.038 to 0.045	May be applied to corn up to 12 inches tall. Add nonionic surfactant according to label directions. Do not apply to Counter-treated corn. Application to corn treated with other organophosphate insecticides may cause injury. Occasional corn leaf burn may result, but this will not affect later growth or corn yield.
S-metolachlor, MOA 15 + mesotrione, MOA 27 + bicyclopyrone, MOA 27 (Acuron Flexi) 3.26 L	2.0 to 2.25 qt	1.43 to 1.61 + 0.16 to 0.18 + 0.04 to 0.045	Acuron Flexi does not contain atrazine. May be applied postemergence to corn up to 30 inches tall or 8-leaf growth stage; see label for tank mixes to control grasses. Add nonionic surfactant according to label directions. Do not apply to Counter-treated corn. Application to corn treated with other organophosphate insecticides may cause injury. Occasional corn leaf burn may result, but this will not affect later growth or corn yield.
S-metolachlor, MOA 15 + mesotrione, MOA 27 + bicyclopyrone, MOA 27 + glyphosate, MOA 9 (Acuron GT) 4.295 L	3.75 pt	0.94 + 0.094 + 0.045 + 0.94	Acuron GT includes glyphosate but does not contain atrazine. May be applied postemergence to corn up to 30 inches tall or 8-leaf growth stage; see label for tank mixes to control grasses. Add nonionic surfactant according to label directions. Do not apply to Counter-treated corn. Application to corn treated with other organophosphate insecticides may cause injury. Occasional corn leaf burn may result, but this will not affect later growth or corn yield. Research on Acuron GT is limited in North Carolina.
acetochlor, MOA 15 + mesotrione, MOA 27 + clopyralid, MOA 4 (Resicore) 3.29 L	2.25 to 3.0 qt	1.58 to 2.1 + 0.169 to 0.225 + 0.107 to 0.143	Apply as a very early postemergence application to broadleaf weeds no larger than 3 inches and before corn exceeds 11 inches. Control of emerged grass weeds will not be consistent. May be tank mixed with several other herbicides to control emerged weeds. Adjust rates for soil types as specified on label. See remarks concerning soil type limitations and rotational crops under Field Corn — Preemergence. Cotton may be planted 12 months after application of Resicore; tobacco and peanuts can be planted after 18 months. See label for comments on rotational crops. See label for organophosphate or carbamate restrictions/ precautions.
acetochlor, MOA 15 + mesotrione, MOA 27 + clopyralid, MOA 4 (Resicore XL) 3.26 L	2.25 to 3.0 qt	1.58 to 2.1 + 0.152 to 0.203 + 0.107 to 0.143	Resicore XL has slightly less mesotrione compared to Resicore. Apply as a very early postemergence application to broadleaf weeds no larger than 3 inches and before corn exceeds 24 inches Controls most broadleaf weeds and annual grasses. Control of emerged grass weeds will not be consistent. May be tank mixed with several other herbicides to control emerged weeds. Adjust rates for soil types as specified on label. See remarks concerning soil type limitations and rotational crops under Field Corn — Preemergence. Cotton may be planted 12 months after application of Resicore XL; tobacco and peanuts can be planted after 18 months. See label for comments on rotational crops. See label for organophosphate or carbamate restrictions/precautions.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Early Postemergence, Small annual broadleaf and grass weeds (continued)			
pyroxasulfone, MOA 15 + mesotrione, MOA 27 + clopyralid, MOA 4 (Maverick) 2.215 SC	14 fl oz	0.076 + 0.091 + 0.057	May be applied to corn from emergence up to V6 or 18 inches in height. May also be used preemergence at ≤ 18 ounces for course soils, ≤ 24 ounces for medium soils, and ≤ 32 ounces for fine soils. Only one application is allowed per year on course or medium soils. For emerged weeds, add a nonionic surfactant at 0.25% by volume (1 quart per 100 gallons spray solution) or crop oil concentrate at 1% by volume (1 gallon per 100 gallons spray solution). The use of crop oil concentrate may result in temporary crop injury. **DO NOT** use UAN or methylated seed oil. If mixing with glyphosate or glufosinate including an adjuvant system, only spray-grade AMS at 8.5 pounds per 100 gallons spray solution is needed. If the glyphosate product calls for an adjuvant, use a nonionic surfactant at 0.25% by volume (1 quart per 100 gallons spray solution) and AMS. Leaf burn and occasional leaf bleaching may occur; however, corn development and yield are not affected. Adding atrazine is recommended to improve postemergence and residual activity. Maverick alone will not provide consistent control of emerged grasses and will require tank mixing with a grass herbicide if grasses are emerged at application. Cotton, tobacco, and peanuts can be planted 18 months after application. See label for comments on rotational crops. See label for organophosphate restrictions/ precautions. Research on Maverick is limited in North Carolina.
fluthiacet-methyl, MOA 14 + pyroxasulfone, MOA 15 (Anthem Maxx) 4.3 SC	2.0 to 6.0 fl oz	0.002 to 0.006 + 0.065 to 0.196	Use 2 to 3 ounces per acre on coarse soils with less than 1% organic matter, 2.0 to 3.5 ounces on coarse soils with greater than 1% organic matter, 2.5 to 4.5 ounces for medium soils, and 3.5 to 6 ounces on fine-textured soils. May be applied to corn through the V4 stage. For optimum postemergence control, use 1 quart nonionic surfactant (NIS) per 100 gallons spray solution or 1 to 2 pints per acre crop oil concentrate (COC) or methylated seed oil (MSO); also add 1 to 2 quarts per acre UAN or spray grade AMS. For improved postemergence control, Anthem Maxx may be mixed with glyphosate, atrazine, mesotrione, or other appropriate postemergence herbicides.
Postemergence, residual control of Texas Panicum, other annual grasses, and small seeded broadleaves			
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 CS	1.8 to 4.8 pt 2.0 to 4.0 pt	0.74 to 1.98 0.95 to 1.9	May be applied postemergence until field corn is 30 inches tall or V8 growth stage, whichever comes first. Apply Prowl H_2O 3.8 CS at 2 pints per acre and Prowl 3.3 EC at 1.8 to 2.4 pints per acre on coarse-textured soils with less than 1.5% organic matter. See label for using higher rates on medium- or fine-textured soil with greater organic matter. Use drop nozzles if corn canopy prevents herbicide from reaching the soil. Suggested only where Texas panicum is predominant annual grass species; residual control of other annual grasses and small seeded broadleaves by pendimethalin is less than MOA 15 herbicides (Dual II Magnum, Harness, Outlook, Warrant, Zidua, and others). Does not control emerged weeds. Pendimethalin plus atrazine has performed well in NC research. Other brands of pendimethalin may be labeled for this use.
Postemergence, Annual broadleaf weeds			
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2.0 pt	0.75 to 1.0	Apply overtop or directed. Drop nozzles suggested after corn is 8 inches tall to ensure better weed coverage. Controls many broadleaf weeds such as cocklebur, jimsonweed, smartweed, velvetleaf, prickly sida, spurred anoda, and spreading dayflower. See label for weeds controlled and recommended weed size for treatment. Add crop oil concentrate at 2 pints per acre. May be tank mixed with atrazine.
bromoxynil, MOA 6 (Buctril) 2 EC (Buctril) 4 EC	1.0 to 1.5 pt 0.5 to 0.75 pt	0.25 to 0.38	Can be applied overtop of corn from four-leaf stage up to tasseling. Drop nozzles suggested after corn is 8 inches tall for better coverage on weeds. Controls most broadleaf weeds if treated when small. See label for weeds controlled and recommended weed size for treatment. Does not control sicklepod, prickly sida, spurred anoda, or croton. Marginally effective on pigweed and morningglory unless treated very timely. Crop oil or surfactant not necessary when applying Buctril alone. Can tank mix with Accent, atrazine, Banvel, Clarity, or 2,4-D for broader spectrum control. Primary advantage over 2,4-D or Clarity is safety when sensitive crops are nearby. Will cause some burn on corn foliage.
carfentrazone, MOA 14 (Aim EC) 2 L	0.5 to 1.0 fl oz	0.008 to 0.016	Controls velvetleaf, morningglory, redroot pigweed, lambsquarters, and nightshade. See label for weed size to treat. Apply before corn exceeds V8 stage (8 leaves with collars). May be applied with drop nozzles up to V14 stage (14 leaves with collars). Add nonionic surfactant at 1 quart per 100 gallons. May be mixed with 2,4-D amine, Accent, atrazine, Banvel, Callisto, Clarity or Distinct. May be mixed with Lightning for Clearfield corn, Liberty for LibertyLink corn, or glyphosate for Roundup Ready corn.
flumiclorac pentyl ester, MOA 14 (Resource) 0.86 EC	4.0 to 8.0 fl oz	0.027 to 0.054	Can be applied overtop of corn from the 2-leaf through the 10-leaf stage at 4 to 6 fluid ounces per acre. At 4 to 6 fluid ounces, Resource controls velvetleaf and small lambsquarters, ragweed, smooth pigweed, and Palmer amaranth. When applying overtop, add nonionic surfactant at 1 quart/100 gallons spray solution. Resource can be directed at 4 to 8 fluid ounces per acre. At 8 fluid ounces, Resource controls velvetleaf and small cocklebur, lambsquarters, ragweed, jimsonweed, Palmer amaranth, redroot and smooth pigweed, and prickly sida. See label for recommended weed sizes for treatment. When directing, add 2 pints per acre of crop oil concentrate. For broader spectrum control, Resource may be tank mixed with atrazine, Accent, Banvel, Buctril, Clarity, or 2,4-D. May be mixed with glyphosate on Roundup Ready corn, with Liberty on LibertyLink corn, and with Lightning on Clearfield corn.
pyraflufen-ethyl, MOA 14 (ET) 0.208 EC	0.5 to 2.0 fl oz	0.0008 to 0.0003	ET can be used for limited suppression of small broadleaf weeds up to V4 stage. Do not apply with crop oil concentrate. Some leaf speckling can occur but is transient. See label for adjuvant and spray volume recommendations. Research with ET is limited in North Carolina.
dicamba, dimethylamine salt, MOA 4 (Banvel) 4 SL (Diablo) 4 SL (Dicamba DMA Salt) 4 SL (Rifle) 4 SL (Sterling) 4 SL	0.5 pt	0.25	Apply overtop of corn from spike stage until 8 inches tall. On corn 8 to 36 inches tall, Banveland Clarity can be applied using drop nozzles. Carefully follow all precautions on label concerning drift to sensitive crops. Dicamba is more effective than 2,4-D on smartweed, sicklepod, nightshade, burcucumber, and pokeweed.
dicamba, diglycolamine salt, MOA 4 (Clarity) 4 SL	0.5 pt 11.0 fl oz	0.25	
dicamba, sodium salt, MOA 4 + diflufenzopyr, sodium salt (Distinct) 76.4 WDG	4.0 oz	0.125 + 0.05	Apply to corn 4 to 36 inches tall. Drop nozzles suggested on corn taller than 10 inches Drop nozzles must be used on corn taller than 24 inches Rate can be increased to 6 ounces on corn shorter than 10 inches Add nonionic surfactant at 1 quart per 100 gallons spray solution plus either 5 quarts 30% UAN or 5 pounds ammonium sulfate per 100 gallons. Do not add crop oil concentrate. Control of annual weeds similar to that by Banvel or Clarity. Distinct may be somewhat more effective on perennial broadleaf weeds. Carefully follow all precautions on label concerning drift to sensitive crops.
dicamba, sodium salt, MOA 4 + diflufenzopyr, sodium salt + safener (Status) 61.1% WDG	5.0 to 10.0 oz	0.14 to 0.28 + 0.053 to 0.106	Apply to corn 4 to 36 inches tall. Drop nozzles suggested on corn taller than 24 inches Add nonionic surfactant at 1 quart per 100 gallons spray solution plus either 5 quarts 30% UAN or 5 pounds ammonium sulfate per 100 gallons. Do not add crop oil concentrate. Potential for crop injury from Status is much less than from dicamba products without safener.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual broadleaf weeds (continued)			
dicamba, diglycolamine salt, MOA 4 + safener (DiFlexx) 4 SC	6.0 to 16.0 fl oz	0.19 to 0.5	Apply to corn from spike through V10 (10 leaf collar) stage or corn 36 inches tall, whichever comes first. Nonionic surfactant at 1 quart per 100 gallons spray solution or crop oil concentrate at 1 gallon per 100 gallons spray solution or methylated seed oil at 1 gallon per 100 gallons spray solution may be used to improve efficacy of DiFlexx, especially in dry growing conditions. If using one of the approved adjuvants, also add 2 to 4 quarts per acre urea ammonium nitrate or 8.5 to 17 pounds ammonium sulfate per 100 gallons spray solution. Do not use sprayable fluid fertilizer as the carrier. DiFlexx contains the new corn safener cyprosulfamide. Research on DiFlexx is limited in North Carolina.
2,4-D amine, MOA 4 (various brands) 3.8 SL	0.5 to 1.0 pt	0.24 to 0.48	Use 0.5 pint overtop when corn is 4 to 5 inches tall and weeds are small. Increase rate to 1 pint as corn reaches 8 inches. Use drop nozzles and direct spray toward base of corn if over 8 inches tall. Do not cultivate for about 10 days after spraying as corn may be brittle. Reduce rate of 2,4-D if extremely hot or soil is wet. For better control of sicklepod and horsenettle, add a nonionic surfactant to 1 pint of 2,4-D and direct spray. Not adequately effective on smartweed, nightshade, burcucumber, or pokeweed. Use extreme caution to avoid drift to sensitive crops such as cotton and tobacco. **Use of ester formulations or acid + ester formulations (such as Weedone 638) or 2,4-D is not suggested if sensitive crops, especially cotton or tobacco, are located within 1 mile of the corn.**
rimsulfuron, MOA 2 + thifensulfuron, MOA 2 (Resolve Q) 22.4% WDG	1.25 oz	0.014 + 0.0031	Apply overtop or with drop nozzles to corn up to 20 inches or 7 leaf collars. Controls redroot and smooth pigweed and velvetleaf. Suppresses cocklebur, smartweed, lambsquarters, common ragweed, and morningglory. Also controls small (1 to 2 inch tall) fall and Texas panicum. Provides short-term residual control of lambsquarters, nightshade, redroot pigweed, and smooth pigweed. Add 1 quart nonionic surfactant per 100 gallons and 2 quart/acre UAN. May tank mix with other postemergence corn herbicides (except Basagran), including glyphosate on Roundup Ready corn and Liberty on LibertyLink corn. See label statement concerning sensitive hybrids. See rotational restrictions on label.
mesotrione, MOA 27 (Callisto) 4 F	3.0 fl oz	0.094	Can be applied overtop or with drop nozzles until corn is 30 inches tall or has eight leaves. Add crop oil concentrate at 1 gallon per 100 gallons spray solution. Do not use methylated seed oil or adjuvant blends containing methylated seed oil. Controls most broadleaf weeds. Partial control of common ragweed and morningglory. Does not control sicklepod or prickly sida. Can tank mix with atrazine, Accent Q, or Steadfast Q. See precautions on labels of these products. Can be mixed with Liberty on LibertyLink corn or glyphosate on Roundup Ready corn. No rotational restrictions for small grains or other crops planted the following spring. Rainfast in 1 hour. See precautions on label concerning use of Counter and Lorsban.
tembotrione, MOA 27 (Laudis) 3.5 SC	3.0 fl oz	0.082	Can be applied overtop or with drop nozzles to corn from emergence up to V8 stage. Add methylated seed oil at 1 gallon per 100 gallons of spray solution. Also add 1.5 quarts/A UAN. Controls most broadleaf weeds. Does not control sicklepod or prickly sida and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. Can tank mix with atrazine, Accent Q, Buctril, or Steadfast Q. Can tank mix with Liberty on LibertyLink corn or glyphosate on Roundup Ready corn. Rain-free in 1 hour. See label for rotational restrictions.
topramezone, MOA 27 (Impact) 2.8 L (Armezon) 2.8 L	0.75 fl oz	0.016	Can be applied overtop or with drop nozzles to corn from emergence until 45 days prior to harvest. Add crop oil concentrate or methylated seed oil at 1 gallon per 100 gallons spray solution. Also add 1.25 to 2.5 gallons UAN per 100 gallons spray solution. See label for adjuvant recommendations in tank mixes. Controls most broadleaf weeds. Does not control sicklepod and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. Can tank mix with glyphosate on Roundup Ready corn, Liberty on LibertyLink corn, or Lightning on Clearfield corn. Rain-free in 1 hour. See label for rotational restrictions.
topramezone, MOA 27 + dimethenamid-P, MOA 15 (Armezon PRO) 5.35 EC	14.0 to 20.0 fl oz	0.01 to 0.016 + 0.57 to 0.82	May be applied preemergence up to the 8-leaf stage or 30-inches-tall corn. Armezon PRO rates vary by soil texture and organic matter, refer to label for recommendations. Add methylated seed oil or crop oil concentrate at 0.5 to 1.0 gallon per 100 gallons of water or nonionic surfactant at 0.25 to 0.5 gallon per 100 gallons of water. Oil-type adjuvants are not recommended when tank-mixing with atrazine. Add nitrogen fertilizer at 1.25 to 2.5 gallons per 100 gallons of water or 8.5 to 17 pounds of ammonium sulfate per 100 gallons.
tolpyralate, MOA 27 (Shieldex) 3.33 SC	1.0 to 1.35 fl oz	0.026 to 0.035	Shieldex may be applied overtop corn up to 6 leaf collars (V6) or 20 inches tall. For best results, methylated seed oil (MSO) at 0.5% by volume (0.5 gallons per 100 gallons spray solution) or crop oil concentrate (COC) at 1% by volume (1 gallon per 100 gallons spray solution) are recommended. Also add spray grade ammonium sulfate (AMS) at 8.5 pounds per 100 gallons spray solution. Controls most broadleaf weeds. Does not control sicklepod and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment.
tembotrione, MOA 27 + thiencarbazone-methyl, MOA 2 + safener (Capreno) 3.45 SC	3.0 fl oz	0.068 + 0.013	Apply postemergence over the top prior to V6 stage. Use drop nozzles for better coverage of later stages of corn. Apply with crop oil concentrate at 1 gallon/100 gallons and UAN at 1.5 quarts/A. See comments under Laudis for spectrum of control and possible tank mixture. See label for precautions when organophosphate insecticide is used in corn.
rimsulfuron, MOA 2 + mesotrione, MOA 27 (Realm Q) 38.75% WDG	4.0 oz	0.0188 + 0.0781	Apply overtop or with drop nozzles to corn up to 20 inches or 7 leaf collars. Controls a number of broadleaf weeds and small grasses. Can mix with atrazine or glyphosate for broader spectrum control. Provides short-term residual control of lambsquarters, nightshade, redroot pigweed, and pigweed. Add 1 quart nonionic surfactant per 100 gallons spray solution or 1 gallon crop oil concentrate (COC) or methylated seed oil (MSO) per 100 gallons spray solution. May tank mix with other postemergence corn herbicides (except Basagran), including glyphosate on Roundup Ready corn and Liberty on LibertyLink corn. See label statement concerning sensitive hybrids. See rotational restrictions on label. See label for organophosphate or carbamate restrictions/precautions.
tembotrione, MOA 27 + dicamba, diglycolamine salt, MOA 4 + safener (DiFlexx Duo) 2.13 SC	24.0 to 40.0 fl oz	0.05 to 0.084 + 0.35 to 0.58	May be applied to corn from emergence up to, but not including, the V7 (seventh leaf collar) or 36 inches tall, whichever occurs first. May be applied directed with drop nozzles to corn in the V7 to V10 (7-10 collars), up to 36 inches tall, or up to 15 days prior to tassel, whichever comes first. Add methylated seed oil or crop oil concentrate at 1 gallon per 100 gallons of spray solution. Do not apply DiFlexx Duo with liquid fertilizers as the primary spray carrier. Do not apply DiFlexx Duo to corn that exhibits injury from previous herbicide applications. DiFlexx Duo contains the new corn safener, cyprosulfamide, to improve corn tolerance to dicamba. Research on DiFlexx Duo is limited in North Carolina.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual grasses, broadleaf weeds, and johnsongrass			
nicosulfuron, MOA 2 + rimsulfuron, MOA 2 (Steadfast Q) 37.7% WDG	1.5 oz	0.024 + 0.011	Apply to corn up to 20 inches tall with 6 or fewer leaf collars. Add 1 gallon crop oil concentrate per 100 gallons or 1 quart nonionic surfactant per 100 gallons. Also add nitrogen fertilizer according to label directions. Controls johnsongrass and most annual grasses and broadleaf weeds. May not adequately control crabgrass, goosegrass, Palmer amaranth, and sicklepod. See label for weeds controlled and weed size to treat. Do not apply to corn treated with Counter 15G; see label for precautions concerning other organophosphate insecticides. See label for comments on susceptible hybrids. Can tank mix with atrazine, Callisto, Clarity, or Distinct. See label precautions for tank mixes. Steadfast Q contains 25% nicosulfuron and 12.5% rimsulfuron.
nicosulfuron, MOA 2 + mesotrione, MOA 27 (Revulin Q) 51.2% WDG	3.4 to 4.0 oz	0.031 to 0.036 + 0.078 to 0.092	Apply to corn up to 20 inches tall with 6 or fewer leaf collars. Add 1 gallon crop oil concentrate per 100 gallons or 2 quarts of high surfactant oil concentrate (HSOC) per 100 gallons. Do not use methylated seed oil (MSO). Also add nitrogen fertilizer according to label directions. Controls johnsongrass and most annual grass and broadleaf weeds. May not adequately control goosegrass, sicklepod, and Palmer amaranth greater than 3 inches tall. See label for weeds controlled and weed size to treat. Do not apply to corn treated with Counter insecticide; see label for precautions concerning tankmixing with foliar applied organophosphate insecticides. Can tank mix with atrazine, glyphosate, or glufosinate. See label precautions for tank mixes. Revulin Q contains 14.4% nicosulfuron and 36.8% mesotrione.
nicosulfuron, MOA 2 + tolpyralate, MOA 27 (Katagon) 2 OD	2.3 to 3.4 fl oz	0.018 to 0.026 + 0.018 to 0.026	Apply to corn up to the 5 leaf collar (V5) or 20 inches in height, whichever comes first. Add methylated seed oil at 1 gallon and spray grade ammonium sulfate at 8.5 lb product per 100 gal spray solution. May not adequately control goosegrass, sicklepod, and Palmer amaranth greater than 3 inches tall. Add 0.5 to 2 lb atrazine per acre to enhance postemergence control of several weeds when corn is <12 inches tall. **DO NOT** mix with products containing bentazon or foliar-applied organophosphate insecticides nor apply to corn treated with Counter insecticide as severe crop injury may occur. **DO NOT** mix with 2,4-D containing products as severe antagonism of grass control may occur. Research on Katagon is limited in North Carolina.
Postemergence, Annual broadleaf weeds and some annual grasses: **Clearfield Hybrids Only**			
imazethapyr, MOA 2 + imazapyr, MOA 2 (Lightning) 70% WDG	1.28 oz	0.042 + 0.014	**Use only on Clearfield hybrids**. Make only one application per year. Can be applied anytime up to 45 days prior to harvest. Use of drop nozzles will give better coverage in larger corn. Controls most annual broadleaf weeds and certain annual grasses; see label for weeds controlled and recommended growth stage for application. Not adequately effective on ragweed. Season-long sicklepod control may require a pre-emergence application of atrazine or a lay-by application of an appropriate herbicide. Suppresses yellow and purple nutsedge. Add either 1 quart per 100 gallons nonionic surfactant or 1 gallon per 100 gallons of crop oil concentrate or methylated seed oil. Also add 1 to 2 quarts per acre of UAN or 2.5 pounds per acre ammonium sulfate. May be tank mixed with most other corn herbicides; see labels for details. See Lightning label for rotational restrictions.
Postemergence, Annual grasses and annual broadleaf weeds: **LibertyLink Hybrids Only**			
glufosinate-ammonium, MOA 10 (Liberty) 2.34 SL (numerous brands) 2.34 SL	29.0 to 43.0 fl oz	0.53 to 0.79	**Use only on LibertyLink hybrids.** May be applied overtop from corn emergence up to V6 growth. Apply with drop nozzles to corn up to 36 inches tall. Rate depends on weed species and weed size; see label for details. Controls most annual grass and broadleaf weeds, but only marginally effective on goosegrass. Not effective on dayflower. Timing of application is critical for pigweed control. Use of drop nozzles in corn over 8 inches tall may improve spray coverage. If glufosinate was applied preplant, one application of glufosinate at 29 to 43 fl oz per acre may be applied in-season to LibertyLink varieties only. If glufosinate was not used preplant, may make 2 applications in season. Total for the year is not to exceed 87 fl oz per acre. Add 3 pounds per acre of ammonium sulfate. Do not add surfactant or crop oil. May be tank mixed with most postemergence corn herbicides; see respective labels for details. Tank mixes of glufosinate plus atrazine have been most effective. Additional brands include Fever, Forfeit 280, Glufosinate 280SL, Inflame 280SL, Noventa, Reckon 280SL, Refer 280SL, Surmise, Tide Glufosinate, and Total.
glufosinate-ammonium, MOA 10 + topramezone, MOA 27 (Sinate) 2.57 SC	21.0 to 28.0 fl oz	0.405 to 0.54 + 0.016 to 0.022	**Use only on LibertyLink hybrids.** May be applied overtop from corn emergence up to V7 or 24-inch-tall corn, whichever occurs first. Apply with drop nozzles to corn up to 36 inches tall. Timing of application is critical for pigweed control. Do not apply more than once per year. Methylated seed oil (MSO) or high surfactant methylated oil concentrated (HSMOC) at 2 to 3 quarts per 100 gallons spray solution are the preferred adjuvants; crop oil concentrate (COC) may be used at 1 gallon per 100 gallons spray solution. Also include spray grade AMS at 3 pounds per acre or liquid equivalent. Tank mixes of Sinate plus atrazine have been most effective.
Postemergence, Annual grasses and broadleaf weeds, johnsongrass, and suppression of perennial broadleaf weeds: **Glyphosate-tolerant Hybrids Only**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.125 (lb a.e.)	**Apply only to glyphosate-tolerant hybrids.** Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. See Table 7-9 for glyphosate rate conversions. Glyphosate controls most annual weeds; exceptions include dayflower, Florida pusley, and hemp sesbania. Timely application is critical for morningglory control. Glyphosate also controls johnsongrass and suppresses other perennial weeds. See label of brand you use for recommended rates and sizes of weeds to treat. Adjuvant recommendations vary according to glyphosate product. See label of brand used for specific recommendations. Apply overtop from corn emergence through the V8 stage (8 leaves with collars) or until corn reaches 30 inches, whichever comes first. Drop nozzles suggested on corn 24 to 30 inches Apply only with drop nozzles when corn is 30 to 48 inches. Make multiple applications at least 10 days apart. Do not exceed a total of 2.25 pounds a.e. per acre in crop. For resistance management, do not rely entirely on glyphosate. Herbicides with other modes of action should be included in the program. Such herbicides can be preemergence, mixed with glyphosate, or lay-by. See comments on resistance management in Table 7-10. Any registered soil-applied herbicide or lay-by herbicide can be used on Roundup Ready corn. Aim, atrazine, Callisto, Clarity, Degree Xtra, Distinct, Harness, Harness Xtra, Impact, Laudis, Resolve Q, Resource, Status or 2,4-D can be mixed with glyphosate applied postemergence. When using a tank mix, follow all directions and precautions on the respective labels, especially corn stage for application.
glyphosate, MOA 9 + mesotrione, MOA 27 (Callisto GT) 4.18 L	2.0 pt	0.95 + 0.095	**Apply only to glyphosate-tolerant hybrids.** Apply from corn emergence up to 30 inches or 8 leaf collars. Add nonionic surfactant at 1 quart per 100 gallons spray solution. Also add AMS according to label directions. Crop oil concentrate may be used at 1 gallon per 100 gallons spray solution but increases the risk for crop injury. Do not use methylated seed oil or adjuvant blends containing methylated seed oil or severe crop injury may occur.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual grasses and broadleaf weeds, johnsongrass, and suppression of perennial broadleaf weeds: **Glyphosate-tolerant Hybrids Only (continued)**			
glyphosate, MOA 9 + s-metolachlor, MOA 15 + mesotrione, MOA 27 (Halex GT) 4.39 L	3.6 to 4.0 pt	0.94 to 1.05 + 0.94 to 1.05 + 0.094 to 0.105	**Apply only to glyphosate-tolerant hybrids.** Apply from corn emergence up to 30 inches or 8 leaf collars. Add nonionic surfactant at 1 quart/100 gallons spray solution. **DO NOT** substitute methylated seed oil or crop oil concentrate for nonionic surfactant. Also add AMS according to label directions. Do not substitute UAN for AMS. If tank mixed with atrazine, must be applied before corn exceeds 12 inches. See precautions on label when using Halex GT in conjunction with insecticides.
Postemergence, most broadleaf weeds: **Enlist Hybrids Only**			
2,4-D choline, MOA 4 (Enlist One) 3.8 SL	1.5 to 2.0 pt	0.71 to 0.95	**Apply only to hybrids designated as Enlist.** Apply when weeds are small and corn is no larger than V8 growth stage or 30 inches tall, whichever occurs first. For corn 30 to 48 inches tall, apply only using ground application equipment using drop nozzles and avoid spraying into whorl of corn plants. Controls most broadleaf weeds. Make 1 to 2 applications at least 12 days apart. The high rate may result in temporary, cosmetic injury in the form of spotting or temporary plant leaning but will not affect long-term crop development or yield.
2,4-D choline, MOA 4 + glyphosate, MOA 9 (Enlist Duo) 3.3 SL	3.5 to 4.75 pt	0.7 to 0.95 + 0.74 to 1.01	**Apply only to hybrids designated as Enlist.** Apply when weeds are small and corn is no larger than V8 growth stage or 30 inches tall, whichever occurs first. For corn 30 to 48 inches tall, apply only using ground application equipment using drop nozzles and avoid spraying into whorl of corn plants. Controls most broadleaf and grass weeds. Make 1 to 2 applications at least 12 days apart. The high rate may result in temporary, cosmetic injury in the form of spotting or temporary plant leaning but will not affect long-term crop development or yield.
Postemergence, Yellow nutsedge			
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2.0 pt	0.75 to 1.0	Apply overtop of corn or directed when yellow nutsedge is 6 to 8 inches tall. If needed, make a second application 7 to 10 days later. Add 2 pints per acre of crop oil concentrate.
Postemergence, Yellow and purple nutsedge			
halosulfuron (Sandea) 75% WDG	0.67 to 1.33 oz	0.03 to 0.06	Apply overtop or with drop nozzles to corn from spike stage until layby. Add nonionic surfactant at 1 quart/100 gallons spray solution.
Postemergence, Yellow and purple nutsedge: **Clearfield Hybrids Only**			
imazethapyr, MOA 2 + imazapyr, MOA 2 (Lightning) 70% WDG	1.28 oz	0.042 + 0.014	**Use only on Clearfield hybrids.** Apply when nutsedge is 1 to 3 inches tall. Add surfactant and nitrogen-containing fertilizer as specified on the label. See comments on Lightning in section on broadleaf weed control. Label claims suppression only.
Postemergence, Yellow and purple nutsedge; **Glyphosate-tolerant Hybrids Only**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.125 (lb a.e.)	**Apply only to Roundup Ready hybrids.** 2 applications of glyphosate may be necessary for nutsedge control. See previous comments under Roundup Ready corn.
Postemergence, Annual grasses			
nicosulfuron, MOA 2 (Accent Q) 54.5% WDG	0.9 oz	0.031	Can be applied overtop or with drop nozzles to corn up to 20 inches tall. If corn is 20 to 36 inches tall, apply only with drop nozzles and avoid spraying into the corn whorl. Do not apply if corn is greater than 36 inches Add either a crop oil concentrate at 1 gallon per 100 gallons or a nonionic surfactant at 1 quart per 100 gallons spray solution. See label concerning additional adjuvants. Do not cultivate for 10 days before application. Controls ryegrass, small broadleaf signalgrass, foxtails, fall panicum, Texas panicum, barnyardgrass, shattercane, and seedling johnsongrass. May not adequately control crabgrass and goosegrass. Also controls small burcucumber, jimsonweed, morningglory, pigweed, and smartweed. Can be applied twice, but do not exceed 1.8 ounces Accent Q per acre per year. Reduced rates may be applied under certain conditions; see label for details. May be tank mixed with atrazine, Callisto, Clarity, or Distinct for improved broadleaf control. See label for comments concerning injury when used in conjunction with insecticides.
Postemergence, Annual grasses: **Enlist Hybrids Only**			
quizalofop, MOA 1 (Assure II) 0.88 EC	5.0 to 12.0 fl oz	0.034 to 0.083	**Apply only to Enlist hybrids.** May be applied to emerged Enlist field corn from V2 through V6. Apply to actively growing grass not under drought stress. See label for maximum weed size to treat and suggested rate. Must include either crop oil concentrate at 1 gallon per 100 gallons spray solution or nonionic surfactant at 1 quart per 100 gallons spray solution. Do not make more than 2 applications per acre per crop season. Do not exceed 12 fl oz per acre per crop season.
Postemergence, Johnsongrass			
nicosulfuron, MOA 2 (Accent Q) 54.5% WDG	0.9 oz	0.031	Apply when seedling johnsongrass is 4 to 12 inches tall, rhizome johnsongrass is 8 to 18 inches tall, or shattercane is 4 to 12 inches tall. See other comments for Accent Q under Annual Grasses.
Postemergence, Johnsongrass: **Glyphosate-tolerant Hybrids Only**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.125 (lb a.e.)	**Apply only to glyphosate-tolerant hybrids.** See previous comments under glyphosate-tolerant hybrids.
Postemergence, Bermudagrass: **Glyphosate-tolerant Hybrids Only**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.125 (lb a.e.)	**Apply only to glyphosate-tolerant hybrids.** See previous comments under glyphosate-tolerant hybrids. 2 applications are usually required for adequate control.
Lay-by, Annual broadleaf weeds; control or suppression of perennial broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL	0.5 to 1.0 pt	0.24 to 0.48	Apply with drop nozzles. Do not apply to corn in the tassel to dough stage. May add 1 quart of nonionic surfactant per 100 gallons spray solution. Surfactant may increase control of sicklepod and perennial weeds. Corn hybrids vary in sensitivity; check with seed dealer for sensitivity of hybrid used. Use extreme caution to avoid drift to sensitive crops, such as cotton and tobacco. **Use of ester formulations or acid + ester formulations (such as Weedone 638) or 2,4-D is not suggested if sensitive crops, especially cotton or tobacco, are located within 1 mile of the corn.** Liquid nitrogen may be used as the carrier. When using 2,4-D amine, mix 1 pint of herbicide in at least 2 quarts of water, and add this mixture to the spray tank with considerable agitation until thoroughly mixed. Do not allow nitrogen-herbicide mixture to stand in the sprayer.

Table 7-1A. Chemical Weed Control in Field Corn

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Lay-by, Annual broadleaf weeds; control or suppression of perennial broadleaf weeds (continued)			
dicamba, dimethylamine salt, MOA 4 (Banvel) 4 SL	0.5 pt	0.25	Apply as directed spray using water as the carrier to corn up to 36 inches tall. Do not apply within 15 days of tassel emergence. Add nonionic surfactant at 1 pint per 100 gallons for Clarity or 2 pints per 100 gallons for Banvel, Distinct, or Status. See comments on labels concerning addition of UAN or AMS. Follow precautions on labels concerning drift to sensitive crops.
dicamba, diglycolamine salt, MOA 4 (Clarity) 4 SL	0.5 pt	0.25	
dicamba, sodium salt, MOA 4 + diflufenzopyr, sodium salt (Distinct) 61.1% WDG	4.0 oz	0.125 + 0.053	
dicamba, sodium salt MOA 4 + diflufenzopyr, sodium salt + safener (Status) 61.1% WDG	5.0 to 10.0 oz	0.14 to 0.28 + 0.053 to 0.107	
ametryn, MOA 5 (Evik) 80% WDG	2.0 lb	1.6	Apply as a directed spray after corn is at least 15 inches tall. Do not apply Evik within 3 weeks of tasseling. Add nonionic surfactant at 2 quarts per 100 gallons spray solution. Evik and Linex may be applied using liquid nitrogen as the carrier. Add surfactant when using nitrogen as the carrier.
linuron, MOA 7 (Linex) 4 L	1.25 to 1.5 pt	0.63 to 0.75	Apply as a directed spray after corn is at least 15 inches tall. Note that current labeled rates of Linex have been reduced from previous years. Use 2 quarts nonionic surfactant per 100 gallons of spray solution. Linex may be applied using liquid nitrogen as the carrier. Do not apply within 57 days of harvest.
Preharvest, Annual grasses and johnsongrass			
sodium chlorate (Defol 750) 7.5 L	3.2 qt	6.0	Apply on warm, sunny day at least 14 days before anticipated harvest. Apply by ground or air after corn reaches hard dough or dent stage. Add surfactant or crop oil according to label directions. Thorough spray coverage essential.
Preharvest, Broadleaf weeds			
2,4-D, amine, MOA 4 (various brands)	1.0 to 2.0 pt	0.48 to 0.95	Suppresses perennial broadleaf weeds and controls many annual broadleaf weeds. Apply after hard dough or dent stage by ground or air. Avoid drift to sensitive crops.
carfentrazone, MOA 14 (Aim) 2 EC	1 to 2 fl oz	0.016 to 0.03	Desiccates morningglory, cocklebur, and pigweed. Apply 3 or more days ahead of harvest. Add 1 gallon crop oil concentrate per 100 gallons spray solution. Thorough coverage is critical; use minimum of 20 GPA for ground application. May be applied by air. For dense morningglory infestations, two applications at 1 ounce/acre may be more effective.
Preharvest, Annual grasses and broadleaf weeds			
paraquat, MOA 22 (Gramoxone) 3 SL	0.8 to 1.3 pt	0.3 to 0.49	Apply after black layer has formed and at least 7 days prior to harvest. Add nonionic surfactant at 1 quart per 100 gallons spray solution. Generic brands of paraquat containing 3 pounds active ingredient per gallon are available **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.**
Preharvest, Annual grasses, johnsongrass, and broadleaf weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply after kernel fill is complete (black layer formed) and grain moisture is 35% or less. Apply at least 7 days prior to harvest. Maximum rate for aerial application varies by product; see label of brand used. Avoid drift to other crops and desirable vegetation.
Postharvest, Horsenettle and other perennial and annual broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL + dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	2.0 pt + 1.0 to 2.0 pt 1.0 to 2.0 pt	0.95 + 0.5 to 1.0	This is an effective way to reduce perennial broadleaf weeds in succeeding crops. Follow label precautions on dicamba label concerning drift to sensitive crops. Delay small grain seeding at least 20 days.
Postharvest, Bermudagrass, other annual and perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	1.5 (lb a.e.)	This is an effective way to reduce perennial weeds in succeeding crops. Apply at least 10 to 14 days before killing frost. Rate can be increased up to 3.75 pounds a.e. Include adjuvant according to the label for the brand used. Dicamba may be mixed with glyphosate.

Weed Response to Preemergence Herbicides — Corn

C. W. Cahoon, Associate Professor and Extension Weed Specialist, Crop and Soil Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-1B. Weed Response to Preemergence Herbicides in Corn

Weed Type	Species	Herbicide															
		Acuron	Atrazine	Atrazine + Simazine	Bicep II Magnum, Brawl II, Cinch ATZ, or Medal II AT	Balance Flexx	Callisto	Corvus	Dual II Magnum, Brawl II, or Medal II	Degree Xtra, Fultime NXT, Harness Xtra, or Keystone NXT	Harness, Surpass NXT, or Warrant	Lexar EZ or Lumax EZ	Outlook	Prowl H_2O	Resicore	SureStart II or TripleFLEX II	Zidua SC, Anthem Maxx or Anthem Flex
Grasses	Bermudagrass	N	N	N	N	F	N	N	N	N	N	N	N	N	N	N	N
	Broadleaf signalgrass	G	P	P	G	N	P	ND	G	G	G	G	FG	P	G	G	GE
	Crabgrass	E	G[1]	G[2]	E	F	F	E	E	E	E	E	E	F	E	E	E
	Fall panicum	E	N	FG	E	FG	PN	GE	E	E	E	E	E	PF	E	E	E
	Foxtails	E	F	FG	E	FG	PN	E	E	E	E	E	E	F	E	E	E
	Goosegrass	E	F	FG	E	N	PN	GE	E	E	E	E	E	PF	E	E	E
	Johnsongrass, Seedling	F	N	N	PF	FG	N	ND	PF	PF	PF	F	PF	PF	PF	PF	PF
	Johnsongrass, Rhizome	N	N	N	N	F	N	ND	N	N	N	N	N	N	N	N	N
	Shattercane	PF	N	N	P	FG	N	ND	P	P	P	PF	P	PF	P	P	P
	Texas panicum	PF	N	N	PF	N	N	G	PF	PF	PF	PF	PF	PF	PF	PF	F
Sedges	Nutsedge, Yellow	FG	N	N	F	N	PF	F	FG[3]	PF	PF	FG	F	N	PF	PF	F
	Nutsedge, Purple	N	N	N	N	N		ND	N	N	N	N	N	N	N	N	N
Broadleaf Weeds	Balloon vine	ND	G	GE	G	ND	ND	ND	N	G	N	G	N	N	ND	ND	N
	Burcucumber[4]	ND	F	FG	F	F	ND	ND	N	F	N	F	N	N	N	N	N
	Cocklebur	E	G	GE	G	N	PF	G	N	G	N	G	N	N	G	G	N
	Eastern black nightshade	E	E	E	E	GE	E	E	F	E	F	E	F	N	GE	FG	F
	Florida beggarweed	G	G	GE	G	ND	ND	ND	F	G	F	G	F	N	F	F	F
	Florida pusley	E	E	E	E	ND	ND	GE	GE	E	GE	E	GE	G	F	F	G
	Hemp sesbania	G	F	F	F	ND	ND	ND	N	F	N	F	N	N	F	ND	N
	Jimsonweed	E	E	E	E	FG	G	G	N	E	N	E	N	N	FG	F	F
	Lambsquarters	E	E	E	E	GE	E	E	F	E	F	E	FG	G	GE	FG	FG
	Morningglory	G	G	G	G	N	FG	G	N	G	N	G	N	N	G	FG	N
	Pigweed	E	E	E	E	G	E	E	G	E	GE	E	GE	FG	GE	GE	E
	Prickly sida	E	E	E	E	F	ND	G	P	E	P	E	P	N	N	F	P
	Ragweed, Common	E	E	E	E	F	F	G	PF	E	PF	E	F	N	G	G	F
	Ragweed, Giant	G	FG	G	G	F	ND	ND	N	G	N	FG	N	N	F	FG	N
	Sicklepod	G	G	GE	G	N	P	G	N	G	N	G	N	N	ND	FG	N
	Smartweed	G	G	GE	G	FG	GE	ND	N	G	N	G	N	N	FG	FG	F
	Tropic croton	G	G	GE	G	N	PN	G	N	G	N	G	N	N	ND	ND	ND
	Velvetleaf	G	G	G	G	GE	E	G	N	G	N	G	N	N	GE	FG	F

[1] No control of smooth crabgrass.

[2] Poor to fair on smooth crabgrass.

[3] Dual is normally good on yellow nutsedge when incorporated

[4] Multiple flushes of germination; one application of any herbicide will seldom be adequate.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%
ND = data not available

Weed Response to Postemergence Herbicides — Corn

C. W. Cahoon, Associate Professor and Extension Weed Specialist, Crop and Soil Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-1C. Weed Response to Postemergence Herbicides — Corn

		Herbicide																						
Weed Type	**Species**	**Accent Q**	**Aim**	**Armezon or Impact**	**Atrazine[1]**	**Banvel, Clarity, DiFlexx, Distinct, or Status**	**Basagran**	**Buctril**	**Callisto**	**Capreno**	**Enlist One or 2,4-D[2]**	**Enlist Duo[2]**	**Evik[3]**	**Glyphosate[4]**	**Halex GT**	**Harmony SG**	**Laudis**	**Liberty[5]**	**Lightning[6]**	**Linex[3]**	**Realm Q**	**Resource**	**Revulin Q**	**Steadfast Q**
Grasses	Bermudagrass	N	N	N	N	N	N	N	N	N	N	F[8]	N	F[8]	F[8]	N	N	NP	N	N	N	N	N	N
	Broadleaf signalgrass	GE	N	N	F	N	N	N	P	GE	N	E	E	E	E	N	G	GE	G	GE	F	N	G	G
	Crabgrass	PF	N	FG	FG[7]	N	N	N	F	GE	N	E	GE	E	E	N	G	G	PF	GE	G	N	PF	PF
	Fall panicum	G	N	FG	P	N	N	N	P	E	N	E	GE	E	E	N	N	E	PF	GE	G	N	G	G
	Foxtails	G	N	GE	G	N	N	N	P	E	N	E	E	E	E	N	GE	E	G	E	G	N	G	G
	Goosegrass	P	N	F	G	N	N	N	P	E	N	E	GE	E	E	N	F	PF	P	G	F	N	P	P
	Johnsongrass, Seedling	E	N	N	P	N	N	N	P	E	N	E	GE	E	E	N	F	GE	GE	G	G	N	E	E
	Johnsongrass, Rhizome	GE	N	N	N	N	N	N	N	N	N	E	P	E	E	N	N	F[12]	G[9]	NP	P	N	GE	G
	Shattercane	E	N	F	P	N	N	N	ND	E	N	E	G	E	E	N	F	ND	G	FG	GE	N	E	E
	Texas panicum	G	N	FG	NP	N	N	N	ND	GE	N	E	G	E	E	N	G	G	PF	G	G	N	G	G
Sedges	Nutsedge, Yellow	P	N	ND	PF	N	G[13]	N	F	F	N	F[8]	F	F[8]	F[8]	N	F	P	F	F	F	N	P	P
	Nutsedge, Purple	N	N	ND	N	N	N	N	F	F	N	FG[8]	PF	FG[8]	FG[8]	N	F	P	FG	P	P	N	N	N
Broadleaf Weeds	Balloon vine	ND	ND	ND	G	G	P	ND	ND	ND	G	GE	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND
	Burcucumber[10]	F	N	FG	FG	F	P	F	ND	F	P	E	F	E	E	PF	F	G	P	F	ND	FG	F	F
	Cocklebur	F	N	GE	E	E	E	E	E	GE	E	E	E	E	E	FG	GE	E	E	E	G	G	E	F
	Eastern black nightshade	N	G	GE	GE	E	P	G	G	E	F	G	G	FG	GE	P	E	G	GE	PF	ND	FG	G	P
	Florida beggarweed	ND	ND	ND	G	G	N	E	ND	ND	FG	GE	E	G	G	ND	ND	E	ND	E	ND	P	ND	ND
	Florida pusley	N	FG	F	G	G	PN	E	ND	GE	G	G	E	P	ND	ND	GE	FG	FG	G	ND	ND	ND	ND
	Hemp sesbania	F	ND	ND	FG	E	P	G	ND	F	E	E	F	P	ND	ND	F	ND	ND	ND	ND	P	ND	ND
	Jimsonweed	FG	N	GE	E	E	E	E	E	E	E	E	E	E	E	F	E	G	E	E	E	G	E	E
	Lambsquarters	P	G	GE	E	E	FG	E	E	GE	E	E	E	E	E	E	E	E	G	E	GE	G	E	F
	Morningglory	F	G	FG	G	E	P	G	GE	GE	E	E	E	FG[11]	FG[11]	FG	F	E	G	E	G	FG	GE	G
	Pigweed, redroot	G	G	GE	E	E	N	F	E	E	E	E	E	E	E	E	E	G	E	E	G	G	E	G
	Palmer amaranth[15]	N	FG	G	G	E	N	PF	G	G	E	G	E	N	E	N	G	G	N	GE	F	G	G	N
	Prickly sida	P		F	GE	G	G	F	P	G	G	E	GE	G	G	P	N	GE	G	GE	G		P	P
	Ragweed, Common	P	P	FG	GE	E	G	E	FG	GE	E	E	E	E	E	F	GE	E	PF	E	G	G	FG	P
	Ragweed, Giant	P	N	FG	F	GE	GE	E	ND	G	E	E	G	G	G	P	G	G	P	G	ND	P	ND	P
	Sicklepod	F	ND	P	G	GE	N	N	P	G	G	E	G	E	E	P	PF	E	F[14]	GE	P	N	P	F
	Smartweed	G	ND	GE	G	E	E	GE	G	E	F	GE	G	G	G	E	E	E	GE	GE	NP	P	G	G
	Tropic croton	ND	ND	ND	G	GE	F	FG	ND	G	G	E	G	G	G	P	ND	ND	P	G	ND	P	ND	ND
	Velvetleaf	F	E	GE	G	G	G	G	G	E	G	E	G	E	E	G	GE	G	GE	G	G	E	G	F

1 Assumes addition of crop oil concentrate.
2 Apply Enlist One and Enlist Duo to Enlist hybrids only.
3 Apply directed only.
4 Apply only to glyphosate-resistant hybrids. See comments on resistance management in TABLE 7-10.
5 Apply only to LibertyLink hybrids.
6 Apply only to Clearfield corn hybrids.
7 No control of smooth crabgrass.
8 Control is good with two applications of glyphosate.
9 Follow-up treatment with Accent may be needed for acceptable control.
10 Multiple flushes of germination; one application of any herbicide will seldom be adequate.
11 With good application timing and a follow-up application as needed, morningglory control can be good.
12 Liberty applied twice is usually good on johnsongrass.
13 Two applications may be needed for good control.
14 Sicklepod control by Lightning can be erratic. For more consistent control, mix atrazine, Banvel, Clarity, Distinct, Marksman, or 2,4-D with Lightning.
15 Assumes glyphosate-resistant and ALS-resistant biotype.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%
ND = data not available

Chemical Weed Control in Cotton

C. W. Cahoon, Associate Professor and Extension Weed Specialist, Crop and Soil Sciences Department

Table 7-2A. Brand Names and Formulations of Active Ingredients Listed in Table 7-2B.

Active ingredient(s)	Brand name(s)[1]	Formulation[2]	Mode of Action
acetochlor	Warrant, Enversa	3 CS	15
acetochlor + fomesafen, premix	Warrant Ultra	3.45 CS (2.82 + 0.63)	15 + 14
carfentrazone	Aim EC, Longbow EC	2 EC	14
clethodim	Intensity One, Select Max, TAPOUT	0.97 EC	1
	Arrow 2EC, Avatar S2, Cleanse, Clethodim 2E; Clethodim 2EC, Dakota, Intensity, Select 2EC, Shadow, Tide USA Clethodim 2EC, Volunteer, Willowood Clethodim 2EC	2 EC	1
	Shadow Ultra	1 EC	1
	Shadow 3 EC, Section Three	3 EC	1
2,4-D, choline salt	Enlist One	3.8 S	4
2,4-D choline salt + glyphosate	Enlist Duo	3.3 S	4 + 9
2,4-D, dimethylamine salt	Numerous brand names	S	4
2,4-D, ethylhexyl ester	Numerous brand names	EC	4
dicamba, diglycolamine salt	Clarifier, Clarity, Clash, Detonate, Dicamba DGA, Dicamba HD, Dicash DGA-4, Sterling Blue, Strut, Veritas	4[3] S	4
dicamba acid + 2,4-D ester	Burnmaster	4.07 EC (1 + 3.077)	4 + 4
	Spitfire	3.57 EC (0.5 + 3.07)	4 + 4
dimethenamid-P	Outlook	6 EC	15
diuron	Direx 4L, Diuron 4L, Parrot 4L	4 F	7
	Diuron 80, Diuron 80 DF, Diuron 80 WDG, Karmex DF	80 WDG	7
fluazifop p-butyl	Fusilade DX	2 EC	1
flumiclorac pentyl ester	Resource	0.86 EC	14
flumioxazin	Outflank, Panther, RedEagle Flumioxazin, Rowel, Valor SX, Warfox	51 WDG	14
	Panther SC, Valor EZ	4 F	14
flumioxazin + pyroxasulfone, premix	Fierce	76 WDG (33.5 + 42.5)	14 + 15
	Fierce EZ	3.04 SC (1.34 + 1.7)	14 + 15
fluometuron	Cotoran 4L, Sharda Fluometuron	4 F	7
fluridone	Brake	1.2 F	12
fomesafen	Agent 1.88, Battle Star, Foma 1.88, fomesafen 1.88, Fomesafen Sodium SC, Rumble, Shafen Star, Top Gun Flex, Vamos, Willowood Fomesafen 1.88	1.88 S	14
	Andros 2.0, Foma 2.0, Fomesafen 2 SL, Reflex, Ringside, Shafen, Top Gun, Willowood Fomesafen 2 SL	2 S	14
	Sinister	2.87 S	14
fomesafen + glyphosate, premix	Flexstar GT3.5	2.82 S (0.56 + 2.26[3])	14 + 9
glufosinate-ammonium	Agri Star Surmise, Cheetah, Forfeit 280, Glufosinate 280 SL, Interline, Liberty 280 SL, Reckon 280 SL, Refer 280 SL, Scout, Tide glufosinate, Total 2.3, Willowood Glufosinate 280SL	2.34 S	10
glufosinate-ammonium + quizalofop P-ethyl	Zalo	2.52 (2.29 + 0.23)	10 + 1
glyphosate	See Table 7-9.	S	9
glyphosate + *S*-metolachlor, premix	Sequence	5.25 EC (2.25[3] + 3)	9 + 15
lactofen	Boa, Cobra, Lactofen 2.0, Mongoose	2 EC	14
MSMA	MSMA 6 Plus, Target 6 Plus	6 S	17
	MSMA 6.6, Target 6.6	6.6 S	17
paraquat	Cyclone SL 2.0, Gramoxone SL 2.0	2 S	22
	Bonedry, Devour, Gramoxone, SL 3.0, Helmquat 3SL, Paraquat Concentrate, Para-Shot 3.0, Parazone 3SL, Quik-Quat, Willowood Paraquat 3SL	3 S	22
pendimethalin	Acumen, Framework, Helena Pendimethalin, Pavilion 3.3 EC, PendiPro 3.3 EC, Prowl 3.3 EC, Satellite 3.3, Stealth	3.3 EC	3
	Prowl H2O, Satellite Hydrocap	3.8 AS	3
prometryn	Caparol 4L	4 F	5
prometryn + trifloxysulfuron, premix	Suprend	80 WDG (79.3 + 0.7)	5 + 2
pyraflufen ethyl	ET Herbicide/Defoliant	0.208 EC	14
pyrithiobac sodium	Dupont Staple LX, Pysonex	3.2 S	2
pyroxasulfone	Zidua SC	4.17 SC	15
pyroxasulfone + carfentrazone, premix	Anthem Flex	4.0 SE	15 + 14
quizalofop p-ethyl	Assure II, Se-Cure EC, Targa	0.88 EC	1
rimsulfuron + thifensulfuron, premix	Leadoff, Leopard	33.4 WDG (16.7 + 16.7)	2 + 2
	Crusher	50 WDG (25 + 25)	2 + 2
S-metolachlor	Brawl, Charger Basic, Dual Magnum, EverpreX, Medal	7.62 EC	15
	Brawl II, Dual II Magnum, Medal II, Moccasin II Plus	7.64 EC	15
	Moccasin	8.0 EC	15
S-metolachlor + fomesafen, premix	Prefix	5.29 EC	14 + 15
	Sinister Intent	5.35 EC	14 + 15
saflufenacil	Sharpen	2.85 SC	14
sethoxydim	Poast Plus	1 EC	1
	Poast	1.5 EC	1
thifensulfuron + tribenuron, premix	Audit 1:1, Edition Broadspec, Firstshot, Rapport Broadspec	50 WDG (25 + 25)	2 + 2
	Harmony Extra SG	50 WDG (33.33 + 16.67)	2 + 2
	Nimble, Treaty Extra, T-Square, Volta Extra	75 WDG (50 + 25)	2 + 2
tiafenacil	Reviton	2.83 SC	14
trifloxysulfuron	Envoke	75 WDG	2
trifluralin	Treflan HFP, Trifluralin 4 EC, Trifluralin 4 E.C., Trifluralin HF, Triflurex HFP, Trust	4 EC	3

[1] Brands registered for sale and use in cotton in North Carolina in 2018 (www.kellysolutions.com/nc/searchbychem.asp); labels for most products available at www.cdms.net/Label-Database.

[2] AS, aqueous suspension; CS, capsule suspension; EC, emulsifiable concentrate; F, flowable; S, solution; SC, suspension concentrate; WDG, water dispersible granule.

[3] Rate expressed as acid equivalent.

NOTE: A mode of action (MOA) code has been added to the Herbicide and Formulation column of the following table. Use MOA codes for herbicide resistance management. See Table 7-10A, Herbicide Modes of Action, for details.

Table 7-2B. Chemical Weed Control in Cotton

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Early Preplant Burndown, Burndown of emerged annual weeds in no-till, strip-till, or stale seedbed systems, any variety			
glyphosate; MOA 9	See label	0.56 to 1.55 (lb a.e.)	Apply any time prior to planting to control emerged weeds. See labels for weeds controlled, application rates for specific weeds, and application directions and precautions. Does not adequately control cutleaf eveningprimrose, field pansy, Carolina geranium, or wild radish. Glyphosate is available in several formulations. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rates in the preceding column are expressed as a.e. See Table 7-9 for glyphosate rate conversions. Adjuvant recommendations vary according to the glyphosate product used. See label of brand used for specific recommendations. Cover crops: Wheat < 12 inches: 0.56 lb a.e. Wheat > 12 inches: 0.75 lb a.e. Rye < 18 inches: 0.56 lb a.e. Rye > 18 inches: 0.75 lb a.e. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed.**
glyphosate; MOA 9 + Aim (2 EC); MOA 14	See label + 0.5 to 1 fl oz	0.56 to 1.55 (lb a.e.) + 0.008 to 0.016	See comments for glyphosate alone. Aim contains carfentrazone; See Table 7-2A. Aim added to glyphosate will increase speed of control and may improve control of some species, but overall long-term control is generally not improved. This tank mix will not control cutleaf eveningprimrose, wild radish, or glyphosate-resistant horseweed. There is no waiting period between application and cotton planting.
glyphosate; MOA 9 + Burnmaster (4.07 EC) or Spitfire (3.57 EC); MOA 4	See label + 1.5 to 2 pt or 1.5 to 2 pt	0.56 to 1.55 (lb a.e.) + 0.76 to 1.02 (lb a.e.) or 0.67 to 0.89 (lb a.e.)	See comments for glyphosate alone. Burnmaster contains 1.0 lb a.e./gal of dicamba acid plus 3.07 lb a.e./gal of 2,4-D ester. Spitfire contains 0.5 lb a.e./gal of dicamba acid plus 3.07 lb a.e./gal of 2,4-D ester. Following application of either Burnmaster or Spitfire and a minimum of 1 inch rainfall, a waiting period of at least 30 days is required before planting. At the 2 pt rate, Burnmaster or Spitfire will control glyphosate-resistant horseweed.
glyphosate; MOA 9 + Clarity (4 S); MOA 4	See label + 8 fl oz	0.56 to 1.55 (lb a.e.) + 0.25 (lb a.e.)	See comments for glyphosate alone. Clarity is formulated as the diglycolamine salt of dicamba; this salt is preferred rather than the dimethylamine salt. Other brands containing dicamba diglycolamine salt are listed in Table 7-2A. Following application of dicamba and a minimum of 1 inch rainfall, a waiting period of at least 21 days is required before planting any cotton. Dicamba controls or suppresses several annual broadleaf weeds, and it suppresses Carolina geranium and curly dock. See Table 7-2E for weed response. Dicamba is somewhat less effective on cutleaf eveningprimrose than 2,4-D. This tank mixture will control glyphosate-resistant horseweed.
glyphosate; MOA 9 + 2,4-D; MOA 4 or Enlist One (3.8 S); MOA 4	See label + See label or 1 to pt	0.56 to 1.55 (lb a.e.) + 0.24 to 0.95 (lb a.e.) or 0.48 to 0.95 (lb a.e.)	See comments for glyphosate alone. Most, but not all, brands of 2,4-D may be applied at least 30 days ahead of cotton planting. Cotton containing the Enlist trait can be planted anytime following Enlist One application. 2,4-D is typically applied at 0.48 lb a.e. (1 pt/acre of 3.8 lb/gal formulation). See Table 7-2E for weed response. Excellent control of cutleaf eveningprimrose can be obtained with 2,4-D at 0.18 to 0.24 lb a.e. Glyphosate plus 2,4-D is not effective on Carolina geranium. At higher rates (0.95 lb a.e.; 2 pt/acre of 3.8 lb/gal formulation), this tank mix will control small glyphosate-resistant horseweed. Enlist One is a choline salt (lowest volatility formulation of 2,4-D). Amine, choline salt, and ester formulations of 2,4-D mixed with glyphosate are similarly effective. An amine formulation or Enlist One is preferred rather than ester if sensitive vegetation is nearby. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed.**
Enlist Duo (3.3 S); MOA 9 + 4	3.5 to 4.75 pt	0.74 to 1.0 (lb a.e.) glyphosate ± 0.7 to 0.95 (lb a.e.) 2,4-D	Enlist Duo contains 1.7 lb a.e./gal glyphosate and 1.6 lb a.e./gal 2,4-D as the choline salt. Enlist Duo contains the lowest volatility formulation of 2,4-D (choline salt). Apply at least 30 days ahead of planting any variety not containing the Enlist trait. Cotton containing the Enlist trait can be planted anytime following Enlist Duo application. Controls most weeds but not effective on Carolina geranium. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed.**
glyphosate; MOA 9 + ET (0.208 EC); MOA 14	See label + 0.5 to 2 fl oz	0.56 to 1.55 (lb a.e.) + 0.0008 to 0.0032	See comments for glyphosate alone. ET contains pyraflufen ethyl. ET added to glyphosate will increase speed of control and may improve control of some species, but overall long-term control is generally not improved. This tank mix will not control cutleaf eveningprimrose, wild radish, or glyphosate-resistant horseweed. There is no waiting period between application and cotton planting.
glyphosate; MOA 9 + Firstshot (50 WDG); MOA 2 + 2	See label + 0.8 oz	0.56 to 1.55 (lb a.e.) + 0.025	Firstshot is a 1:1 ratio premix of thifensulfuron plus tribenuron. Other brands of this premix are listed in Table 7-2A. This treatment should be applied at least 14 days prior to planting. Compared to glyphosate alone, the tank mix is more effective on Carolina geranium, curly dock, henbit, swinecress, Virginia pepperweed, wild mustard, and wild radish. Add nonionic surfactant according to the Firstshot label. This tank mix is not effective on cutleaf eveningprimrose or glyphosate-resistant horseweed.
glyphosate; MOA 9 + Harmony Extra (50 WDG); MOA 2 + 2	See label + 0.75 oz	0.56 to 1.55 (lb a.e.) + 0.023	Harmony Extra is a 2:1 ratio premix of thifensulfuron plus tribenuron formulated as 50 WDG. This treatment should be applied at least 14 days prior to planting. Compared to glyphosate alone, the tank mix is more effective on Carolina geranium, curly dock, henbit, swinecress, Virginia pepperweed, wild mustard, and wild radish. See Table 7-2E for weed response. Add nonionic surfactant according to the Harmony Extra label. This tank mix is not effective on cutleaf eveningprimrose or glyphosate-resistant horseweed. Other brands of thifensulfuron plus tribenuron 2:1 ratio, formulated as 75 WDG, include Nimble, Treaty Extra, T-Square, and Volta Extra. See Table 7-2A. The equivalent rate of these brands is 0.5 oz/acre.
glyphosate; MOA 9 + Leadoff (33.4 WDG); MOA 2 + 2 or Leopard (33.4 WDG); MOA 2 + 2	See label + 1.5 oz	0.56 to 1.55 (lb a.e.) + 0.031	Leadoff and Leopard are 1:1 ratio premixes of rimsulfuron plus thifensulfuron. Can be applied from late fall to 30 days prior to planting. Controls emerged winter annual weeds plus provides residual control of later emerging winter weeds. See Leadoff label for adjuvant recommendations. 2,4-D can also be included in the mixture. Leadoff does not substitute for a flumioxazin (Valor, others) application. The best use of Leadoff is a late fall or winter application (December to early March) followed by another burndown application containing flumioxazin 2 to 4 weeks ahead of planting. Crusher 50 WDG also contains a 1:1 ratio of rimsulfuron plus thifensulfuron. The equivalent rate of Crusher is 1 oz/acre.
glyphosate; MOA 9 + Resource (0.86 EC); MOA 14	See label + 2 to 4 fl oz	0.56 to 1.55 (lb a.e.) + 0.013 to 0.027	See comments for glyphosate alone. Resource contains flumiclorac pentyl ester. Resource added to glyphosate will increase speed of control and may improve control of some species, but overall long-term control is generally not improved. This tank mix will not control cutleaf eveningprimrose, wild radish, or glyphosate-resistant horseweed. There is no waiting period between application and cotton planting.

Table 7-2B. Chemical Weed Control in Cotton

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Early Preplant Burndown, Burndown of emerged annual weeds in no-till, strip-till, or stale seedbed systems, any variety (continued)			
glyphosate; MOA 9 + Valor SX (51 WDG); MOA 14 or Valor EZ (4 SC); MOA 14	See label + 1 to 2 oz or 1 to 2 fl oz	0.56 to 1.55 (lb a.e.) + 0.031 to 0.063	See comments for glyphosate alone. Valor SX/EZ contains flumioxazin. Other brands of flumioxazin are listed in Table 7-2A. In no-till or stale seedbed system, a minimum of 14 days must pass, and a 1-inch rainfall must occur between flumioxazin application and cotton planting when flumioxazin is applied at 1 oz/acre; 21 days must pass when applied at 1.5 to 2 oz/acre. If a strip-till operation occurs between flumioxazin application and cotton planting, the waiting interval can be reduced to 14 days for 2 oz flumioxazin. However, strip-tilling after flumioxazin application will reduce or eliminate weed control in the tilled strip. Compared to glyphosate alone, the tank mix will improve control of cutleaf eveningprimrose and wild radish. However, this tank mix is less effective than glyphosate plus 2,4-D on primrose and wild radish. Dicamba or 2,4-D may be added to this mixture. Regardless of glyphosate product used, a nonionic surfactant at 1 qt/100 gal. is recommended on flumioxazin labels. Applied at 1 oz/acre, flumioxazin will give 2 to 4 weeks residual control of lambsquarters, pigweed, prickly sida, spurge, and Florida pusley. At 2 oz/acre, flumioxazin will give 6 to 8 weeks residual control of these species. Application to cover crop or dense stand of winter weeds may reduce residual control. This tank mixture will not control glyphosate-resistant horseweed. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed.** **Carefully follow label directions for cleaning out the sprayer after each day's use.**
paraquat; MOA 22 2 lb/gal formulations 3 lb/gal formulations	 2.6 to 4 pt 1.7 to 2.7 pt	0.65 to 1	Apply any time prior to planting to control emerged weeds. Add nonionic surfactant at 1 pt per 100 gal or crop oil concentrate at 1 gal per 100 gal. Follow directions and precautions on label. Usually not adequately effective on cutleaf eveningprimrose, horseweed, or larger wild mustard or wild radish. Apply 0.65 lb a.i. for wheat and 0.5 lb a.i. for rye cover crops. Best control of small grain cover crops will be achieved if paraquat is applied at the boot stage or later. See Table 7-2A for brands. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicatorsfor more information.**
paraquat; MOA 22 2 lb/gal formulations 3 lb/gal formulations + diuron, MOA 7 4 F formulations 80 WDG formulations	 2.6 to 4 pt 1.7 to 2.7 pt + 1 to 2 pt 0.63 to 1.25 lb	0.65 to 1 + 0.5 to 1	See comments for paraquat alone. See diuron label for use rates on various soils. Apply 15 to 45 days ahead of planting. If Cotoran is applied preemergence, reduce Cotoran rate to account for residual activity of diuron. When mixed with crop oil concentrate and applied in April, this combination has given good control of common weeds, including cutleaf eveningprimrose. See Table 7-2A for brands of paraquat and diuron. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.**
Early Preplant Burndown, Glyphosate-resistant horseweed, any variety			
Enlist Duo; MOA 9 + 4 + Valor SX (51 WDG); MOA 14 or Valor EZ (4 SC); MOA 14	4.75 pt + 1 to 2 oz or 1 to 2 fl oz	(lb a.e.) glyphosate + 0.95 (lb a.e.) 2,4-D + 0.032 to 0.063 flumioxazin	Glyphosate-resistant horseweed is very common in eastern North Carolina and is beginning to become a problem in the Piedmont. See previous comments concerning waiting intervals between application of 2,4-D, dicamba, and flumioxazin and planting. The 2,4-D or dicamba is needed in the mixture to control emerged resistant horseweed, and the flumioxazin will control horseweed germinating after this application. Dicamba may be somewhat more effective than 2,4-D on horseweed. Better results will be obtained if treatment is applied prior to first of April. Enlist Duo contains 1.7 lb a.e./gal glyphosate and 1.6 lb a.e./gal 2,4-D as the choline salt. Enlist One contains the choline salt of 2,4-D. Valor SX/EZ contains flumioxazin; see Table 7-2A for other brands of flumioxazin. In no-till or stale seedbed systems, a minimum of 14 days must pass, and a 1-inch rainfall must occur between flumioxazin application and cotton planting when flumioxazin is applied at 1 oz/acre; 21 days must pass when applied at 1.5 to 2 oz/acre. If a strip-till operation occurs between flumioxazin application and cotton planting, the waiting interval can be reduced to 14 days for 2 oz flumioxazin. However, strip-tilling after flumioxazin application will reduce or eliminate weed control in the tilled strip.
Enlist One; MOA 4 + glyphosate; MOA 9 + Valor SX (51 WDG); MOA 14 or Valor EZ (4 SC); MOA 14	2 pt + See label + 1 to 2 oz or 1 to 2 fl oz		
glyphosate; MOA 9 + 2,4-D; MOA 4 + Valor SX (51 WDG); MOA 14 or Valor EZ (4 SC); MOA 14	See label + See label + 1 to 2 oz or 1 to 2 fl oz	0.56 to 1.55 (lb a.e.) + 0.95 (lb a.e.) + 0.032 to 0.063	
glyphosate; MOA 9 + Clarity (4 SL); MOA 4 + Valor SX (51 WDG); MOA 14 or Valor EZ (4 SC); MOA 14	See label + 8 fl oz + 1 to 2 oz	0.56 to 1.55 (lb a.e.) + 0.25 + 0.032 to 0.063	
glyphosate; MOA 9 + Sharpen (2.85 F); MOA 14	See label + 1.0 fl oz	0.56 to 1.55 (lb a.e.) + 0.022	Sharpen contains saflufenacil. After applying Sharpen, wait to plant cotton until at least 42 days and an accumulation of 1 inch of rainfall has occurred. Do not apply Sharpen to soils classified as sand with less than 1.5% organic matter. Do not mix flumioxazin with Sharpen. See Sharpen label for specifics on adjuvant selection.
glyphosate; MOA 9 + Reviton (2.83 SC); MOA 14	See label + 1 to 3 fl oz	0.56 to 1.55 (lb a.e.) + 0.022 to 0.066	Reviton contains tiafenacil. Wait to plant cotton at least 7 days when applying 1 oz per acre Reviton or 14 days when applying >1 oz per acre. Add either methylated seed oil at 1% by volume (1 gal per 100 gal). May also add urea ammonium nitrate at 2.5% by volume (2.5 gal per 100 gal) or spray grade ammonium sulfate at 8.5 lb product per 100 gal spray solution. Tank-mixing with 2,4-D or dicamba is suggested to improve broadleaf weed control.
Liberty (2.34 S); MOA 10	29 to 43 fl oz	0.53 to 0.79	Liberty (see Table 7-2A for other brands containing glufosinate) is recommended only for fields where growers have failed to control glyphosate-resistant horseweed and it is too late to use 2,4-D or dicamba. Best results with glufosinate will be obtained if sprayed when daytime temperatures exceed 75 degrees. If greater than 29 oz applied preplant, the seasonal total applied cannot exceed 72 fl oz.

Table 7-2B. Chemical Weed Control in Cotton

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
At Planting Burndown, Burndown of cover crops and weeds at planting, any variety			
glyphosate; MOA 9	See label	0.56 to 1.55 (lb a.e.)	See Table 7-9 for glyphosate brands and rate conversions. See Table 7-2A for brands of paraquat. If an early burndown treatment was applied (see COTTON—Early Preplant Burndown), apply glyphosate or paraquat in combination with desired residual herbicides at planting. Glyphosate or paraquat may be tank mixed with registered preemergence herbicides and applied after planting but before cotton emergence. See suggested rates and precautions on labels of tank-mix partners. If an early burndown treatment was not used, apply glyphosate or paraquat 7 to 21 days ahead of planting. If weeds are emerged at planting, make a second application in combination with desired residual herbicides. See comments on residual herbicides under COTTON—Preemergence. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.** Glyphosate and paraquat rates depend upon weed species and size; see labels for recommended rates. Add nonionic surfactant at 1 pt per 100 gal or crop oil concentrate at 1 gal per 100 gal spray solution to paraquat. Need for adjuvants with glyphosate depends upon brand used; see specific labels for details. Cover crops: Wheat < 12 inches: glyphosate, 0.56 lb a.e. or paraquat, 0.65 lb a.i. Wheat > 12 inches; glyphosate 0.75 lb a.e. or paraquat, 0.65 lb a.i. Rye < 18 inches: glyphosate, 0.56 lb a.e. or paraquat, 0.5 lb a.i. Rye > 18 inches: glyphosate, 0.75 lb a.e. or paraquat, 0.5 lb a.i.
paraquat; MOA 22 2 lb/gal formulations 3 lb/gal formulations	 2.6 to 4 pt 1.7 to 2.7 p	0.65 to 1	
Liberty (2.34 S); MOA 10	29 to 43 fl oz	0.53 to 0.79	See comments under EARLY PREPLANT BURNDOWN for more details. Suggested only if glyphosate-resistant horseweed is a problem. Liberty contains glufosinate. Other brands of glufosinate are listed in Table 7-2A.
At Planting Burndown, Burndown of cover crops and weeds at planting, Enlist varieties only			
glyphosate; MOA 9 + Enlist One (3.8 S); MOA 4	See label + 2 pt	(lb a.e.) glyphosate + 0.95 (lb a.e.) 2,4-D	Enlist varieties only. Enlist One is the only brand of 2,4-D approved for this application timing. Can be applied any time prior to planting or behind the planter. Controls most weeds but not effective on Carolina geranium. See website www.enlist.com/en/herbicides/approved-tank-mix.html for approved adjuvants, drift reduction agents, tank mixes, and training modules (www.enlist.com/en/enlist-ahead.html); can be mixed with all commonly used preemergence herbicides. See Enlist One federal label for details on drift management, including recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, susceptible plants, endangered species areas, and how to mitigate runoff (www.enlist.com/en/enlist-ahead/mitigation-measures-to-manage-runoff.html). It is best for this application to follow an earlier burndown application. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed.**
Enlist Duo (3.3S); MOA 9 + 4	4.75 pt	1.0 (lb a.e.) glyphosate + 0.95 (lb a.e.) 2,4-D	Enlist varieties only. Enlist Duo is a premix of glyphosate plus the choline salt of 2,4-D. See comments for glyphosate + Enlist One.
Preplant Incorporated, Annual grasses and certain small-seeded broadleaf weeds, any variety			
Prowl 3.3 EC (3.3EC); MOA 3	1.2 to 3.6 pt	0.5 to 1.5	Prowl 3.3 EC and Prowl H2O contain pendimethalin; Treflan contains trifluralin; see Table 7-2A for other brands of pendimethalin and trifluralin. Consult labels for application rates and for time, method, and depth of incorporation. Deep incorporation, especially on sandy soils, may cause stunting and delayed crop development. Incorporation of trifluralin can be delayed 24 hrs; pendimethalin incorporation can be delayed 7 days. Immediate incorporation is suggested.
Prowl H2O (3.8AS); MOA 3	2 to 4 pt	0.95 to 1.9	
Treflan (4EC); MOA 3	1 to 2 pt	0.5 to 1	
Preemergence, Annual grasses and pigweed, any variety			
Warrant/Enversa (3 CS); MOA 15	3 pt	1.125	Warrant and Enversa contain acetochlor in an encapsulated formulation. They can be applied in combination with another preemergence herbicide such as diuron, fluometuron (Cotoran, others), fluridone (Brake), or fomesafen (Reflex, others). If replanting cotton into previously applied Warrant or Enversa, research from North Carolina and Georgia suggests waiting at least 3 weeks prior to replanting cotton no-till or 2 weeks if fresh soil is brought into planting zone via ripper shanks.
Preemergence, Annual grasses, pigweed, and lambsquarters, any variety			
Prowl 3.3 EC; MOA 3	2.4 to 3.6 pt	1.0 to 1.5	Prowl 3.3 EC and Prowl H2O Contain pendimethalin. See Table 7-2A for other brands of pendimethalin. See labels for rates on specific soils. May be mixed with diuron, fluometuron (Cotoran, others), fomesafen (Reflex, others), or pyrithiobac (Staple LX, others).
Prowl H2O (3.8AS); MOA 3	2.1 to 4 pt	1.0 to 1.9	
Preemergence, Annual grasses and various broadleaf weeds, any variety			
Warrant Ultra (3.45 CS); MOA 15 + 14	3 pt	1.29	Warrant Ultra is a premix formulation containing 2.82 lb/gal of acetochlor plus 0.63 lb/gal fomesafen. Use preemergence only on coarse-textured soils. If replanting cotton into previously applied Warrant Ultra, research from North Carolina and Georgia suggests waiting at least 3 weeks prior to replanting cotton no-till or 2 weeks if fresh soil is brought into planting zone via ripper shanks.
Preemergence, Annual broadleaf weeds, any variety			
Brake (1.2F); MOA 12	16 to 32 fl oz	0.15 to 0.3	Label specifies to tank mix Brake with another residual herbicide when Brake is applied at less than 21 oz/acre. Suggested tank mixes include diuron, fluometuron (Cotoran, others), fomesafen (Reflex, others), or encapsulated acetochlor (Warrant/Enversa). If applied alone, Brake will be most effective at 32 oz. See label for rotational restrictions. Brake suggested primarily for fields with problem Palmer amaranth or common ragweed populations.
Cotoran (4 F); MOA 7	1 to 2 qt	1 to 2	Cotoran contains fluometuron; see Table 7-2A for other brands. Use lower end of rate range on lighter soils. May be tank mixed with pendimethalin (Prowl, others), fomesafen (Reflex, others), pyrithiobac (Staple LX, others), or encapsulated acetochlor (Warrant/Enversa).
diuron, MOA 7 4 F formulations 80 WDG formulations	 1 to 2 pt 0.63 to 1.25 lb	0.5 to 1	See labels for rates on specific soils. May be mixed with pendimethalin (Prowl, others), fomesafen (Reflex, others), pyrithiobac (Staple LX, others), or encapsulated acetochlor (Warrant/Enversa). See rotational restrictions and maximum seasonal use rates on label. See Table 7-2A for brands of diuron.
Reflex (2 S); MOA 14	1 pt	0.25	Reflex contains fomesafen. Other brands containing 1.88 or 2 lb/gal of fomesafen are listed in Table 7-2A. Suggested primarily for control of Palmer amaranth and common ragweed. Label restricts preemergence application only to coarse-textured soils. May be tank mixed with diuron (Direx, others), fluometuron (Cotoran, others), pendimethalin (Prowl, others), pyrithiobac (Staple LX, others), or encapsulated acetochlor (Warrant/Enversa). See labels for specific comments on tank mixing.
Sinister (2.87 S); MOA 14	0.7 pt	0.25	Sinister contains fomesafen. Suggested primarily for control of Palmer amaranth. Label restricts preemergence application only to coarse-textured soils. May be tank mixed with diuron (Direx, others), fluometuron (Cotoran, others) pendimethalin (Prowl, others), pyrithiobac (Staple LX, others), or encapsulated acetochlor (Warrant/Enversa). See labels for specific comments on tank mixing.
Staple LX (3.2 SL); MOA 2	1.7 to 2.1 fl oz	0.0425 to 0.053	Staple contains pyrithiobac. Other brands of pyrithiobac are listed in Table 7-2A. Do not apply pyrithiobac preemergence on soils with less than 0.5% organic matter. May tank mix with diuron (Direx, others), fluometuron (Cotoran, others), pendimethalin (Prowl, others), fomesafen (Reflex, others) or encapsulated acetochlor (Warrant/Enversa). Palmer amaranth biotypes resistant to pyrithiobac are very common in North Carolina.

Table 7-2B. Chemical Weed Control in Cotton

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-emergence Overtop, Annual broadleaf weeds, any variety			
Envoke (75 WDG); MOA 2	0.1 oz	0.0047	Envoke contains trifloxysulfuron. May be applied overtop cotton after it has a minimum of 5 true leaves up to 60 days prior to harvest. On larger cotton, directed application is preferred for better coverage of weeds. Add nonionic surfactant at 0.25% by volume (1 qt per 100 gal). May make two applications, but do not exceed 0.0188 lb a.i./acre per year of trifloxysulfuron from the combined use of all trifloxysulfuron-containing products (Envoke and Suprend). Do not mix with other pesticides when applying overtop of cotton. See label for rotational restrictions and weeds controlled. Controls most broadleaf weeds with timely application; common exceptions include prickly sida, jimsonweed, copperleaf, and spurred anoda. Reduced growth of cotton, due to shortened internodes, is sometimes observed. Shortened internodes are more likely on smaller cotton. Envoke may also be applied overtop at 0.15 oz/acre if needed for larger weeds. Pyrithiobac (Staple, others) and Envoke are ALS inhibitors. Biotypes of Palmer amaranth, common ragweed, and cocklebur resistant to ALS inhibitors have been found in North Carolina; ALS-resistant Palmer amaranth is very common. To aid in resistance management, it is suggested that an ALS inhibitor be applied only once per year.
Staple LX (3.2 S); MOA 2	2.6 to 3.8 fl oz	0.065 to 0.095	Staple contains pyrithiobac. Other brands of pyrithiobac are listed in Table 7-2A. May be applied overtop of cotton from cotyledonary stage up to 60 days prior to harvest. Avoid application during or shortly after cool weather. Add nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Do not add crop oil concentrate. May make 2 applications per year, not exceeding a total of 5.1 fl oz. May be tank mixed with most insecticides, but do not tank mix with any product containing malathion. Tank mixing with post-emergence grass control herbicides is discouraged. See label for rotational restrictions and weeds controlled. Timing of application is very important for most weeds. Apply before susceptible broadleaf weeds exceed 4 inches tall. Does not control tall morningglory, lambsquarters, or common ragweed. Only suppresses sicklepod. Pyrithiobac and Envoke are ALS inhibitors. Biotypes of Palmer amaranth, common ragweed, and cocklebur resistant to ALS inhibitors have been found in North Carolina; ALS-resistant Palmer amaranth is very common. To aid in resistance management, it is suggested that an ALS inhibitor be applied only once a year.
Envoke (75 WDG); MOA 2 + Staple LX (3.2 S); MOA 2	0.1 oz + 1.3 to 1.9 fl oz	0.0047 + 0.033 to 0.048	See comments for Envoke and Staple applied alone. Compared with Envoke alone, tank mix is more effective on eclipta, jimsonweed, and spurred anoda. Compared with Staple alone, tank mix is more effective on ragweed, lambsquarters, tall morningglory, and sicklepod. Add nonionic surfactant at 0.25% by volume.
Post-emergence Overtop, Annual grasses, any variety			
Assure II (0.88 EC); MOA 1	7 to 8 fl oz	0.05 to 0.06	Assure II contains quizalofop p-ethyl. Other brands are listed in Table 7-2A. Apply to actively growing grass not under drought stress. See label for maximum weed size to treat and suggested rate. Apply in 10 to 40 gpa. Add either crop oil concentrate at 1% by volume (1 gal per 100 gal) or nonionic surfactant at 0.25% by volume (1 qt per 100 gal). A second application may be made if needed. May use 5 oz per acre for seedling johnsongrass or shattercane.
Fusilade DX (2 EC); MOA 1	8 to 12 fl oz	0.125 to 0.188	Apply to actively growing grass not under drought stress. Suggested application rate varies by species and weed size; see label. Apply in 5 to 40 gpa at 40 to 60 psi. Add either crop oil concentrate at 1% by volume (1 gal per 100 gal) or nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Second application may be made if necessary. May use 6 oz per acre for seedling johnsongrass or shattercane.
Poast (1.5 EC) or Poast Plus (1.0 EC) MOA 1	16 fl oz or 24 fl oz	0.19	Apply to actively growing grass not under drought stress. Consult label for maximum grass size to treat. Apply in 5 to 20 gpa at 40 to 60 psi. Add 2 pt per acre of crop oil concentrate. A second application may be made if necessary. Consult label for special rates for early treatment or rescue treatment. Poast and Poast Plus contain sethoxydim. See Table 7-2A for other brands of sethoxydim.
Select (2 EC) or Select Max (0.97 EC) MOA 1	6 to 8 fl oz or 9 to 16 fl oz	0.094 to 0.125 or 0.068 to 0.121	Contains clethodim; see Table 7-2A for other brands. Apply to actively growing grass not under drought stress. See labels for maximum weed size to treat and suggested rate. Apply in 10 to 40 GPA. Add adjuvant according to label. A second application may be made if needed.
Post-emergence Overtop, Bermudagrass and Johnsongrass, any variety			
Assure II (0.88 EC); MOA 1	10 fl oz	0.07	Assure II contains quizalofop p-ethyl. Other brands are listed in Table 7-2A. Apply to actively growing bermudagrass when runners are up to 6 inches or johnsongrass 10 to 24 inches tall. A second application of 7 fl oz per acre may be applied if needed when bermudagrass regrowth is up to 6 inches or johnsongrass regrowth is 6 to 10 inches. Add either a crop oil concentrate at 1% by volume (1 gal per 100 gal) or a nonionic surfactant at 0.25% by volume (1 qt per 100 gal).
Fusilade DX (2 EC); MOA 1	12 fl oz	0.19	Apply to actively growing bermudagrass when runners are 4 to 8 inches long or johnsongrass 8 to 18 inches tall and before boot stage. If regrowth occurs, make a second application of 8 fl oz when bermudagrass runners are 4 to 8 inches or johnsongrass regrowth is 6 to 12 inches. Add either crop oil concentrate at 1 qt per acre or nonionic surfactant at 0.25% by volume (1 qt per 100 gal).
Poast (1.5 EC) or Poast Plus (1.0 EC) MOA 1	24 fl oz or 36 fl oz	0.28	Apply to actively growing bermudagrass before runners exceed 6 inches or to johnsongrass up to 25 inches tall. If regrowth occurs or new plants emerge, make a second application before bermudagrass runners exceed 4 inches or johnsongrass regrowth exceeds 12 inches. See labels for second application rates. Add 2 pt of crop oil concentrate per acre. Poast and Poast Plus contain sethoxydim. See Table 7-2A for other brands of sethoxydim.
Select (2 EC) or Select Max (0.97 EC) MOA 1	8 to 16 fl oz or 12 to 32 fl oz	0.125 to 0.25 or 0.091 to 0.24	Apply to actively growing bermudagrass when runners are up to 6 inches or johnsongrass is 12 to 24 inches tall. A second application may be applied if needed when bermudagrass regrowth is up to 6 inches or johnsongrass regrowth is 6 to 18 inches. See labels for second application rates. Add adjuvant according to label. Use the higher rate under heavy grass pressure or on larger grass. Contains clethodim; see Table 7-2A for other brands.
Post-emergence Overtop, Annual broadleaf weeds and most annual grasses, Glytol LibertyLink, Enlist, or XtendFlex Cultivars only			
Liberty (2.34 S); MOA 10	29 to 43 fl oz	0.53 to 0.79	Contains glufosinate; see Table 7-2A for other brands. Apply overtop or directed from cotton emergence until the early bloom stage. Good spray coverage is critical. Use flat-fan nozzles and a minimum of 15 GPA. Better coverage may be obtained on larger cotton with a semi-directed application. An adjuvant is not necessary. Application time of day is important. Two hours of sunshine before a morning application is suggested. Do not apply later than 1 hour before sunset. Multiple applications are allowed. Liberty at 29 fl oz can be applied three times, with a seasonal maximum of 87 fl oz. If applied at rates greater than 29 oz, only two applications are allowed and the total rate per season cannot exceed 72 fl oz. Liberty controls most annual grass and broadleaf weeds, although timing of application on pigweed (including Palmer amaranth) and grasses (especially goosegrass) is critical. Preemergence herbicides are encouraged to help in control of pigweed and grasses. Liberty is generally more effective on broadleaf weeds than grasses. Broadleaf weeds should be 2 to 3 inches tall and grasses 1 to 2 inches tall. Postemergence grass control by herbicides, such as clethodim, fluazifop, quizalofop, and sethoxydim, is reduced when tank mixed with glufosinate. If applied separately, postemergence grass herbicides and glufosinate should be separated by at least 5 days.
Liberty (2.34 S); MOA 10 + Dual Magnum (7.62 EC); MOA 15	29 to 43 fl oz + 1 to 1.33 pt	0.53 to 0.79 + 0.95 to 1.27	See comments for Liberty applied alone. Dual Magnum contains *S*-metolachlor; see Table 7-2A for other brands. *S*-metolachlor will not control emerged weeds, but it can provide residual control of susceptible species such as annual grasses and pigweed species. This treatment may cause foliar burn on the crop. Burn may be enhanced if applied to cotton with dew, under extremely high temperatures, or when mixed with insecticides or adjuvants. Several products containing metolachlor (not *S*-metolachlor) are available. Metolachlor products are less effective per unit of formulated product than those with *S*-metolachlor. In general, it takes 1.5 pt of a metolachlor product to give the activity one gets from 1 pt of *S*-metolachlor.

Table 7-2B. Chemical Weed Control in Cotton

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-emergence Overtop, Annual broadleaf weeds and most annual grasses, Glytol LibertyLink, Enlist, or XtendFlex Cultivars only (continued)			
Liberty (2.34 L); MOA 10 + Outlook (6 EC); MOA 15	29 to 43 fl oz + 12 to 16 fl oz	0.53 to 0.79 + 0.56 to 0.75	See comments for Liberty applied alone. Outlook will not control emerged weeds, but it can provide residual control of susceptible species such as annual grasses and pigweed species. This treatment may cause foliar burn on the crop. Burn may be enhanced if applied to cotton with dew, under extremely high temperatures, or when mixed with insecticides or adjuvants.
Liberty (2.34 L); MOA 10 + Staple LX (3.2 S); MOA 2	29 to 43 fl oz + 1.3 to 3.8 fl oz	0.53 to 0.79 + 0.033 to 0.095	See comments for Liberty applied alone. Staple contains pyrithiobac. See Table 7-2A for other brands of glufosinate and pyrithiobac. See directions on pyrithiobac label concerning adjuvant usage. Staple will improve control of non-ALS-resistant Palmer amaranth plus provide residual control.
Liberty (2.34 L); MOA 10 + Warrant/Enversa (3 CS); MOA 15	29 to 43 fl oz + 3 pt	0.53 to 0.79 + 1.125	See comments for Liberty applied alone. Warrant/Enversa will not control emerged weeds, but it can provide residual control of susceptible species such as annual grasses and pigweed species. This treatment may cause foliar burn on the crop. Burn may be enhanced if applied to cotton with dew, under extremely high temperatures, or when mixed with insecticides or adjuvants.
Zalo (2.52 SL); MOA 10 + 1	32 to 43 fl oz	0.63 to 0.85	Contains glufosinate plus the graminicide quizalofop for improved control of grasses like Texas panicum, goosegrass, crowsfootgrass, and rhizome johnsongrass over glufosinate applied alone. Apply from cotton emergence up to 14 days prior to bloom. Applications of Zalo require the addition of an adjuvant and a nitrogen fertilizer sources to achieve optimal weed control. A maximum of 69 fl oz/ per acre per crop year of Zalo may be applied in cotton.
Post-emergence Overtop, Annual grasses, broadleaf weeds, perennial grasses, and nutsedge; suppression of perennial broadleaf weeds, Enlist, Glytol LibertyLink, Roundup Ready Flex, or XtendFlex varieties only			
glyphosate; MOA 9	See labels	0.56 to 1.13 (lb a.e.)	Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rates in the preceding column are expressed as a.e. See TABLE 7-9 for glyphosate rate conversions. Glyphosate controls most annual weeds; exceptions include dayflower, dove weed, Florida pusley, and hemp sesbania. Timely application is critical for morningglory control. Multiple applications are needed for nutsedge and bermudagrass. See label of brand you use for recommended rates and sizes of weeds to treat. Adjuvant recommendations vary according to glyphosate product. See label of brand used for specific recommendations. Glyphosate-resistant Palmer amaranth is common in North Carolina, and glyphosate-resistant common ragweed is present in several counties. Continued heavy reliance on herbicide programs based predominantly on glyphosate will enhance selection for resistant biotypes. Other chemistry, including preemergence herbicides, tank mixes with glyphosate, and layby herbicides in addition to glyphosate, is recommended as part of a resistance-management strategy. See section on Herbicide Resistance and TABLE 7-10A.
glyphosate; MOA 9 + Dual Magnum (7.62 EC); MOA 15	See labels + 1 to 1.33 pt	0.56 to 1.13 (lb a.e.) + 0.95 to 1.27	See comments for glyphosate applied alone. Dual Magnum contains *S*-metolachlor; see Table 7-2A for other brands. *S*-metolachlor will not control emerged weeds, but it can provide residual control of susceptible species such as annual grasses and pigweed species. This treatment may cause foliar burn on the crop. Burn may be enhanced if applied to cotton with dew, under extremely high temperatures, or when mixed with insecticide or adjuvant. Several products containing metolachlor (not *S*-metolachlor) are available. Metolachlor products are less effective per unit of formulated product than those with *S*-metolachlor. In general, it takes 1.5 pt of a metolachlor product to give the activity one gets from 1 pt of *S*-metolachlor.
glyphosate; MOA 9 + Envoke (75 WDG); MOA2	See labels + 0.1 oz	0.56 to 1.13 (lb a.e.) + 0.0047	See comments for glyphosate and Envoke applied alone. See Envoke label and glyphosate label for suggestions on adjuvant usage. Tank mix can be applied from 5-leaf cotton stage until 60 days prior to harvest. For better crop safety, however, cotton should have at least 7 to 8 leaves at time of treatment.
glyphosate; MOA 9 + Outlook (6 EC); MOA 15	See labels + 12 to 16 fl oz	0.56 to 1.13 (lb a.e.) + 0.56 to 0.75	See comments for glyphosate applied alone. Can apply from first true leaf to mid-bloom stage. Outlook will not control emerged weeds, but it will provide residual control of susceptible species such as annual grasses and pigweed species. Optimum timing is 2- to 3-leaf cotton, and before weeds emerge. Make only one application per year. Outlook plus glyphosate may cause some foliar burn on cotton; mixing with insecticides or adjuvants may increase burn. Suggested rates are 12 oz on coarse soils, 14 oz on medium soils, and 16 oz on fine soils.
glyphosate; MOA 9 + Staple LX (3.2 S;) MOA 2	See labels + 1.3 to 3.8 fl oz	0.56 to 1.13 (lb a.e.) + 0.033 to 0.095	See comments for glyphosate applied alone. Staple contains pyrithiobac; see Table 7-2A for other brands. Can apply overtop from cotyledonary stage cotton until 60 days prior to harvest. See directions on pyrithiobac labels concerning adjuvant usage. Palmer amaranth resistant to both pyrithiobac and glyphosate is widespread in North Carolina.
glyphosate; MOA 9 + Warrant/Enversa (3 CS); MOA 15	See labels + 3 pt	0.56 to 1.13 (lb a.e.) + 1.125	See comments for glyphosate applied alone. Apply after cotton is completely emerged but before first bloom. Warrant/Enversa will not control emerged weeds, but it will provide residual control of susceptible species such as annual grasses and pigweed species. Optimum timing is 2- to 3-leaf cotton, and before weeds emerge. A second application can be made if directed to the soil surface. Warrant/Enversa plus glyphosate may cause some foliar burn on cotton; mixing with insecticides or adjuvants may increase burn. Warrant/Enversa rate can be increased to 4 pt on some soils; see label for details.
Sequence (5.25 L); MOA 9 + 15	2.5 to 3.5 pt	0.70 to 1.0 (lb a.e.) glyphosate + 0.94 to 1.3 S-metolachlor	Sequence is a premix containing 2.25 lb a.e./gal glyphosate and 3 lb/gal *S*-metolachlor. See comments for glyphosate alone and glyphosate + *S*-metolachlor. Apply to cotton in cotyledonary stage up to 10-leaf stage, but not to cotton taller than 12 inches. Apply 2.5 pt to cotton less than 5 leaves. Can increase rate to 3.5 pt on cotton with 5 to 10 leaves.
Post-emergence Overtop, Annual grasses and broadleaf weeds. Enlist varieties only			
Liberty (2.34 S); MOA 10 + Enlist One (3.8 S); MOA 4	29 to 43 oz + 2 pt	0.53 to 0.79 + 0.95	**Enlist varieties only**. Enlist One contains the choline salt of 2,4-D. It and Enlist Duo are the only brands of 2,4-D registered for postemergence application to Enlist cotton. Can be applied any time from cotton emergence to first bloom. Can be applied twice postemergence; allow minimum of 12 days between applications. See website www.enlist.com/en/herbicides/approved-tank-mix.html for approved adjuvants, drift reduction agents, tank mixes, and training modules (www.enlist.com/en/enlist-ahead.html). Can be mixed with Dual Magnum, EverpreX, Moccasin, Staple LX, or Warrant/Enversa for residual control; the addition of these products will increase foliar burn. See Enlist One federal label for details on drift management, including recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, susceptible plants, endangered species areas, and how to mitigate runoff (www.enlist.com/en/enlist-ahead/mitigation-measures-to-manage-runoff.html).
Post-emergence Overtop, Annual and perennial grasses, broadleaf weeds, nutsedge. Enlist varieties only			
glyphosate; MOA 9 + Enlist One (3.8 S); MOA 4	See labels + 2 pt	1.0 (lb a.e.) + 0.95	**Enlist varieties only**. Enlist One and Enlist Duo contain the choline salt of 2,4-D. They are the only brands of 2,4-D registered for postemergence application to Enlist cotton. Can be applied any time from cotton emergence to first bloom. Can be applied twice postemergence; allow minimum of 12 days between applications. See website www.enlist.com/en/herbicides/approved-tank-mix.html for approved adjuvants, drift reduction agents, tank mixes, and training modules (www.enlist.com/en/enlist-ahead.html). Can be mixed with several brands of glyphosate; see website for approved mixes. Can be mixed with Dual Magnum, EverpreX, Moccasin, Staple LX, or Warrant/Enversa for residual control; the addition of these products will increase foliar burn. See Enlist One federal label for details on drift management, including recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, susceptible plants, endangered species areas, and how to mitigate runoff (www.enlist.com/en/enlist-ahead/mitigation-measures-to-manage-runoff.html).

Table 7-2B. Chemical Weed Control in Cotton

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-emergence Overtop, Annual and perennial grasses, broadleaf weeds, nutsedge. Enlist varieties only (continued)			
Enlist Duo (3.3 S); MOA 9 + 4	4.75 pt	1.0 (lb a.e.) glyphosate ± 0.95 (lb a.e.) 2,4-D	**Enlist varieties only**. Enlist Duo contains 1.7 lb a.e./gal glyphosate and 1.6 lb a.e./gal 2,4-D as the choline salt. Can be applied any time from cotton emergence to first bloom. Can be applied twice postemergence; allow minimum of 12 days between applications. See website www.enlist.com/en/herbicides/approved-tank-mix.html for approved adjuvants, drift reduction agents, tank mixes, and training modules (www.enlist.com/en/enlist-ahead.html). Can be mixed with Moccasin (s-metolachlor) and Warrant/Enversa for residual control; the addition of these products will increase foliar burn. See Enlist Duo federal label for details on drift management, including recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, susceptible plants, endangered species areas, and how to mitigate runoff (www.enlist.com/en/enlist-ahead/mitigation-measures-to-manage-runoff.html).
Post-emergence Overtop, Volunteer Roundup Ready corn, any variety			
Assure II (0.88 EC); MOA 1	5 to 8 fl oz	0.034 to 0.055	Contains quizalofop; see Table 7-2A for other brands. See above comments for quizalofop. See quizalofop label for application rates on various sizes of corn and for adjuvant recommendations. Can mix with glyphosate.
Fusilade DX (2 EC); MOA 1	4 to 6 fl oz	0.063 to 0.094	See above comments for Fusilade. See label for application rates on various sizes of corn and for adjuvant recommendations. Can mix with glyphosate.
Poast (1.5 EC) or Poast Plus (1.0 EC) MOA 1	16 fl oz or 24 fl oz	0.189	Contains sethoxydim; see Table 7-2A for other brands. See above comments for sethoxydim. See sethoxydim label for application rates on various sizes of corn and for adjuvant recommendations. Can mix with glyphosate.
Select (2 EC) or Select Max (0.97 EC) MOA 1	4 to 8 fl oz or 6 to 12 fl oz	0.063 to 0.125 or 0.045 to 0.106	Contains clethodim; see Table 7-2A for other brands. See clethodim labels for application rates on various sizes of corn and for adjuvant recommendations. Can mix with glyphosate.
Post-emergence Overtop, Volunteer Roundup Ready soybean, any variety			
Envoke (75 WDG); MOA 2	0.1 oz	0.0047	See above comments for Envoke. Cotton should have at least 5 leaves, and the soybean should have no more than 4 to 5 trifoliate leaves. Not adequately effective on soybean with the STS or Bolt trait.
Post-emergence Directed, Cocklebur, small annual grasses, and nutsedge, any variety			
MSMA; MOA 17 6 lb/gal formulation 6.6 lb/gal formulation	 2.67 pt 2.5 pt	2	Do not apply overtop at these rates. MSMA can be directed alone or mixed with other postemergence broadleaf herbicides on cotton at least 3 inches tall up to first bloom. Do not apply MSMA after first bloom. Adequate control of nutsedge usually requires 2 applications. Follow label directions for use of adjuvants.
Post-emergence Directed, Annual broadleaf weeds, small annual grasses, and nutsedge, any variety			
Caparol (4 F); MOA 5 + MSMA; MOA 17 6 lb/gal formulation 6.6 lb/gal formulation	1.3 to 2.8 pt + 2.67 pt 2.5 pt	0.65 to 1.4 + 2	Apply 1.3 pt Caparol as directed spray only to cotton at least 6 inches tall. Increase to higher rate for the soil type after cotton is at least 12 inches tall. See label for rates on various soil types. Add 2 qt nonionic surfactant per 100 gal spray solution. Do not apply after first bloom. Aim at 1 fl oz or Cobra at 6 to 12.5 fl oz may be added to improve control of larger morningglory. Cotton should be at least 16 inches tall when applying Aim. Do not allow Aim to contact green stem tissue.
Cobra (2 EC); MOA 14 + MSMA; MOA 17 6 lb/gal formulation 6.6 lb/gal formulation	12.5 oz + 2.67 pt 2.5 pt	0.2 + 2	Apply as directed spray or with hooded sprayer. Cotton should be at least 6 to 8 inches tall, preferably larger. See Cobra label for weeds controlled, directions on weed size and application rates, and use of surfactant or crop oil. Do not apply MSMA after first bloom. Cobra contains lactofen; see Table 7-2A for other brands.
Cobra (2 EC); MOA 14 + diuron, 4 F; MOA 7 + MSMA; MOA 17 6 lb/gal formulation 6.6 lb/gal formulation	6 to 12.5 fl oz + 0.8 to 1.2 pt + 2.67 pt 2.5 pt	0.094 to 0.2 + 0.4 to 0.6 + 2	See Table 7-2A for brands of diuron. Apply as directed spray or with hooded sprayer. Cotton should be at least 12 inches tall. See Cobra label for weeds controlled and directions on weed size and application rates. Add 1 qt per acre of crop oil concentrate. See rotational restrictions on diuron label. Do not apply MSMA after first bloom.
Cotoran (4 L); MOA 7 + MSMA; MOA 17 6 lb/gal formulation 6.6 lb/gal formulation	1 to 2 qt + 2.67 pt 2.5 pt	1 to 2 + 2	Apply as a directed spray only to cotton at least 3 inches tall up to first bloom. Follow label directions for weed size and addition of surfactant. See Cotoran label for maximum application rates per season and rotational restrictions. *S*-metolachlor (Dual Magnum, others) may be added. Cotoran contains fluometuron; see Table 7-2A for other brands.
diuron (4 F) or diuron (80 WDG); MOA 7 + MSMA; MOA 17 6 lb/gal formulation 6.6 lb/gal formulation	1.6 to 2.4 pt or 1 to 1.5 lb + 2.67 pt 2.5 pt	0.8 to 1.2 + 2	See Table 7-2A for brands of diuron. Apply as directed spray only to cotton at least 12 inches tall. Adjust rate according to soil type. See application precautions on label. Add nonionic surfactant at 1 to 2 quarts per 100 gal spray solution or crop oil concentrate at 1 gal per 100 gal spray solution. See label for rotational restrictions. Do not apply MSMA after first bloom. Aim at 1 fl oz or Cobra at 6 to 8 fl oz per acre may be added to improve control of larger morningglory. Cotton should be at least 16 inches tall when applying Aim. Do not allow Aim to contact green stem tissue.
Fierce (76 WDG); MOA 14 + 15 or Fierce EZ (3.04 SC); MOA 14 + 15 + MSMA; MOA17 6.0 lb/gal formulation 6.6 lb/gal formulation	3 oz or 6 fl oz + 2.67 pt 2.5 pt	 0.143 + 2	Fierce and Fierce EZ are premixes containing flumioxazin plus pyroxasulfone. Can be applied with hooded sprayer after cotton is at least 6 inches tall. Do not allow spray solution to contact cotton. Can be applied with layby applicator after cotton is at least 16 inches tall, but do not contact more than the lower 2 inches of cotton stalk. Add non-ionic surfactant according to label. Do not use crop oil, methylated seed oil, or organo-silicant adjuvants. Controls emerged broadleaf weeds normally controlled by flumioxazin plus MSMA and gives residual control of annual grasses, Palmer amaranth and other pigweed species, nightshade, eclipta, Florida pusley, and most annual grass species.
Suprend (80 WDG); MOA 5 + 2 + MSMA; MOA 17 6 lb/gal formulation 6.6 lb/gal formulation	1 to 1.25 lb + 2.67 pt 2.5 pt	0.8 to 1 + 2	Suprend is a premix product containing 79.3% prometryn plus 0.7% trifloxysulfuron. Apply as directed spray to cotton at least 6 inches tall, preferably taller. Add nonionic surfactant at 1 qt per 100 gal spray solution. See rotational restrictions on label. Do not apply MSMA after first bloom. Do not exceed 0.0188 lb a.i./acre per year of trifloxysulfuron from the combined use of all trifloxysulfuron-containing products (Envoke and Suprend).
Valor SX (51 WDG); MOA 14 or Valor EZ (4 SC); MOA 14 + MSMA; MOA17 6.0 lb/gal formulation 6.6 lb/gal formulation	2 oz or 2 fl oz+2.67 pt 2.5 pt	 0.064 + 2	Valor SX/EZ contains flumioxazin; see Table 7-2A for other brands. Apply as directed spray only to cotton at least 16 inches tall. Direct the spray to the lower 2 inches of the cotton stem. Do not allow spray solution to contact green portion of stem. Add nonionic surfactant at 1 qt per 100 gal spray solution. Do not use crop oil concentrate, methylated seed oil, organo-silicone adjuvants, or any adjuvant product containing any of these. Do not apply MSMA after first bloom. No rotational restrictions of concern in North Carolina. May be applied under a hood on cotton at least 6 inches tall. Do not allow spray solution to contact cotton.

Table 7-2B. Chemical Weed Control in Cotton

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-emergence Directed, Annual grasses and broadleaf weeds, nutsedge, and suppression of perennial weeds; Enlist, Glytol LibertyLink, Roundup Ready Flex or XtendFlex varieties only			
glyphosate; MOA 9	See labels	0.75 to 1.13 (lb a.e.)	Glyphosate alone can be directed up to 7 days prior to harvest. When using glyphosate alone, contact with the cotton is not of concern; the primary reason to direct is to obtain better coverage of weeds under the crop canopy. Use of other herbicides, in addition to glyphosate, is recommended to aid in resistance management. See the section on Herbicide Resistance Management and Table 7-10A. When tank mixing, follow directions on label of tank mix partner concerning cotton size for application, application directions (including allowable contact with cotton plant), and rotational restrictions. Glyphosate-resistant Palmer amaranth is widespread in North Carolina, and glyphosate-resistant common ragweed is present in several counties.
glyphosate; MOA 9 + Aim (2 EC); MOA 14	See labels + 1 to 1.5 fl oz	0.75 to 1.13 (lb a.e.) + 0.016 to 0.024	Cotton should be at least 16 inches tall. Extreme care should be exercised in application; see directions and precautions on Aim label. Contact on green stem tissue will lead to severe injury. Add crop oil concentrate according to the Aim label. See comments on Aim label concerning sprayer clean-out. Compared to glyphosate alone, this combination controls larger morningglories. See above comments for glyphosate alone.
glyphosate; MOA 9 + Anthem Flex (4 SE); MOA 15	See labels + 1.4 to 3.8 fl oz	0.75 to 1.13 (lb a.e.) + 0.043 to 0.119	Anthem Flex contains pyroxasulfone plus carfentrazone. Apply as a directed spray only to cotton that is a minimum of 6 inches in height. Hooded or shielded sprayers should be used when cotton is less than 6 nodes to avoid contact with green tissue. Apply layby treatments as a directed spray to cotton 12 inches or greater when stem has sufficient bark of at least 4 inches in development. Direct spray solution to base of cotton plant for minimal contact to green stem tissue or foliage. Follow label directions for weed size and addition of surfactant. See Anthem Flex label for maximum application rates per season and rotational restrictions. Anthem Flex at 2.7 to 3.8 fl oz per acre may also be applied impregnated on to dry fertilizer. Apply at least 250 lb of fertilizer for optimum coverage. Do not use with nitrate-based fertilizers.
glyphosate; MOA 9 + Caparol (4 F); MOA 5	See labels + 0.5 to 1	0.75 to 1.13 (lb a.e.) + 1 to 2 pt	Caparol contains prometryn; see Table 7-2A for other brands. Direct to cotton at least 6 to 8 inches tall. Use 1 to 1.3 pt prometryn on cotton 6 to 12 inches tall; rate can be increased to 2 pt on cotton at least 12 inches tall. Add surfactant according to the label of the brand of glyphosate used. See precautions and rotational restrictions on prometryn label. Compared to glyphosate alone, this combination will improve control of larger morningglory and may provide residual control of small-seeded broadleaf weeds, such as pigweed. This mixture may give less control of larger grasses than glyphosate alone under drier conditions.
glyphosate MOA 9 + diuron (4 F) or diuron (80 WDG); MOA 7	See labels + 1 to 1.5 pt or 0.63 to 0.94 lb	0.75 to 1.13 (lb a.e.) + 0.5 to 0.75	See Table 7-2A for brands of diuron. Use 1 pt of diuron 4F or 0.63 lb diuron 80WDG on cotton 8 to 12 inches tall. Increase rate to 1.5 pt or 0.94 lb on cotton greater than 12 inches. See comments for glyphosate applied alone. Add surfactant according to the label of the glyphosate brand used. Compared to glyphosate alone, this combination controls larger morningglories and provides residual control of small-seeded broadleaf weeds, such as pigweed. This tank mix may give less control of larger grasses than glyphosate alone under dry conditions. See diuron label for rotational restrictions.
glyphosate MOA 9 + Dual Magnum (7.62 EC); MOA 9	See labels + 1 to 1.33 pt	0.75 to 1.13 (lb a.e.) + 0.95 to 1.27	Dual Magnum contains S-metolachlor; see Table 7-2A for other brands of S-metolachlor. Can be applied to cotton 3 inches tall through layby. See comments for glyphosate applied alone. *S*-metolachlor does not improve control of emerged weeds, but it can give residual control of annual grasses, pigweed species, and spreading dayflower plus suppression of yellow nutsedge. Do not apply to sand or loamy sand soils.
glyphosate MOA 9 + Envoke (75 DF); MOA 2	See labels + 0.1 to 0.2 oz	0.75 to 1.13 (lb a.e.) + 0.0047 to 0.0094	Direct to cotton from 6 inches tall through layby. Add nonionic surfactant according to the Envoke label. Compared to glyphosate alone, the combination is more effective on nutsedge and morningglory and provides residual control of susceptible broadleaf weeds. See comments above for glyphosate alone.
glyphosate; MOA 9 + Fierce (76 WDG); MOA 14 + 15 or Fierce EZ (3.04 SC); MOA 14 + 15	See label + 3 oz or 6 fl oz	0.75 to 1.13 (lb a.e.) + 0.143	Fierce and Fierce EZ are premixes containing flumioxazin plus pyroxasulfone. See comments for glyphosate applied alone and Fierce applied alone. Can be applied with hooded sprayer after cotton is at least 6 inches tall. Do not allow spray solution to contact cotton. Can be applied with layby applicator after cotton is at least 16 inches tall, but do not contact more than the lower 2 inches of cotton stalk. Add non-ionic surfactant according to premix label. Do not use crop oil, methylated seed oil, or organo-silicant adjuvants.
glyphosate; MOA 9 + Outlook (6 EC); MOA 15	See labels + 12 to 16 fl oz	0.75 to 1.13 (lb a.e.) + 0.56 to 0.75	Can be directed to cotton up to mid-bloom. See comments for glyphosate applied alone. Outlook does not improve control of emerged weeds, but it can give residual control of annual grasses and pigweed species. Suggested rates are 12 oz on coarse soils, 14 oz on medium soils, and 16 oz on fine soils.
glyphosate; MOA 9 + Prefix (5.29 EC); MOA 14 + 15	See labels + 2 to 2.33 pt	0.75 to 1.13 (lb a.e.) + 1.32 to 1.54	Prefix contain fomesafen plus *S*-metolachlor. Use as a layby application to cotton with a minimum of 4 inches of bark on the stem. Do not use Prefix at layby if fomesafen (Reflex, others) was used preemergence. See Prefix label for suggestions on adjuvant.
glyphosate; MOA 9 + Reflex (2 L); MOA 14	See label + 1 to 1.5 pt	0.75 to 1.13 (lb a.e.) + 0.25 to 0.375	Reflex contains fomesafen; see Table 7-2A for other brands. Use as a layby application to cotton with a minimum of 4 inches of bark on the stem. Add surfactant or crop oil according to the fomesafen label. May include prometryn, diuron, S-metolachlor, Envoke, Layby Pro, or Suprend in the mixture. Do not use fomesafen at layby if fomesafen was used preemergence.
Sequence (5.25 L); MOA 9 + 15	2.5 to 3.5 pt	0.70 to 1 (lb a.e.) glyphosate + 0.94 to 1.3 S-metolachlor	Sequence contains 2.25 lb a.e./gal glyphosate plus 3 lb/gal *S*-metolachlor. Direct to cotton up to 12 inches tall. Do not add adjuvants or tank mix with other products. Compared with glyphosate alone, Sequence will give residual control of annual grasses, pigweed species, and spreading dayflower plus suppression of nutsedge. See comments above for glyphosate alone.
glyphosate MOA 9 + Suprend (80 WDG); MOA 5 + 2	See labels + 1 to 1.25 lb	0.75 to 1.13 (lb a.e.) + 0.8 to 1.0	Suprend contains prometryn plus trifloxysulfuron. Direct to cotton at least 6 to 8 inches tall. Add surfactant according to label of glyphosate brand used. See precautions and rotational restrictions on Suprend label. Compared to glyphosate alone, this combination will improve control of larger morningglory and nutsedge and may provide residual control of small-seeded broadleaf weeds, such as pigweed. This mixture may give less control of larger grasses than glyphosate alone under drier conditions.
glyphosate; MOA 9 + Valor SX (51 WDG); MOA 14 or Valor EZ (4 SC); MOA 14	See label + 1 to 2 oz or 1 to 2 fl oz	0.75 to 1.13 (lb a.e.) + 0.031 to 0.063	Valor SX/EZ contains flumioxazin; see Table 7-2A for other brands. Cotton should be at least 16 inches tall. Direct the spray to the lower 1 to 2 inches of the cotton stem; minimize cotton contact as much as possible. Do not allow spray solution to contact green portion of stem. See comments above for glyphosate alone. Add nonionic surfactant at 1 qt per 100 gal spray solution. DO NOT use crop oil concentrate, methylated seed oil, organo-silicone adjuvants, or any adjuvant product containing any of these. No rotational restrictions of concern in North Carolina. Compared with glyphosate alone, the combination will give better control of larger morningglories plus residual control of susceptible broadleaf weeds. May be applied under a hood on cotton at least 6 inches tall. Do not allow spray solution to contact cotton.

Table 7-2B. Chemical Weed Control in Cotton

Herbicide, Mode of Action Code and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-emergence Directed, Annual grasses and broadleaf weeds, nutsedge, and suppression of perennial weeds; Enlist, Glytol LibertyLink, Roundup Ready Flex or XtendFlex varieties only (continued)			
glyphosate; MOA 9 + Warrant/Enversa (3.0 CS); MOA 9	See labels + 3 pt	0.75 to 1.13 (lb a.e.) + 1.125	Can be directed to cotton up to first bloom. See comments for glyphosate applied alone. Warrant/Enversa does not improve control of emerged weeds, but it can give residual control of annual grasses and pigweed species.
glyphosate; MOA 9 + Warrant Ultra (3.45 CS); MOA 9 + 14	See labels +	0.75 to 1.13 (lb a.e.) +	Warrant Ultra contains acetochlor plus fomesafen. Use as a layby application to cotton with a minimum of 4 inches of bark on the stem. Avoid contact with cotton foliage. Do not use Warrant Ultra at layby if Warrant Ultra or fomesafen (Reflex, others) was used preemergence. Do not exceed a maximum of 3 lb active acetochlor per year from all applications.
glyphosate; MOA 9 + Zidua (4.17 SC); MOA15	See labels + 2.5 to 3.5 fl oz	0.75 to 1.13 (lb a.e.) + 0.081 to 0.114	Labeled rate of Zidua SC is 2.5 to 3.5 fl oz on all soil types. Do not use on soils with greater than 10% organic matter. Direct to minimize contact with cotton foliage when cotton is from 5-leaf stage to beginning of bloom stage. Do not apply overtop. Zidua does not control emerged weeds but gives residual control of annual grasses and pigweed species. Zidua may also be applied impregnated on to dry fertilizer. Apply at least 250 lb of fertilizer for optimum coverage. Do not use with nitrate-based fertilizers.
Post-Emergence (hooded sprayers), Annual grasses, broadleaf weeds, and sedges; any variety			
glyphosate; MOA 9	See labels	0.75 (lb a.e.)	On varieties not resistant to glyphosate, hoods must be kept close to the ground so that no spray solution contacts the crop. Speed should not exceed 5 mph. Use 5 to 10 gpa and maximum pressure of 25 psi. Do not use liquid nitrogen as the carrier. Other herbicides as discussed in the section on directed application may be mixed with glyphosate to improve burndown and to provide residual control.
paraquat; MOA 22 2.0 lb/gal formulations 3.0 lb/gal formulations	 1.2 to 2.4 pt 0.8 to 1.6 pt	0.3 to 0.6	See Table 7-2A for brands of paraquat. Hoods should be kept as close to the ground as possible. Do NOT allow the spray solution to contact cotton plants. Apply in a minimum of 10 gpa at maximum pressure of 25 psi. Do not exceed 5 mph. It is suggested that cotton be at least 6 inches tall. Add nonionic surfactant or crop oil concentrate according to the paraquat label. Control will generally be much better if diuron, Cotoran, or prometryn is mixed with paraquat. Diuron, Cotoran, or prometryn may also provide residual control. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.**
Harvest Aid, Annual grasses and broadleaf weeds			
glyphosate; MOA 9	See labels	0.75 to 1.5 (lb a.e.)	Apply to any cultivar after at least 60% of the bolls are open. May be tank mixed with some defoliants; see labels for details. Include nonionic surfactant according to the label of the glyphosate brand used. Can be applied to Roundup Ready Flex, Xtend Flex, Enlist, or GlyTol LibertyLink cotton up to 7 days before harvest.
glyphosate; MOA 9 + Aim (2 EC); MOA 14	See labels + Up to 1.6 fl oz	0.75 to 1.13 (lb a.e.) + Up to 0.025	Do not apply within 7 days of harvest. Add nonionic surfactant or crop oil concentrate according to temperature recommendations on the Aim label. Use a minimum of 10 gallons spray solution per acre. Compared to glyphosate alone, this combination controls larger morningglories. See above comments for glyphosate alone.
paraquat; MOA 22 2.0 lb/gal formulations 3.0 lb/gal formulations	 1 to 2 pt 0.67 to 1.33 pt	0.25 to 0.5	See Table 7-2 for paraquat brands. Defoliate cotton as normal. After at least 75 to 80% of the bolls are open, the remaining bolls expected to be harvested are mature, and most of the cotton leaves have dropped, apply paraquat in a minimum of 20 gal per acre and add 1 pt nonionic surfactant per 100 gal. Wait 5 days before picking, then pick as soon as possible. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.**

Weed Response to Cotton Herbicides

C. W. Cahoon, Associate Professor and Extension Weed Specialist, Crop and Soil Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-2C. Weed Response to Burndown Herbicides for Conservation-Tillage Cotton[1]

Weed	2,4-D[2]	glyphosate	glyphosate + dicamba[3]	glyphosate + 2,4-D[2]	glyphosate + flumioxazin[4] + dicamba[3]	glyphosate + flumioxazin[4] + 2,4-D[2]	glyphosate + Leadoff or Crusher[5]	glyphosate + thifensulfuron + tribenuron[6]	glyphosate + Sharpen[7]	Glyphosate + Reviton[8]	paraquat	paraquat + diuron
Annual bluegrass	N	E	E	E	E	E	E	E	E	E	GE	E
Little barley	N	E	E	E	E	E	E	E	E	E	G	E
Buttercups	G	E	E	E	E	E	E	E	E	E	E	E
Carolina geranium	PF	PF	G	F	G	F	G	GE	ND	ND	GE	E
Chickweed	P	E	E	E	E	E	E	E	E	E	E	E
Cudweed	NP	E	E	E	E	E	E	E	E	E	FG	G
Curly dock	F	F	GE	FG	F	FG	F	E	ND	ND	NP	P
Cutleaf evening primrose	E	PF	G	E	FG	E	PF	F	ND	ND	F[9]	G[9]
Field pansy	P	F	F	F	F	F	ND	F	F	G	G	GE
Henbit	PF	G	E	E	E	E	E	E	G	G	E	E
Horseweed (marestail), glyphosate-susceptible	GE[10]	GE	E	E	E	E	GE	GE	E	E	PF	G
Horseweed (marestail), glyphosate-resistant	GE[10]	N	E	E[10]	E	E[10]	P	P	E	F	PF	G
Prickly lettuce	G	E	E	E	E	E	E	E	E	E	P	PF
Ryegrass	N	G	G	G	G	G	GE	G	G	G	F	FG
Speedwell	PF	E	E	E	E	E	E	E	E	E	E	E
Swinecress	F	FG	FG	G	ND	E	E	E	E	E	E	E
Vetch	E	F	E	E	FG	E	ND	G	ND	ND	PF	F
Virginia pepperweed	GE	G	GE	E	GE	E	G	G	ND	ND	G	G
Wheat or rye cover crop [11]	N	E	E	E	E	E	E	E	E	E	G[13]	GE[13]
Wild mustard, wild radish	FG[12]	FG	G	E	G	E	FG	GE	ND	ND	FG	G

Note: E = excellent, 90% or better control; G = good, 80 to 90% control; F = fair, 50 to 80% control; P = poor, 25 to 50% control; N = no control, less than 25% control; ND = no data.

[1] See Table 7-2A for brand names and Table 7-2B for application rates.

[2] Apply 2,4-D at least 30 days ahead of planting. No waiting period is needed on Enlist cotton.

[3] Following application of dicamba and a minimum of 1 in. of rainfall, a minimum 21-day waiting period is required before planting. No waiting period is needed on XtendFlex cotton.

[4] A minimum of 14 days must pass and 1 inch of rainfall must occur between application of flumioxazin at 1 oz and planting. Delay planting 21 days after application of 1.5 to 2 oz of flumioxazin. See exceptions for strip-tillage in Table 7-2B.

[5] Apply Leadoff or Crusher from late fall to 30 days prior to planting. May include 2,4-D or dicamba. See Table 7-2A for brands.

[6] Apply thifensulfuron + tribenuron at least 14 days ahead of planting.

[7] A minimum of 42 days must pass and 1 inch of rainfall must occur between application of Sharpen and cotton planting.

[8] Wait to plant cotton at least 7 days when applying 1 oz per acre Reviton or 14 days when applying >1 oz per acre.

[9] This level of control requires that the primrose be blooming when treated.

[10] This level of control requires 2 pt of 2,4-D.

[11] Glyphosate rate is 0.56 lb a.e. for wheat less than 12 in. or rye less than 18 in., or 0.75 lb a.e. for wheat greater than 12 in. or rye greater than 18 in.

[12] Wild radish and wild mustard control by 2,4-D is good if application is made before plants begin flowering. Use 1 pt per acre of 2,4-D to control these species.

[13] Wheat or rye must have visible seed heads for this level of control.

Table 7-2D. Weed Response to Preplant Incorporated and Preemergence Herbicides in Cotton

	PPI	PRE							PRE Tank Mixtures							
Species	Prowl or Treflan	Brake	Cotoran	diuron	Prowl	Reflex	Staple	Warrant/Enversa	Reflex + Cotoran	Reflex + diuron	Reflex + Warrant/Enversa	diuron + Warrant/Enversa	Cotoran + Warrant/Enversa	Brake + Cotoran	Brake + diuron	Brake + Reflex
Bermudagrass	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Broadleaf signalgrass	G	FG	P	P	F	FG	P	G	FG	FG	G	G	G	FG	FG	FG
Crabgrass	E	G	FG	FG	G	FG	P	E	FG	FG	E	E	E	G	G	G
Crowfootgrass	E	ND	FG	FG	G	ND	P	E	FG	FG	E	E	E	FG	FG	ND
Fall panicum	G	ND	F	P	F	ND	PF	E	F	ND	E	E	E	F	ND	ND
Foxtails	E	ND	FG	ND	G	ND	P	E	FG	ND	E	E	E	FG	ND	ND
Goosegrass	E	G	F	F	G	ND	PF	E	F	F	E	E	E	G	G	G
Johnsongrass, Seedling	E	ND	P	P	G	ND	FG	F	ND	ND	F	F	F	ND	ND	ND
Johnsongrass, Rhizome	P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Texas panicum	G	PF	P	P	F	PF	N	P	PF	PF	PF	P	P	PF	PF	PF
Nutsedge, Purple	N	PF	N	N	N	ND	F	N	ND	ND	ND	N	N	PF	PF	PF
Nutsedge, Yellow	N	FG	N	N	N	GE	F	PF	GE	GE	GE	PF	PF	FG	FG	GE
Cocklebur	N	G	FG	F	N	G	NP	N	G	G	G	F	FG	G	G	G
Common purslane	E	G	E	E	G	G	G	G	E	E	G	E	E	E	E	G
Common ragweed, glyphosate-susceptible	N	FG	E	G	N	G	NP	P	E	G	G	G	E	E	G	GE
Common ragweed, glyphosate-resistant	N	FG	E	G	N	G	NP	P	E	G	G	G	E	E	G	GE
Cowpea	N	ND	P	P	N	ND	FG	N	ND	ND	ND	P	P	ND	ND	ND
Crotalaria	N	ND	G	G	N	ND	ND	N	G	G	ND	G	G	G	G	ND
Eclipta	P	ND	G	G	P	GE	ND	FG	GE	GE	GE	G	G	G	G	GE
Florida beggarweed	P	ND	GE	G	N	P	G	P	GE	G	P	G	GE	GE	G	ND
Florida pusley	E	ND	FG	PF	FG	P	F	E	FG	PF	E	E	E	FG	PF	ND
Hemp sesbania	N	ND	P	P	N	P	P	N	P	P	P	P	P	ND	ND	ND
Jimsonweed	N	ND	G	G	N	G	FG	N	G	G	G	G	G	G	G	G
Lambsquarters	GE	ND	E	E	G	E	G	P	E	E	E	E	E	E	E	E
Morningglory, tall	P	F	G	F	P	PF	P	P	G	F	PF	F	G	G	F	F
Morningglory, other species	P	F	G	F	P	PF	F	P	G	F	PF	F	G	G	F	F
Palmer amaranth, glyphosate-susceptible	FG	E	F	G	PF	E	G	G	E	E	E	GE	G	E	E	E
Palmer amaranth, glyphosate-resistant	FG	E	F	G	PF	E	G	G	E	E	E	GE	G	E	E	E
Palmer amaranth, ALS-resistant	FG	E	F	G	PF	E	N	G	E	E	E	GE	G	E	E	E
Palmer amaranth, glyphosate- & ALS-resistant	FG	E	F	G	PF	E	N	G	E	E	E	GE	G	E	E	E
Pigweed, redroot	E	E	GE	GE	FG	E	E	GE	E	E	E	GE	GE	E	E	E
Prickly sida	N	ND	G	F	N	ND	G	P	G	F	ND	F	G	G	F	ND
Sicklepod	N	P	G	F	N	P	PF	N	G	F	P	F	G	G	F	P
Smartweed	N	ND	G	G	N	ND	G	N	G	G	ND	G	G	G	G	ND
Spurge	N	ND	PF	F	N	ND	G	F	PF	F	F	F	F	PF	F	ND
Spurred anoda	N	G	F	F	N	ND	E	N	F	F	ND	F	F	G	G	G
Tropic croton	N	G	FG	FG	N	FG	FG	N	FG	FG	FG	FG	FG	G	G	G
Velvetleaf	N	ND	F	PF	N	ND	E	N	F	PF	ND	PF	F	F	PF	ND
Volunteer peanuts	N	P	PF	P	N	P	P	N	PF	P	P	P	PF	PF	P	P

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%
ND = data not available

Weed Response to Postemergence Overtop Herbicides in Cotton

C. W. Cahoon, Associate Professor and Extension Weed Specialist, Crop and Soil Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-2E. Weed Response to Postemergence Overtop Herbicides in Cotton

Species	Assure II	Fusilade	Poast, Poast Plus	Select	Enlist Duo or glyphosate + Enlist One	Envoke	Staple	glyphosate	glyphosate + Envoke	glyphosate + Staple	Liberty	Liberty + Enlist One	Liberty + Staple	Zalo
Bermudagrass	G[1]	G[1]	F[1]	G[1]	F[2]	N	N	F[2]	F[2]	F[2]	N	N	N	F
Broadleaf signalgrass	G	GE	E	E	E	N	N	E	E	E	G	G	G	E
Crabgrass	G	G	GE	GE	E	P	N	E	E	E	G	G	G	G
Crowfootgrass	G	F	FG	G	E	N	N	E	E	E	G	G	G	E
Fall panicum	GE	GE	E	E	E	NP	N	E	E	E	G	G	G	E
Foxtails	E	E	E	E	E	NP	N	E	E	E	G	G	G	G
Goosegrass	G	G	GE	GE	E	NP	N	E	E	E	P	P	P	G
Johnsongrass, Seedling	E	E	E	E	E	P	P	E	E	E	G	G	G	E
Johnsongrass, Rhizome	E	GE	G	GE	GE	P	NP	GE	GE	GE	F[2]	F[2]	F[2]	G
Texas panicum	G	G	E	E	E	NP	N	E	E	E	G	G	G	E
Nutsedge, Purple	N	N	N	N	FG[2]	FG	PF	FG[2]	GE	FG[2]	PF	PF	F	PF
Nutsedge, Yellow	N	N	N	N	FG[2]	G	PF	F[2]	E	FG[2]	PF	PF	F	PF
Cocklebur	N	N	N	N	E	GE	G	E	E	E	E	E	E	E
Common purslane	N	N	N	N	FG	ND	F	FG	ND	G	FG	FG	FG	FG
Common ragweed, glyphosate-susceptible	N	N	N	N	E	G	P	E	E	E	E	E	E	E
Common ragweed, glyphosate-resistant	N	N	N	N	E	G	P	N	G	P	E	E	E	E
Cowpea	N	N	N	N	E	G	G	GE	E	E	G	GE	E	G
Crotalaria	N	N	N	N	G	ND	G	G	G	G	ND	ND	G	ND
Doveweed	N	N	N	N	P	ND	N	P	ND	P	P	P	P	P
Eclipta	N	N	N	N	E	PF	G	E	E	E	G	GE	E	G
Florida beggarweed	N	N	N	N	E	GE	G	E	E	E	G	GE	E	G
Florida pusley	N	N	N	N	G	P	NP	PF	PF	PF	F	G	F	F
Hemp sesbania	N	N	N	N	E	ND	GE	PF	ND	GE	ND	GE	ND	ND
Jimsonweed	N	N	N	N	E	N	E	E	E	E	E	E	E	E
Lambsquarters	N	N	N	N	E	G	N	G	E	G	E	E	E	E
Morningglory, tall	N	N	N	N	E	G	P	FG	E	FG	E	E	E	E
Morningglory, other species	N	N	N	N	E	G	G	FG	E	GE	E	E	E	E
Palmer amaranth, glyphosate-susceptible	N	N	N	N	E	PF	F	E	E	E	G	E	G	G
Palmer amaranth, glyphosate-resistant	N	N	N	N	G	PF	F	N	PF	F	G	E	G	G
Palmer amaranth, ALS-resistant	N	N	N	N	E	N	N	E	E	E	G	E	G	G
Palmer amaranth, glyphosate- & ALS-resistant	N	N	N	N	G	N	N	N	N	N	G	E	G	G
Pigweed, redroot	N	N	N	N	E	FG	G	E	E	E	G	E	GE	G
Prickly sida	N	N	N	N	G	N	F	FG	FG	FG	FG	G	FG	FG
Sicklepod	N	N	N	N	E	E	PF	E	E	E	E	E	E	E
Smartweed	N	N	N	N	G	G	G	G	E	E	GE	GE	E	GE
Spreading dayflower	N	N	N	N	ND	N	FG	P	P	FG	PF	PF	FG	PF
Spurge	N	N	N	N	G	ND	FG	G	G	G	FG	FG	G	FG
Spurred anoda	N	N	N	N	E	P	G	E	E	E	P	GE	G	P
Tropic croton	N	N	N	N	E	PF	P	E	E	E	G	GE	G	G
Velvetleaf	N	N	N	N	E	G	G	E	E	E	F	GE	G	F
Volunteer peanuts	N	N	N	N	G	PF	P	F	FG	F	GE	GE	GE	GE

[1] Two applications may be needed for adequate control.

[2] Acceptable control with two applications or a follow-up application of glyphosate.

Key:

E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%
ND = data not available

Weed Response to Postemergence-Directed Herbicides in Cotton

C. W. Cahoon, Associate Professor and Extension Weed Specialist, Crop and Soil Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-2F. Weed Response to Postemergence-Directed Herbicides in Cotton

Species	Caparol + MSMA	Cobra + MSMA	Cotoran + MSMA	diuron+ MSMA	Suprend+ MSMA	Valor or Fierce + MSMA	glyphosate + Aim	glyphosate + Caparol	glyphosate + diuron	glyphosate + Suprend	glyphosate + Valor or Fierce	paraquat + diuron[1]
Bermudagrass	N	N	N	N	N	N	F[2]	F[2]	F[2]	F[2]	F[2]	P
Broadleaf signalgrass	F	F	F	F	F	F	E	GE	GE	GE	E	GE
Crabgrass	FG	PF	F	F	FG	F	E	GE	GE	GE	E	G
Crowfootgrass	FG	PF	F	F	FG	F	E	GE	GE	GE	E	G
Fall panicum	FG	PF	F	F	FG	F	E	GE	GE	GE	E	G
Foxtails	FG	PF	F	F	FG	F	E	GE	GE	GE	E	G
Goosegrass	FG	PF	F	F	FG	F	E	GE	GE	GE	E	G
Johnsongrass, Seedling	FG	PF	F	F	FG	F	E	GE	GE	GE	E	G
Johnsongrass, Rhizome	P	P	P	P	P	P	GE	G	G	G	GE	P
Texas panicum	F	P	P	F	F	P	E	GE	GE	GE	E	G
Nutsedge, Purple	F[3]	F[3]	F[3]	F[3]	E	F[3]	FG[2]	FG[2]	FG[2]	GE	FG[2]	PF
Nutsedge, Yellow	FG[3]	FG[3]	FG[3]	G	E	G	F[2]	F[2]	F[2]	E	F[2]	PF
Cocklebur	E	E	E	E	E	E	E	E	E	E	E	E
Common purslane	FG	G	FG	G	ND	G	FG	GE	GE	E	GE	E
Common ragweed, glyphosate-susceptible	E	E	GE	E	E	GE	E	E	E	E	E	G
Common ragweed, glyphosate-resistant	E	E	GE	E	E	GE	PF	P	PF	G	P	G
Cowpea	G	FG	G	G	E	G	GE	GE	GE	E	E	E
Crotalaria	G	G	G	G	E	ND	G	G	G	G	ND	ND
Doveweed	N	N	N	N	ND	ND	P	P	ND	ND	G	E
Eclipta	G	E	G	E	E	E	E	E	E	E	E	G
Florida beggarweed	E	E	E	E	E	E	E	E	E	E	E	E
Florida pusley	F	F	F	F	F	FG	G	G	G	G	GE	P
Hemp sesbania	PF	F	PF	PF	ND	ND	GE	ND	ND	ND	ND	FG
Jimsonweed	G	GE	GE	G	G	E	E	E	E	E	E	E
Lambsquarters	G	F	G	G	GE	FG	GE	GE	GE	E	GE	G
Morningglory	G	E	G	GE	E	E	E	GE	GE	E	E	G
Palmer amaranth, glyphosate-susceptible	F	G	FG	G	GE	G	E	E	E	E	E	GE
Palmer amaranth, glyphosate-resistant	F	G	FG	G	GE	G	PF	PF	F	PF	PF	GE
Palmer amaranth, ALS-resistant	F	G	FG	G	F	G	E	E	E	E	E	GE
Palmer amaranth, glyphosate- & ALS-resistant	F	G	FG	G	F	G	PF	PF	F	P	PF	GE
Pigweed, redroot	G	G	G	GE	GE	GE	E	E	E	E	E	GE
Prickly sida	GE	GE	FG	GE	GE	GE	FG	G	G	G	GE	FG
Sicklepod	GE	PF	G	GE	E	GE	E	E	E	E	E	E
Smartweed	F	F	G	F	ND	G	GE	G	G	E	G	GE
Spreading dayflower	G	G	G	G	G	G	P	P	P	P	P	ND
Spurge	G	G	PF	G	ND	G	GE	GE	GE	E	G	ND
Spurred anoda	F	F	FG	F	ND	G	E	E	E	E	E	G
Tropic croton	G	E	G	G	GE	E	E	E	E	E	E	G
Velvetleaf	F	F	F	F	F	G	E	E	E	E	E	ND
Volunteer peanuts	FG	PF	FG	G	G	FG	FG	FG	G	FG	FG	F

[1] Apply only with a hooded sprayer and avoid all contact with cotton foliage or stems.

[2] Acceptable control with a follow-up application of glyphosate.

[3] Acceptable control with second application of MSMA or a follow-up application of glyphosate.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%
ND = data not available

Chemical Weed Control in Peanuts

D. L. Jordan, Crop and Soil Sciences Department

Control of witchweed is part of the State/Federal Quarantine Program. Contact the North Carolina Department of Agriculture, Plant Industry Division, at 1-800-206-9333. Note that the active ingredient and examples of tradenames are listed for each herbicide. This approach is used for the simplicity of presentation but does not imply that other formulations of the same active ingredient are not equally effective.

Table 7-3A. Chemical Weed Control in Peanuts

Weed	Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preplant Incorporated, Annual grasses and small-seeded broadleaf weeds	alachlor, MOA 15 (Intrro 4 EC)	2 to 3 (2 to 3 qt)	Incorporate no deeper than 2 inches; see label for specific instructions. Unless shallowly incorporated, Intrro is more consistently effective when applied preemergence. Weak on Texas panicum. Do not apply more than 3 qt of Intrro per acre per season. **Before using Intrro, check with buyers to determine if there are marketing restrictions on Intrro-treated peanuts.**
	acetochlor, MOA 15 (Warrant 3 ME)	0.94 to 1.5 (1.25 to 2 qt)	Apply and incorporate in top 2 inches of soil. Do not apply more than 4 qt of Warrant per acre per year.
	ethalfluralin, MOA 3 (Sonalan 3 EC)	0.56 to 0.75 (1.5 to 2 pt)	Controls common annual grasses including Texas panicum. Use 3 pt Prowl or 2 pt ethalfluralin for control of broadleaf signalgrass, Texas panicum, and fall panicum. Incorporate 3 inches deep for Texas panicum; otherwise, incorporate 2 to 3 inches deep. See labels for maximum waiting period between application and incorporation. Immediate incorporation is best. Dual Magnum, Outlook, or Warrant may be tank mixed with Prowl or Sonalan to suppress yellow nutsedge.
	pendimethalin, MOA 3 (Prowl H2O 3.8 EC) (Prowl 3.3 EC)	0.71 to 1.43 (1.5 to 3 pt) (1.7 to 3.5 pt)	
Preplant Incorporated, Annual grasses, small-seeded broadleaf weeds, and nutsedge	dimethenamid, MOA 15 (Outlook 6.0 L)	0.75 to 1 (16 to 21 fl oz)	Apply and incorporate in top 2 inches of soil within 14 days of planting. Use high rate of Dual Magnum, Dual, or Outlook for yellow nutsedge and broadleaf signalgrass. Not effective on purple nutsedge. Weak on Texas panicum. May be tank mixed with Prowl or Sonalan.
	metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt)	
Preplant Incorporated, Broadleaf weeds and suppression of nutsedge	diclosulam, MOA 2 (Strongarm 84 WDG)	0.024 (0.45 oz)	Effective on common cocklebur, morningglory, common ragweed, eclipta, and common lambsquarters. Suppresses yellow and purple nutsedge. Does not control sicklepod. More effective when applied in combination with Dual, Outlook, Warrant, Prowl, or Sonalan. See label for rotation restrictions, especially corn and grain sorghum. Growers are cautioned that Strongarm can occasionally injure cotton the following year on soils with a shallow hardpan (less than 10 inches) or loam soils. Cotton grown under early season stress resulting from conditions such as excessively cool, wet, dry, or crusted soils may be particularly susceptible to carryover of Strongarm. The rotation interval between applying Strongarm to peanut and then planting cotton is 18 months in Camden, Currituck, Pasquotank, and Perquimans counties. Some weed species have developed resistance to Strongarm including common ragweed and Palmer amaranth.
Preplant Incorporated, Annual grasses, broadleaf weeds, and suppression of nutsedge	diclosulam, MOA 2 Strongarm + pendimethalin, MOA 3 (Prowl H2O 3.8 EC) (Prowl 3.3 EC) or ethalfluralin, MOA 3 (Sonalan 3 EC) or metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC) or dimethenamid (Outlook 6.0 L) or acetochlor (Warrant 3 ME)	0.024 (0.45 oz) + 0.71 to 1.43 (1.5 to 3 pt) (1.7 to 3.5 pt) or 0.56 to 0.75 (1.5 to 2 pt) or 0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt) or 0.75 to 1 (16 to 21 fl oz) or 0.95 to 1.5 (1.24 to 2 qt)	Effective on annual grasses, common cocklebur, common ragweed, eclipta, morningglory, and common lambsquarters. Suppresses purple and yellow nutsedge. Does not control sicklepod. See Strongarm label for rotation restrictions.
PPI followed by PRE, Annual grasses, broadleaf weeds, and suppression of nutsedge	pendimethalin, MOA 3 (Prowl H2O 3.8 EC) (Prowl 3.3 EC) or ethalfluralin, MOA 3 (Sonalan 3 EC) or metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC) or dimethenamid, MOA 15 (Outlook 6.0L) or acetochlor, MOA 15 (Warrant 3 ME) followed by diclosulam, MOA 2 (Strongarm 84 WDG) or flumioxazin, MOA 14 (Valor SX 51 WDG)	0.71 to 1.43 (1.5 to 3 pt) (1.7 to 3.5 pt) or 0.56 to 0.75 (1.5 to 2 pt) or 0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt) or 0.75 to 1 (16 to 21 oz) or 0.95 to 1.5 (1.24 to 2 qt) 0.024 0.45 oz or 0.063 (2 oz)	Controls most broadleaf weeds. Will not control sicklepod and is marginal on certain large-seeded broadleaf weeds. **Do not incorporate** Valor SX. Valor SX should be applied to the soil surface immediately after planting. Significant injury can occur if flumioxazin is incorporated or applied 3 or more days after planting. Significant injury from Valor SX has been noted in some years even when applied according to label recommendations. However, injury is generally transient and does not affect yield. See previous comments about cotton response to Strongarm applied the previous year on some soils. Up to 3 oz per acre of Valor SX can be applied to peanut but injury potential increases. **See product label for sprayer cleanup before other uses.**

Table 7-3A. Chemical Weed Control in Peanuts

Weed	Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Split application (PPI + POST), Most broadleaf weeds and nutsedge	imazethapyr, MOA 2 (Pursuit 2 AS)	0.031 + 0.031 (2 + 2 oz)	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control eclipta, lambsquarters, ragweed, or croton. Pursuit will usually control seedling johnsongrass and foxtails. For control of other annual grasses, Pursuit may be tank mixed with Dual Magnum, Dual, Outlook, Prowl H2O, Prowl, or Sonalan and incorporated. See label for incorporation directions and rotational restrictions. Some weed species have developed resistance to Pursuit. Research in NC has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
Preemergence, Annual grasses and small-seeded broadleaf weeds	alachlor, MOA 15 (Intrro 4 EC)	2 to 3 (2 to 3 qt)	Apply as soon after planting as possible. All 4 herbicides are weak on Texas panicum. **Before using Intrro, check with buyers to determine if there are marketing restrictions on Intrro-treated peanuts**.
	dimethenamid, MOA 15 (Outlook 6.0 L)	0.75 to 1 (16 to 21 fl oz)	
	metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt)	
	acetochlor (Warrant 3 ME)	0.95 to 1.5 (1.25 to 2 qt)	
Preemergence, Broadleaf weeds	flumioxazin, MOA 14 (Valor SX 51 WDG)	0.063 2 oz	Apply within 2 days after planting. Significant injury can occur if Valor SX is incorporated or applied 3 or more days after seeding. Controls carpetweed, common lambsquarters, Florida pusley, nightshade, pigweeds, prickly sida, and spotted spurge. Does not control sicklepod, yellow and purple nutsedge, or annual grasses. Morningglory control is marginal where Valor SX is applied at 2 oz per acre. Significant injury from Valor SX has been noted in some years even when applied according to label. However, injury is generally transient and does not affect yield. Injury may occur if excessive and forceful rainfall occurs when peanut is emerging. Peanut recovers from injury by midseason in most instances. Up to 3 oz per acre of Valor SX can be applied to peanut, but injury potential increases. **See product label for comments on sprayer cleanup before other uses.**
Preemergence, Annual grasses, broadleaf weeds, and suppression of nutsedge	flumioxazin, MOA 14 (Valor SX 51 WDG) + metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC) or dimethenamid, MOA 15 (Outlook 6.0L) or acetochlor, MOA 15 (Warrant 3 ME)	0.063 (2 oz) + 0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt) or 0.75 to 1 (16 to 21 fl oz) or 0.94 to 1.5 (1.25 to 2 qt)	Apply within 2 days after planting. Significant injury can occur if applied 3 or more days after planting. The combination of Valor SX and Dual, Dual Magnum, Warrant, or Outlook does not control sicklepod but will control annual grasses (except Texas panicum) and will suppress yellow nutsedge. Valor SX and Warrant will not suppress yellow nutsedge. Significant injury from Valor SX has been noted in some years even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Injury may occur if excessive and forceful rainfall occurs when peanut is emerging. Peanut recovers from injury by midseason in most instances. Up to 3 oz per acre of Valor SX can be applied to peanut but injury potential increases. **See product label for comments on sprayer cleanup before other uses.**
	diclosulam, MOA 2 (Strongarm 84 WDG)	0.024 (0.45 oz)	Effective on common cocklebur, morningglory, common ragweed, eclipta, and common lambsquarters. Suppresses yellow and purple nutsedge. Does not control sicklepod. More effective when applied in combination with Dual, Dual Magnum, Outlook, Prowl, Sonalan, or Warrant. See label for rotation restrictions, especially corn and grain sorghum. See previous comments on possible cotton injury from Strongarm applied the previous year on some soils.
	sulfentrazone, MOA 14 + carfentrazone, MOA 14 (Spartan Charge (0.35 + 3.15 F)	0.07 to 0.12 (3 to 5 fl oz)	Do not apply Spartan Charge after peanuts crack soil. Application immediately after planting is advised. See label for specific rates based on soil texture and organic matter content. See product label for comments on application with other herbicides. Rotation restriction for planting cotton following Spartan Charge at recommended rates for peanut is 12 months.
	diclosulam, MOA 2 (Strongarm 84 WDG) + metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC) or dimethenamid, MOA 15 (Outlook 6.0 L) or acetochlor, MOA 15 (Warrant 3 ME)	0.024 (0.45 oz) + 0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt) or 0.75 to 1 (16 to 21 oz) or 0.94 to 1.5 (1.25 to 2 qt)	Effective on annual grasses, common cocklebur, common ragweed, eclipta, morningglory, and common lambsquarters. Suppresses purple and yellow nutsedge. Does not control sicklepod. See label for rotation restrictions. Some weed species have developed resistance to Strongarm. See previous comments on carryover potential to cotton on some soils and restrictions on planting corn or grain sorghum after use in peanut.
Preemergence, Most annual broadleaf weeds	fluridone, MOA 12 (Brake 1.2 L) + flumioxazin, MOA 14 (Valor SX 51 WDG) or metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC) or dimethenamid, MOA 15 (Outlook 6.0L) or acetochlor, MOA 15 (Warrant 3 ME)	0.11 to 0.15 (12 to 16 fl oz) + 0.063 (2 oz) + 0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt) or 0.75 to 1 (16 to 21 fl oz) or 0.94 to 1.5 (1.25 to 2 qt)	Effective on annual grasses and broadleaf weeds. Apply within 36 hours after planting. Apply the rate specified on label based on soil texture. Requires rainfall or irrigation within one week after application for adequate weed control. Must be applied with other herbicides in case activation rainfall does not occur. Do not plant wheat for grain production in the fall after Brake is applied to peanut. See label for other **rotation restrictions** for crops other than wheat.
Preemergence, Most annual broadleaf weeds and nutsedge	imazethapyr, MOA 2 (Pursuit 2 AS)	0.063 (4 fl oz)	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control ragweed, eclipta, lambsquarters, or croton. Pursuit may be tank mixed with Dual, Dual Magnum, Warrant, or Outlook for annual grass control. See label for **rotational restrictions**. Some weed species have developed resistance to Pursuit. Research in NC has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
Cracking stage, Emerged annual grasses and broadleaf weeds	paraquat, MOA 22 (Gramoxone 2 SL) (Parazone 3 SL)	0.18 (11 oz) (8 oz)	Apply at ground cracking to control small emerged annual grasses and broadleaf weeds. May be tank mixed with Dual, Dual Magnum, Outlook, Anthem Flex, Zidua, or Warrant for residual control. Tank mix may increase injury to emerged peanuts. Add 1 pint nonionic surfactant per 100 gallons spray solution. Follow safety precautions on label. Applying Basagran at 0.5 pt per acre will reduce injury. **Do not apply to peanuts with significant injury caused by thrips.**

Table 7-3A. Chemical Weed Control in Peanuts

Weed	Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Cracking stage and Postemergence, Additional residual control of annual grasses and certain small-seeded broadleaf weeds	alachlor, MOA 15 (Intrro 4 EC)	2 to 3 (2 to 3 qt)	Use as a supplement to preplant or preemergence herbicides to provide additional residual control of annual grasses and certain small-seeded broadleaf weeds such as pigweed and eclipta. With the exception of Anthem Flex, this treatment will not control emerged grasses or broadleaf weeds. Anthem Flex improves control of emerged morningglory. See product labels for recommended tank mixtures with contact and systemic herbicides with foliar activity on weeds.
	dimethenamid, MOA 15 (Outlook 6.0L)	0.75 to 1 (16 to 21 oz)	
	metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 1 pt 1.5 pt	
	pyroxasulfone, MOA 15 (Zidua) 85 WG (Zidua) 4.25 SC	0.08 to 11 (1.5 to 2.1 oz) (2.4 to 3.3 fl oz)	
	pyroxasulfone, MOA 15 + carfentrazone, MOA 15 (Anthem Flex)	0.073 + 0.005 (2.5 oz)	
	acetochlor, MOA 15 (Warrant 3 ME)	0.94 to 1.5 (1.25 to 2 qt)	
Cracking stage, Most annual broadleaf weeds and nutsedge	imazethapyr, MOA 2 (Pursuit 2 AS)	0.063 (4 oz)	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control ragweed, eclipta, lambsquarters, or croton. If weeds are emerged, add surfactant or crop oil according to label directions. See label for rotational restrictions. Pursuit may be tank mixed with paraquat. Some weed species have developed resistance to Pursuit.
Cracking stage, Some emerged broadleaf weeds and suppression of eclipta and yellow nutsedge	diclosulam, MOA 2 (Strongarm 84 WDG)	0.024 (0.45 oz)	Strongarm can be applied through the cracking stage. Add 1 quart nonionic surfactant per 100 gallons. The spectrum of weeds controlled is much narrower when applied to emerged weeds. Strongarm will not control emerged common lambsquarters or pigweeds but will control common ragweed and morningglories and will suppress yellow nutsedge and eclipta. See product labels for information on mixing Strongarm with other herbicides. Some weed species have developed resistance to Strongarm. See product label for carryover potential to cotton, corn, and grain sorghum. Strongarm suppresses emerged marestail and dogfennel more effectively than other postemergence broadleaf herbicides when applied to small weeds.
Postemergence, Annual broadleaf weeds	acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.25 to 0.38 (1 to 1.5 pt)	Apply when weeds are small and actively growing. Use minimum of 20 GPA and high pressure (40 to 60 psi). See label for species controlled, maximum weed size to treat, and addition of surfactant. Do not apply more than 2 pints per acre per season. May make sequential applications of 0.25 pound followed by 0.25 pound per acre. Allow at least 15 days between sequential applications.
	acifluorfen, MOA 14 (Ultra Blazer 2 L) + 2,4-DB, MOA 4 (Butyrac 200 2 L)	0.25 to 0.38 (1 to 1.5 pt) + 0.25 (16 fl oz)	Addition of 2,4-DB to Ultra Blazer improves control of certain weeds when weed size exceeds that specified on the Ultra Blazer label. See label suggestions on use of surfactant or crop oil. Apply when peanuts are at least 2 weeks old and before pod filling begins.
	bentazon, MOA 6 (Basagran 4 L)	0.75 to 1 (1.5 to 2 pt)	Apply when weeds are small and actively growing. Use minimum of 20 GPA and high pressure (40 to 60 psi). See label for addition of oil concentrate, species controlled, and maximum weed size to treat. Basagran may also be applied at 1 pint per acre for control of cocklebur, jimsonweed, and smartweed 4 inches or less. Do not apply more than 4 pints of bentazon per acre per season.
	bentazon, MOA 6 (Basagran 4 L) + acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.5 to 1 (1 to 2 pt) + 0.25 to 0.38 (1 to 1.5 pt)	See above comments for Ultra Blazer and Basagran. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Can be applied as a tank mixture or as Storm 4L.
	bentazon, MOA 6 + acifluorfen, MOA 14 (Storm 4L)	0.5 + 0.25 (1.5 pt)	These rates of bentazon and acifluorfen (Ultra Blazer and Basagran) may not provide consistent control of lambsquarters, prickly sida, spurred anoda, and morningglory.
	bentazon, MOA 6 (Basagran 4 L) + acifluorfen, MOA 14 (Ultra Blazer 2 L) + 2,4-DB, MOA 4 (Butyrac 200 2 L)	0.5 (1 pt) + 0.25 (1 pt) + 0.125 to 0.25 (8 to 16 fl oz)	Adding 2,4-DB will improve control of larger morningglory, cocklebur, common ragweed, pigweed, jimsonweed, and citron. Add surfactant or crop oil according to label directions. Apply when peanuts are at least 2 weeks old. Do not apply after pod filling begins. See comments for Ultra Blazer and Basagran alone.
	bentazon, MOA 6 (Basagran 4 L) + 2,4-DB, MOA 4 (Butyrac 200 2 L)	0.75 to 1 1.5 to 2 pt) + 0.125 (8 fl oz)	Addition of 2,4-DB to Basagran improves control of morningglories. See above comments for Basagran. Add surfactant or crop oil according to label directions. Do not make more than 2 applications per year. Apply when peanuts are at least 2 weeks old and not within 45 days of harvest.
	imazapic, MOA 2 (Cadre 2 AS) (Impose 2 AS)	0.063 (4 fl oz)	Controls most broadleaf weeds except ragweed, croton, lambsquarters, and eclipta. Apply before weeds exceed 2 to 4 inches; see label for specific weed sizes to treat. Add nonionic surfactant at 1 quart per 100 gallons or crop oil concentrate at 1 quart per acre. A soil-applied grass control herbicide should be used. However, Cadre will usually control escaped broadleaf signalgrass, large crabgrass, fall panicum, and Texas panicum but not goosegrass. Cadre can be mixed with Cobra, Ultra Blazer, and 2,4-DB. See label for rotational restrictions. Some weed species have developed resistance to Cadre.
	imazethapyr, MOA 2 (Pursuit 2 L)	0.063 (4 fl oz)	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control eclipta, lambsquarters, ragweed, or croton. Apply when weeds are 3 inches tall or less. Add surfactant or crop oil according to label directions. See label for rotational restrictions. Pursuit may be tank mixed with Basagran, Ultra Blazer, Gramoxone, and 2,4-DB. Some weed species have developed resistance to Pursuit.
	2,4-DB, MOA 4 (Butyrac 200 2 L)	0.2 to 0.25 (12 to 16 fl oz)	Effective on cocklebur and entireleaf, ivyleaf, and tall morningglories. Pitted morningglory may be only partially controlled. Best results achieved when applied to small weeds. May use two applications per year. Do not apply within 45 days before harvest. Suppresses large Palmer amaranth and sicklepod.
	lactofen, MOA 14 (Cobra 2 EC)	0.2 (12.5 fl oz)	Apply after peanuts have at least six true leaves. Apply to actively growing peanut. Controls most annual broadleaf weeds. See label for species controlled and maximum weed size to treat. Add nonionic surfactant at 1 quart per 100 gallons or crop oil concentrate or methylated seed oil at 1 to 2 pints per acre. See label on when to use various adjuvants. Allow at least 14 days between applications. Can be tank mixed with Basagran, Pursuit, Cadre, 2,4-DB, or Select.

Table 7-3A. Chemical Weed Control in Peanuts

Weed	Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual broadleaf weeds (continued)	lactofen, MOA 14 (Cobra 2 EC) + bentazon, MOA 6 (Basagran 4 L)	0.2 (12.5 fl oz) + 0.75 to 1 (1.5 to 2 pt)	See above comments for Basagran and Lactofen alone. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants.
	lactofen, MOA 14 (Cobra 2 EC) + bentazon, MOA 6 (Basagran 4 L) + 2.4-DB, MOA 4 (Butyrac 200 2 L)	0.2 (12.5 fl oz) + 0.75 to 1 (1.5 to 2 pt) + 0.125 to 0.25 (8-16 fl oz)	Adding 2,4-DB will improve control of larger morningglory, cocklebur, common ragweed, jimsonweed, and citron. See above comments for bentazon, lactofen, and 2,4-DB. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants.
	lactofen, MOA 14 (Cobra 2 EC) + imazapic, MOA 2 (Cadre 2 AS) (Impose 2 AS)	0.2 (12.5 fl oz) + 0.063 (4 fl oz)	See above comments for imazapic and lactofen. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Some weed species have developed resistance to Cadre.
	lactofen, MOA 14 (Cobra 2 EC) + imazethapyr, MOA 2 (Pursuit 2 AS)	0.2 (12.5 fl oz) + 0.063 (4 fl oz)	See above comments for imazethapyr and lactofen. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Some weed species have developed resistance to Pursuit.
Postemergence, Annual grasses and broadleaf weeds	paraquat, MOA 22 (Gramoxone 2 SL) (Parazone 3 SL) + bentazon, MOA 6 (Basagran 4 L)	0.18 (11 oz) (8 oz) + 0.25 to 0.75 (0.5 to 1.5 pt)	See label for weeds controlled and maximum weed size to treat; best results if weeds 1 inches or less. A postemergence application may be made following an at-crack application. Do not make more than 2 applications per season, do not apply later than 28 days after ground cracking, and do not apply if peanuts are under stress or have significant injury from thrips feeding. Gramoxone is more effective when applied within 2 weeks after peanut emergence. Add 1 pint of nonionic surfactant per 100 gallons of spray solution. Will cause foliar burn on peanuts, but peanuts recover, and yield is not affected. Follow all safety precautions on label. The residual herbicides Dual Magnum, Outlook, Warrant, Zidua, and Anthem Flex can be applied with paraquat. Basagran improves control of common ragweed, prickly sida, smartweed, lambsquarters, and cocklebur and reduces injury to peanuts from paraquat.
	paraquat, MOA 22 (Gramoxone 2 SL) (Parazone 3 SL) + bentazon, MOA 6 + acifluorfen, MOA 14 (Storm 4 L)	0.18 (11 fl oz) (8 fl oz) + 0.5 + 0.25 1 pt	See previous comments for paraquat plus Basagran. Storm improves control of common ragweed, smartweed, lambsquarters, common cocklebur, tropic croton, and spurred anoda. May be applied anytime from ground cracking up to 28 days after ground cracking. Add 1 pint of nonionic surfactant per 100 gallons of spray solution. The mixture of Gramoxone and Storm is more injurious than these herbicides applied alone. Annual grass control will be less than control by Gramoxone plus Basagran when grasses are large.
Postemergence, Florida beggarweed	chlorimuron, MOA 2 (Classic 0.25 DF)	0.008 (0.5 oz)	Use only for control of Florida beggarweed. Apply from 60 days after crop emergence to within 45 days of harvest. Application to peanuts less than 60 days old will result in crop injury and yield reduction. Apply before Florida beggarweed has begun to bloom and before it has reached 10 inches tall. Larger beggarweed may only be suppressed. Add 1 quart of nonionic surfactant per 100 gallons spray solution; do not add crop oil. May be tank mixed with 2,4-DB; see label for rates and precautions. **Recommended as a salvage treatment only.**
Postemergence, Yellow nutsedge	bentazon, MOA 6 (Basagran 4 L)	0.75 to 1 (1.5 to 2 pt)	Apply when nutsedge is 6 to 8 inches tall. A repeat application 7 to 10 days later may be needed. Adding crop oil concentrate at 1 quart per acre will increase control. Do not apply more than 4 pints of Basagran per season. Not effective on purple nutsedge.
Postemergence, Yellow and purple nutsedge	imazapic, MOA 2 (Cadre 2 AS) (Impose 2 AS)	0.063 (4 fl oz)	Apply postemergence when nutsedge is 4 inches or less. Add nonionic surfactant at 1 quart per 100 gallons or crop oil concentrate at 1 quart per acre. See label for rotational restrictions**.**
	imazethapyr, MOA 2 (Pursuit 2 AS)	0.063 (4 fl oz)	Apply before nutsedge is larger than 3 inches tall. Add surfactant at 1 quart per 100 gallons or crop oil concentrate at 1 quart per acre. Do not mix with Basagran for nutsedge control. See label for rotational restrictions. A split application with half of the Pursuit applied preplant incorporated and half applied early postemergence may be more effective than applying all of the Pursuit at one time.
Postemergence, Annual grasses	clethodim, MOA 1 (Select Max 0.97 EC) (Select 2 EC)	0.094 to 0.125 (9 to 16 fl oz) (6 to 8 fl oz)	Apply Select and Poast to actively growing grass not under drought stress. Consult labels for maximum grass size to treat. Apply in 5 to 20 GPA at 40 to 60 psi. Do not cultivate within 7 days before or after application. Add 2 pints crop oil to Poast. See label for adjuvant use with Select or Select Max. Some broadleaf/sedge herbicides and fungicides can reduce the efficacy of Select and Poast when applied in tank mixtures. See product labels for specific instructions concerning compatibility with other chemicals. See *2023 Peanut Information* AG-331 for specific pesticides that reduce control by these herbicides.
	sethoxydim, MOA 1 (Poast 1 EC) (Poast Plus 1.5 EC)	0.19 (1.5 pt) (1 pt)	
Postemergence, Bermudagrass	clethodim, MOA 1 (Select Max 0.97 EC) (Select 2 EC)	0.125 to 0.25 (12 to 32 fl oz) (8 to 16 fl oz)	Apply to actively growing bermudagrass before runners exceed 6 inches. In most cases, a second application will be needed. Make second application if regrowth occurs. See comments under annual grasses for adjuvant selection and tank mixing for these herbicides.
	sethoxydim, MOA 1 (Poast 1 EC) (Poast Plus 1.5 EC)	0.28 (2.25 pt) (1.5 pt)	
Postemergence, Rhizome johnsongrass	clethodim, MOA 1 (Select Max 0.97 EC) (Select 2 EC)	0.125 to 0.25 (12 to 32 fl oz) (8 to 16 fl oz)	Apply to actively growing johnsongrass before it exceeds 25 inches tall. Add 2 pints per acre of crop oil concentrate. A second application of the same rates can be made if needed before new plants or regrowth exceeds 12 inches.
	sethoxydim, MOA 1 (Poast 1 EC) (Poast Plus 1.5 EC)	0.28 (2.25 pt) (1.5 pt)	

Table 7-3A. Chemical Weed Control in Peanuts

Weed	Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Suppression of large Palmer amaranth and other pigweed species that are resistant to the ALS inhibiting herbicides imazapic, chlorimuron, imazethapyr, and diclosulam	2,4-DB, MOA 4 (Butyrac 200 2 SL) + lactofen, MOA 14 (Cobra 2 EC) or acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.25 (16 fl oz) + 0.20 (12.5 fl oz) or 0.38 (1.5 pt)	Suppresses and does not completely control Palmer amaranth and other pigweed species that exceed 8 inches. Suppression of weeds exceeding 12 inches will be less than suppression of smaller weeds. Do not expect suppression to exceed 60%. Applying 2,4-DB 3 to 4 days prior to Ultra Blazer or Cobra may be more effective than tank mixtures of 2,4-DB with Ultra Blazer or Cobra. Cobra is generally more effective on larger Palmer amaranth and other pigweed species than Ultra Blazer. Apply crop oil concentrate at 1 gallon per 100 gallons water with acifluorfen or lactofen. Do not apply adjuvant with 2,4-DB alone. See product labels for comments on spray volume and effects on peanut especially during pod set and pod fill. Higher spray volumes are more effective by increasing spray coverage of the contact herbicides Ultra Blazer and Cobra. Two applications of 2,4-DB spaced 10 to 14 days apart will suppress Palmer amaranth and other pigweed species. Although suppression by 2,4-DB is lower than sequential or tank mix application of 2,4-DB and acifluorfen or lactofen within 2 weeks after application, suppression by sequential applications of 2,4-DB 4 to 5 weeks after initial application is only slightly lower than suppression by sequential or tank mix application of 2,4-DB and Ultra Blazer or Cobra. For more information on managing herbicide-resistant weeds in peanut, see AG-331, *2023 Peanut Information*.
	2,4-DB, MOA 4 (Butyrac 200 2 SL) then lactofen, MOA 14 (Cobra 2 EC) or acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.25 (16 fl oz) then 0.20 (12.5 fl oz) or 0.38 (1.5 pt)	
	2,4-DB, MOA 4 (Butyrac 200 2 L) then 2,4-DB, MOA 4 (Butyrac 200 2 L)	0.25 (16 oz) then 0.25 (16 oz)	
	paraquat, MOA 22 (Gramoxone SL)	See comments	Apply in a roller/wiper implement. Best control achieved when at least 60% coverage of weed foliage occurs. Do not allow paraquat to contact peanut foliage. Mix 1 part Gramoxone SL (other formulations may not be labeled) with 1 to 1.5 parts water to prepare 40 to 50% solution. Add nonionic surfactant at 1 quart per 100 gallons. Adjust equipment to apply up to 2 pints per acre of the herbicide-water mixture.
Postemergence, Late-season residual control of annual grasses and certain small-seeded weeds	dimethenamid, MOA 15 (Outlook 6.0 L)	0.75 to 1 (16 to 21 fl oz)	Will not control emerged grasses or weeds; apply following a cultivation or appropriate postemergence herbicide if emerged grasses or broadleaf weeds are present. Benefit likely only on very sandy fields heavily infested with annual grasses that receive above normal rainfall during the first 4 to 5 weeks of the growing season. Lay-by of Dual Magnum, Outlook, Warrant, Zidua, or Anthem Flex may also be of value in fields with a history of eclipta problems; the application must be made before eclipta emerges. Rates are on a broadcast basis; apply in an 18-inch band to row middles. See labels for preharvest intervals. Anthem Flex provides suppression of emerged morningglory. See product labels for co-applying with contact and systemic herbicides.
	metolachlor, MOA 15 (Dual Magnum 7.62 EC)	0.64 to 0.84 (0.67 to 0.88 pt)	
	acetochlor, MOA 15 (Warrant 3 ME)	0.95 to 1.5 (1.25 to 2 qt)	
	pyroxasulfone, MOA 15 (Zidua) 85 WG (Zidua) 4.25 SC	0.08 to 11 (1.5 to 2.1 oz) (2.4 to 3.3 fl oz)	
	pyroxasulfone, MOA 15 + carfentrazone, MOA 15 (Anthem Flex)	0.073 + 0.005 (2.5 oz)	
Postemergence, Harvest aid for morningglory control	Carfentrazone, MOA 14 (Aim) 2 EC	0.015 to 0.031 (1.0 to 2.0 oz)	Aim desiccates annual morningglory. Apply with 1 quart nonionic surfactant per 100 gallons water or 1 gallon crop oil concentrate per 100 gallons water. Apply within 7 days prior to digging and vine inversion. Yield reduction can occur if Aim is applied earlier in the season.

Weed Response to Preplant Incorporated, Preemergence, and At-Cracking Herbicides in Peanuts

D. L. Jordan, Crop and Soil Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-3B. Weed Response to Preplant Incorporated, Preemergence, At-Cracking, and Postemergence Herbicides in Peanuts

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC= At-Cracking; POST = Postemergence

Species	Prowl or Sonalan PPI	Prowl or Sonalan + Dual Magnum or Dual PPI	Prowl or Sonalan + Outlook PPI	Dual Magnum or Dual PPI	Warrant PPI	Outlook PPI	Strongarm PPI or PRE	Prowl or Sonalan + Strongarm PPI	Pursuit PPI + POST	Dual Magnum or Dual PRE	Intrro PRE	Warrant PRE	Outlook PRE	Valor SX PRE	Prowl or Sonalan PPI + Valor SX PRE	Dual Magnum, Dual, Outlook or Warrant + Valor SX PRE	Brake PRE	Dual Magnum or Dual AC[1] or POST[1]	Intrro AC[1] or POST[1]	Outlook AC[1] or POST[1]	Zidua AC[1] or POST[1]	Anthem Flex AC or POST[1]	Gramoxone SL AC or POST[1]	Strongarm AC[2]	Gramoxone SL + Strongarm AC[2]
Bermudagrass	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	P
Black nightshade	N	F	F	F	F	F	N	N	G	F	FG	FG	F	E	E	E		F	FG	F	F	F	PF	N	G
Broadleaf signalgrass	G	E	E	G	FG	FG	P	G	G	G	FG	FG	FG	P	G	FG	E	G	FG	FG	FG	FG	E	N	GE
Carpetweed	G	G	G	FG	FG	FG	G	G	FG	FG	FG	FG	G		G	G	G	FG	FG	G	G	G	FG		G
Cocklebur	N	N	N	N	N	N	G	G	GE	N	N	N	N	PF	PF	PF	P	N	N	N	N	N	E	E	E
Common ragweed	N	P	PF	PF	PF	F	G	G	P	PF	PF	PF	F	FG	G	GE	F	PF	PF	F	F	F	F	E	E
Crabgrass	E	E	E	E	E	E	P	E	F	E	E	E	E	PF	E	E	E	E	E	E	E	E	G	N	G
Crowfootgrass	E	E	E	E	E	E				E	E	E	E	PF	G	G	E	E	E	E	E	E	E	N	GE
Dayflower	P	GE		GE			G	G		GE				F	F	GE		GE							G
Eclipta	N	G	G	G	FG	G	GE	GE	P	FG	FG	FG	FG	G	G	GE		FG	FG	FG	FG	FG	FG	NP	FG
Fall panicum	G	E	E	E	E	E	P	E	PF	E	E	E	E	PF	FG	GE	G	E	E	E	E	E	E	N	GE
Florida beggarweed	N	PF	PF	F	F	F	F	F	P	F	F	F	F	G	GE	E		F	F	F	F	F	E	FG	G
Foxtails	E	E	E	E	E	E	P	E	G	E	E	E	E	PF	E	E	G	E	E	E	E	E	E	N	GE
Goosegrass	E	E	E	E	E	E	P	E	PF	E	E	E	E	PF	GE	E	E	E	E	E	E	E	E	N	GE
Jimsonweed	N	N	N	N	N	N	GE	GE	G	N	N	N	N	G	G	GE	E	N	N	N	N	N	E		E
Johnsongrass, Seedling	G	G	G	PF	PF	PF	N	G	GE	PF	PF	PF	PF	N	FG	PF	E	PF	PF	PF	PF	PF	E	N	GE
Johnsongrass, Rhizome	P	PF	PF	N	N	N	N	P	FG	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	P
Lambsquarters	G	G	G	F	F	FG	FG	GE	FG	F	F	F	FG	GE	GE	GE	E	F	F	FG	FG	FG	F	N	G
Morningglory	P	P	P	N	N	N	G	G	G	N	N	N	N	FG	G	G	F	N-P	N-P	N-P	P	G-E[3]	F	GE	E
Nutsedge, Yellow	N	G	FG	G	N	FG	FG	FG	FG	FG	P	N	F	P	PF	FG	P	FG	P	F	F	F	PF	PF	G
Nutsedge, Purple	N	N	N	N	N	N	FG	FG	FG	N	N		N	P	P	P	P	N	N	N	N	N	PF	NP	PF
Pigweed	G	E	E	G	G	G	G	E	E	G	GE	G	GE	E	E	E	E	GE	GE	GE	GE	GE	E	NP	E
Prickly sida	N	P	P	P	P	P	FG	FG	G	P	P	P	P	FG	G	G	G	P	P	P	P	P	F		G
Purslane	G	GE	GE	G	FG	G		G		G	G	FG	G	G	GE	GE	E	GE	P	P	P	P			
Sicklepod	N	NP	NP	NP	NP	NP	P	P	P	NP	PF	NP	NP	P	PF	PF	F	NP	PF	NP	NP	NP	G	N	G
Smartweed	N	N	N	N	N	N	G	G	G	N	N	N	N				F	N	N	N	N	N	G		E
Spurge spp.	P	F	F	PF	P	PF			P	F	P	P	F	G	G	G		N	N	N	N	N	FG		FG
Spurred anoda	N	N	N	N	N	N	FG	FG	G	N	N	N	N	F	FG	FG	GE	N	N	N	N	N	P		G
Texas millet	G	G	G	PF	PF	PF	P	G	PF	PF	PF	NP	PF	PF	G	F	FG	PF	PF	PF	F	F	E	N	GE
Tropic croton	N	N	N	N	N	N	PF	PF	P	N	N	N	N				G	N	N	N	N	N	F		F
Velvetleaf	N	N	N	N	N	N	GE	GE	FG	N	N	N	N	F	FG	FG	GE	N	N	N	N	N	F		FG

[1] Residual control only.
[2] Assumes weeds are 1- to 2-inches tall or smaller.
[3] POST control.

Key:
E = excellent control, 90% or better
F = fair control, 50% to 80%
N = no control, less than 25%
G = good control, 80% to 90%
P = poor control, 25% to 50%

Weed Response to Postemergence Herbicides in Peanuts
D. L. Jordan, Crop and Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-3C. Weed Response to Postemergence Herbicides — Peanuts

	Butyrac 200	Gramoxone SL + Basagran	Gramoxone SL + Storm	Basagran	Basagran + Butyrac 200	Ultra Blazer	Ultra Blazer + Butyrac 200	Ultra Blazer + Basagran[2]	Storm	Storm + Butyrac 200	Pursuit + Butyrac 200	Cadre or Impose	Cobra	Cobra + Basagran	Cobra + Basagran + Butyrac 200	Cobra + Cadre or Impose	Cobra + Pursuit	Poast or Poast Plus	Clethodim products
Bermudagrass	N	P	P	N	N	N	N	P	N	N	N	N	N	N	N	N	N	FG	G
Black nightshade	N	PF	G	P	P	G[1]	G[1]	G[1]	G[1]	G[1]	G	G	G[1]	G[1]	G[1]	G	G	N	N
Broadleaf signalgrass	N	E	GE	N	N	NP	NP	P	NP	NP	G	G	N	N	N	G	G	E	E
Carpetweed	P	FG	G	P	P	GE	E	E	G	G	FG	FG	G	G	G	G	G	N	N
Cocklebur	E	E	E	E	E	G	E	E	E	E	E	E	G	G	E	E	E	N	N
Common ragweed	PF	G	E	G[4]	G[4]	E[1]	E[1]	E[1]	E[1]	E[1]	P	PF	E	E	E	E	E	N	N
Crabgrass	N	G	G	N	N	N	N	N	N	N	FG	FG	N	N	N	FG	FG	GE	GE
Crowfootgrass	N	G	GE	N	N	P	P	P	P	P	P	G	N	N	N	G	P	F	G
Dayflower		G	FG	G	G			G	FG	FG		G		G	G	G		N	N
Eclipta	P	F	FG	FG	FG	G	G	G	FG	FG	P	F	G	G	G	G	G	N	N
Fall panicum	N	G	GE	N	N	PF	PF	P	PF	PF	PF	G	N	N	N	G	PF	E	E
Florida beggarweed	P	GE	G	N	P	PF	F	F	P	P	P	F	F	F	F	F	F	N	N
Foxtails	N	G	GE	N	N	PF	PF	P	PF	PF	G	G	N	N	N	G	G	E	E
Goosegrass	N	G	GE	N	N	N	N	N	N	N	N	F	N	N	N	F	N	GE	GE
Jimsonweed	P	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	N	N
Johnsongrass, Seedling	N	GE	GE	N	N	P	P	P	P	P	GE	E	N	N	N	E	GE	E	E
Johnsongrass, Rhizome	N	P	P	N	N	N	N	N	N	N	F	FG	N	N	N	FG	F	G	GE
Lambsquarters	PF	G	G	FG	G[4]	G	G	GE	G	G	P	PF	P	FG	G	PF	P	N	N
Morningglory, Pitted	FG	FG	E	P	G	E	E	E	E	E	G	GE	G	G	G	GE	G	N	N
Morningglory, Others	E	FG	E	P	E	GE	E	E	GE	E	E	G	G	G	E	G	E	N	N
Nutsedge, Yellow	N	FG	G	G[3]	G	N	N	G	F	F	F	G	N	G[3]	G[3]	G	F	N	N
Nutsedge, Purple	N	PF	PF	NP	P	N	N	P	N	N	FG	G	N	P	P	G	FG	N	N
Pigweed	PF	G	E	N	P	E	E	E	E	E	E	E	E	E	E	E	E	N	N
Prickly sida	F	G	G	G	G	N	F	G	FG	G	P	G	G	G	G	G	G	N	N
Purslane	FG	G	G	G	G	E	E	E	GE	GE	FG		E	E	E	E	E	N	N
Sicklepod	G[3]	G	G	N	G[5]	NP	G[5]	NP	NP	G[5]	G[5]	E	P	P	G[5]	E	F	N	N
Smartweed	PF	E	E	E	E	GE	E	E	E	E	G	F	F	E	E	F	G	N	N
Spurge spp.	P	F[1]	F[1]	P	P	F[1]	F[1]	F[1]	PF[1]	PF[1]	PF[1]		F[1]	F[1]	F[1]	F[1]		N	N
Spurred anoda	P	FG	G	G	GE	P	P	G	F	F	F	G	F	G	GE	G	F	N	N
Texas millet	N	G	GE	N	N	NP	NP	NP	NP	NP	NP	G	N	N	N	G	NP	E	E
Tropic croton	PF	F	G	F	F	G	G	G	G	G	P	P	G	G	G	G	G	N	N
Velvetleaf	P	G	FG	G	G	PF	PF	FG	FG	FG	FG	G	G	G	G	G	G	N	N

[1] Assumes weeds are 1 to 2 inches tall or smaller.
[2] Assumes optimum rates and ratios of Basagran and Blazer; see labels.
[3] Two applications, 10 to 14 days apart.
[4] Assumes optimum conditions and addition of crop oil concentrate.
[5] Assumes follow-up treatment with 2,4-DB.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Chemical Weed Control in Sorghum

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10, Herbicide Resistance Management, for details.

Table 7-4. Chemical Weed Control in Sorghum

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Grain Sorghum No-Till Burndown, Emerged annual broadleaf and grass weeds, suppression or control of perennials			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared based on pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions. Apply before crop emerges. Glyphosate rate depends upon weed species and weed size; see labels for suggested rates. Higher rates can be applied for perennial weeds; see labels for details. See comments on labels concerning nitrogen as the carrier. Apply in 10 to 20 gallons of water per acre using flat fan nozzles. For residual grass and broadleaf weed control, glyphosate products may be tank mixed with most preemergence herbicides. See the section on Grain Sorghum—Preemergence. Refer to specific product labels for application rates, weeds controlled, application directions, and precautions. Adjuvant recommendations vary according to the glyphosate product used. See label of brand used for specific recommendations.
Grain Sorghum No-Till Burndown, Emerged annual broadleaf and grass weeds, top-kill of perennials			
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2 to 4 pt	0.5 to 1	Apply before, during, or after planting but before crop emerges using clean water or clear fertilizer solution as the carrier. Apply in a minimum of 10 GPA (20 to 40 preferred) using flat fan nozzles. Add either a nonionic surfactant at 1 pint per 100 gallons or crop oil concentrate at 1 gallon per 100 gallons. Use 0.5 to 0.64 pound a.i. on weeds 1 to 3 inches, 0.75 pound a.i. on weeds 3 to 6 inches, and 1 pound a.i. on weeds 6 inches or larger. Use 0.5 pound a.i. for rye cover crop or 0.75 pound a.i. for wheat cover crop. Rainfast within 30 minutes. For residual grass and broadleaf weed control, paraquat can be tank mixed with most preemergence sorghum herbicides and herbicide combinations. See the section on Grain Sorghum—Preemergence, Conventionally Planted. Refer to specific product labels for application rates, weeds controlled, application directions, and precautions. Better control of emerged weeds will be obtained with tank mixtures of Gramoxone plus an atrazine-containing product. Generic brands of paraquat containing 3 pounds active per gallon may be applied at 1.3 to 2.7 pints.
Grain Sorghum No-Till Burndown or Preemergence			
saflufenacil, MOA 14 (Sharpen)	1.0 to 2.0 fl oz	0.027 to 0.054 (lb a.i.)	Sharpen can be applied to control glyphosate-resistant marestail prior to grain sorghum emergence. See label for application with other herbicides and specifics on adjuvant selection. To avoid injury potential with burndown or preemergence applications, consult local seed company for possible injury of grain sorghum hybrids or varieties.
thifensulfuron, MOA 2 + tribenuron, MOA 2 (FirstShot SG with TotalSol) 50 WDG	0.5 to 0.8 oz	0.008 to 0.013 + 0.008 to 0.013	FirstShot should be applied 14 days prior to sorghum planting. Tank mix with glyphosate or paraquat for broad spectrum burndown. See label for specific rates and soil type restrictions. See label for adjuvant recommendations.
Grain Sorghum Preemergence, Annual broadleaf weeds and certain annual grasses			
atrazine, MOA 5 (AAtrex) 4 F (AAtrex Nine-O) 90 WDG	 1 to 2 qt 1.1 to 2.2 lb	1 to 2	Controls most broadleaf weeds and large crabgrass, crowfootgrass, foxtails, goosegrass, and sandbur. Does not control broadleaf signalgrass, fall panicum, Texas panicum, seedling johnsongrass, or shatter-cane. Do not use on sand, loamy sand, or sandy loam soils. Do not use on medium- or fine-textured soils with less than 1% organic matter. On highly erodible soils (defined by NRCS) with less than 30% plant residue cover, do not exceed 1.6 pounds active ingredient. See labels for details on set-back requirements from streams and lakes. See labels for comments on rotational crops. For improved grass control, atrazine may be tank mixed with S-metolachlor, alachlor, or dimethenamid if the seed have been properly treated with a safener. See comments for S-metolachlor, alachlor, or dimethenamid applied preemergence. Generic brands of atrazine are available.
Grain Sorghum Preemergence, Annual grasses and small-seeded broadleaf weeds			
alachlor, MOA 15 (Intrro) 4 EC (Micro-Tech) 4 FME	1.5 to 2.5 qt	1.5 to 2.5	Controls most annual grasses and pigweed. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on grain sorghum planted with seed properly treated with a safener containing the active ingredient flurazole. Rate depends upon soil texture; see label for details. May be tank mixed with atrazine for broadleaf weed control. See comments for atrazine applied preemergence.
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	12 to 21 fl oz	0.56 to 0.98	Use 12 to 18 fluid ounces on soils with less than 3% organic matter or 14 to 21 fluid ounces on soils with greater than 3% organic matter. Controls most annual grasses and pigweed. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on grain sorghum planted with seed properly treated with Concep or Screen protectant. Rate depends upon soil texture and organic matter; see label for details. May be tank mixed with atrazine for broadleaf weed control. See comments for atrazine applied preemergence.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel) 7.8 EC (Parallel PCS) 8 EC (Stalwart) 8 EC	1 to 1.67 pt	1 to 1.67	See comments for S-metolachlor products. Products containing S-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pints of a metolachlor product to get the activity one would get from 1 pint of an S-metolachlor product.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Brawl II) 7.64 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC (EverpreX) 7.62 EC	1 to 1.67 pt	0.95 to 1.6	Controls most annual grasses and pigweed. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on grain sorghum planted with seed properly treated with Concep or Screen protectant. Rate depends upon soil texture and organic matter; see label for details. May be tank mixed with atrazine for broadleaf weed control. See comments for atrazine applied preemergence.
Grain Sorghum Preemergence, Annual grasses and broadleaf weeds			
alachlor, MOA 15 + atrazine, MOA 5 (Bullet) 4 FME (Lariat) 4 F	2.5 to 4 qt	1.56 to 2.5 + 0.94 to 1.5	Controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on grain sorghum planted with seed properly treated with Concep or Screen protectant. Rate depends upon soil texture and organic matter; see label for details. See label for comments on rotational crops and details on set-back requirements from streams and lakes.

Table 7-4. Chemical Weed Control in Sorghum

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Grain Sorghum Preemergence, Annual grasses and broadleaf weeds (continued)			
dimethenamid-P, MOA 15 + atrazine, MOA 5 (Guardsman Max) 5F	2.5 to 4.6 pt	0.5 to 1 + 1 to 1.9	Controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only with Concep-treated seed. Apply only to medium- or fine-textured soils. Rate depends on soil texture and organic matter; see label for details. See label for comments on rotational crops and set-back requirements from streams and lakes. May be applied postemergence to sorghum up to 12 inches tall.
S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 F (Brawl II ATZ) 5.5 F (Cinch ATZ) 5.5 F (Medal II AT) 5.5 F	1.6 to 2.1 qt	0.96 to 1.26 + 1.24 to 1.63	Controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only with Concep-treated seed. Apply only to medium- and fine-textured soils with at least 1% organic matter. See label for comments on rotational crops and details on set-back requirements from streams and lakes. May be applied postemergence to sorghum up to 12 inches tall.
dimethenamid-P, MOA 15 + saflufenacil, MOA 14 (Verdict) + dimethenamid-P, MOA 15 (Outlook) 6.0 EC	10 to 18 fl oz + 4 to 12 fl oz	0.045 to 0.08 + 0.4 to 0.7 + 0.19 to 0.56	Tank mix with Outlook at 4 to 10 fluid ounces on coarse soils or 6 to 12 fluid ounces on medium to fine soils to ensure grass control. The tank mix controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane or Texas panicum. Use only with Concep-treated seed. Apply only where organic matter is greater than 1.5%. Rate depends on soil texture; see label for details. See label for comments on rotational crops. DO NOT apply to emerged sorghum, or severe injury may occur.
Grain Sorghum Postemergence, Annual grass and small broadleaf weeds			
quinclorac, MOA 4, 26 (Facet L) 1.5 L	22 to 32 fl oz	0.26 to 0.375	Apply from preemergence up to 12 inches tall. Grass and broadleaf weeds must be under 2 inches tall. Controls small barnyardgrass, broadleaf signalgrass, large crabgrass, and foxtail species. See label for list of broadleaf weeds controlled. Add 1 quart per acre of crop oil concentrate or 1 to 2 pints per acre of methylated seed oil. May be tank mixed with atrazine, 2,4-D, dicamba, Peak, or Buctril. See label for rotation restrictions.
Grain Sorghum Postemergence, Annual grass and small broadleaf weeds: **Inzen Tolerant Grain Sorghum ONLY**			
nicosulfuron, MOA 2 (Inzen) 75 WDG	0.67 to 1.33 oz	0.032 to 0.064	Can be applied overtop to grain sorghum up to 20 inches tall. Applications made to 4- to 20-inch tall grain sorghum for best crop tolerance. Do not apply if grain sorghum is greater than 20 inches. Add either a crop oil concentrate at 1 gallon per 100 gallons or a nonionic surfactant at 1 quart per 100 gallons spray solution. See label concerning additional adjuvants and fertilizers. Controls ryegrass, small broadleaf signalgrass, foxtails, fall panicum, Texas panicum, barnyardgrass, shattercane, and seedling johnsongrass. May not adequately control crabgrass and goosegrass. Also controls small burcucumber, jimsonweed, morningglory, pigweed, and smartweed. Can be applied twice, but do not exceed 1.8 ounces per acre per year. Reduced rates of 1/3 to 1/2 ounce may be applied under certain conditions; see label for details. May be tank mixed with 2,4-D ester, atrazine, Ally XP, dicamba, or Starane Ultra for improved broadleaf control. See label for comments concerning injury when used in conjunction with insecticides.
Grain Sorghum Postemergence, Annual broadleaf weeds			
atrazine, MOA 5 (AAtrex) 4 F (AAtrex Nine-O) 90 WDG	 1.2 qt 1.3 lb	1.2	Apply after sorghum reaches the three-leaf stage but before it exceeds 12 inches tall. Do not use on sand or loamy sand soil. Broadleaf weeds must be 4 inches tall or less. See label for list of weeds controlled. Add 1 quart per acre of crop oil concentrate. If a postemergence application is made following an at-planting application, do not exceed a total of 2.5 pounds active ingredient per acre per season. See label for details on set-back requirements from streams and lakes. Generic brands of atrazine are available.
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2 pt	0.75 to 1	Apply overtop or directed any time prior to heading. See label for weeds controlled and recommended weed size for treatment. Adding crop oil concentrate at 1 to 2 pt per acre will improve control. Do not apply more than 2 pints Basagran per acre per season. Basagran also controls or suppresses yellow nutsedge. May be tank mixed with atrazine. When tank mixing, see respective labels for application rates, directions, and precautions.
bromoxynil, MOA 6 (Buctril) 2 EC (Buctril 4 EC) 4 EC	 1.5 pt 0.75 pt	0.375	Can apply overtop of sorghum from the four-leaf stage until the preboot stage. Use of drop nozzles is suggested after sorghum is 6 to 8 inches tall to ensure better weed coverage. An adjuvant is not needed. Controls cocklebur, morningglory, lambsquarters, ragweed, jimsonweed, smartweed, velvetleaf, and very small pigweed. See label for recommended weed size for treatment. Do not apply when sorghum foliage is wet. May be tank mixed with atrazine, Banvel, Clarity, or 2,4D. When tank mixing, see respective labels for application rates, directions, and precautions.
bromoxynil, MOA 6 + pyrasulfotole MOA 27 (Huskie) 2.06 EC	13 to 16 oz	0.21 to 0.26	Apply overtop between 3-leaf stage up to 30 inches and/or flag leaf emergence, whichever comes first. Best control occurs when weeds are 4 inches tall or less. Controls cocklebur, morningglory, lambsquarters, ragweed, jimsonweed, smartweed, velvetleaf, and pigweed. Transitory leaf burn will occur after Huskie application to grain sorghum. Stunting and yellowing can also occur; however, these symptoms generally dissipate within 21 days and do not affect yield. May be tank mixed with atrazine, 2,4-D or dicamba as needed for additional broadleaf control. May also be tank mixed with Bicep II Magnum, Dual II Magnum, Guardsman Max, Outlook, Starane, and Warrant for additional control. When tank mixing, see respective labels for application rates, directions, and precautions.
carfentrazone, MOA 14 (Aim) 2 EC	0.5 fl oz	0.008	Apply from sorghum emergence through six-leaf stage. Add nonionic surfactant according to label directions. Controls small lambsquarters, morningglory, pigweed. Aim at rates up to 1 fluid ounce can be applied with drop nozzles.
dicamba, MOA 4 (Banvel) 4 S L (Clarity) 4 SL (Engenia) 5 SL	 0.5 pt 0.5 pt 6.4 fl oz	0.25	Apply from spike stage until sorghum is 8 inches tall. May be tank mixed with atrazine or Buctril. When tank mixing, see respective labels for application rates, directions, and precautions. **Carefully follow all precautions on labels to avoid drift to sensitive crops.**
dicamba, MOA 4 + atrazine, MOA 5 (Marksman) 3.2 F	 2 pt	0.28 + 0.53	Controls most broadleaf weeds. Apply when sorghum has two to five leaves (about 2 to 8 inches tall). Do not add surfactant or crop oil. Do not apply in vicinity of dicamba-sensitive crops. See label for details on set-back requirements from streams and lakes.
prosulfuron, MOA 2 (Peak) 57 WDG	0.75 to 1 oz	0.027 to 0.036	Controls pigweed, lambsquarters, cocklebur, morningglory, jimsonweed, ragweed, smartweed, sicklepod, and velvetleaf. Apply to sorghum 5 to 30 inches tall. Use drop nozzles if sorghum is over 20 inches Add nonionic surfactant at 1 quart per 100 gallons or crop oil concentrate at 1 quart per acre. See label for rotational restrictions. May tank mix with atrazine, Banvel, Buctril, or 2,4-D. See labels for details. See Peak label for rotational restrictions.
2,4-D amine formulation, MOA 4 (various brands) 3.8 SL	0.5 pt	0.24	Can apply overtop of sorghum 6 to 15 inches tall. Wait until secondary roots are well established. Sorghum is less tolerant of 2,4-D than is corn. Use drop nozzles as soon as possible and certainly after sorghum is 8 inches tall. Note that 2,4-D rates listed here are less than rates on most labels. Less than label-recommended rates are suggested to avoid injury to the crop. Do not apply during boot, flowering, or early dough stages. May be applied in nitrogen solution at lay-by. When mixing 2,4-D amine in nitrogen solution, add 1 pint of 2,4-D amine to 4 pints of water and mix. Then add this mixture to the nitrogen solution in the spray tank with considerable agitation until thoroughly mixed. Do not allow mixture to stand in sprayer. **Use extreme caution to avoid drift to sensitive crops such as cotton and tobacco. Ester formulations of 2,4D may be applied to sorghum. However, use of ester formulations of 2,4-D or acid/ester mixtures, such as Weedone 638, is not suggested if sensitive crops are located within 1 mile of the sorghum.**

Table 7-4. Chemical Weed Control in Sorghum

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Grain Sorghum Postemergence-Directed, Annual grass and broadleaf weeds			
linuron, MOA 7 (Linex) 4 L	1 to 2 pt	0.5 to 1	Apply as directed spray in 25 to 40 gallons per acre of water. Add 1 pint of nonionic surfactant per 25 gallons of spray mixture. For application with precision directed equipment, apply 0.5 pound active per acre when sorghum is 12 inches tall and weeds are up to 2 inches tall. Apply 0.5 to 1 pound active per acre when sorghum is 15 inches tall and weeds are 2 to 4 inches tall.
Forage Sorghum Preemergence, Annual broadleaf weeds and certain annual grasses			
atrazine, MOA 5 (AAtrex) 4 F (AAtrex Nine-O) 90 WDG	 1 to 2 qt 1.1 to 2.2 lb	1 to 2	Controls most broadleaf weeds and large crabgrass, crowfootgrass, foxtails, goosegrass, and sandbur. Does not control broadleaf signalgrass, fall panicum, Texas panicum, seedling johnsongrass, or shatter-cane. Do not use on sand, loamy sand, or sandy loam soils. Do not use on medium- or fine-textured soils with less than 1% organic matter. Do not exceed 1.6 pounds active ingredient per acre on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. See labels for comments on rotational crops. See label for details on set-back requirements from streams and lakes. For improved grass control, atrazine may be tank mixed with Cinch, Dual Magnum, or Dual II Magnum; see comments for Cinch, Dual Magnum, or Dual II Magnum applied preemergence. Generic brands of atrazine are available.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel) 7.8 EC (Parallel PCS) 8 EC (Stalwart) 8 EC	1 to 1.67 pt	1 to 1.67	See comments for S-metolachlor products. Products containing S-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pints of a metolachlor product to get the activity one would get from 1 pint of an S-metolachlor product.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Brawl II) 7.64 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.62 EC (EverpreX) 7.62 EC	1 to 1.67 pt	0.95 to 1.6	Controls most annual grasses and pigweed. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on sorghum planted with seed properly treated with Concep or Screen protectant. Rate depends upon soil texture and organic matter; see label for details. May be tank mixed with atrazine for broadleaf weed control. See comments for atrazine applied preemergence.
S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 F (Brawl II ATZ) 5.5 F (Cinch ATZ) 5.5 F (Medal II AT) 5.5 F	1.6 to 2.1 qt	0.96 to 1.26 + 1.24 to 1.63	Controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only with Concep- or Screen-treated seed. Apply only to medium- and fine-textured soils with at least 1% organic matter. See label for comments on rotational crops and details on set-back requirements from streams and lakes.
Forage Sorghum Postemergence, Annual broadleaf weeds			
atrazine, MOA 5 (AAtrex) 4 F (AAtrex Nine-O) 90 WDG	 1.2 qt 1.3 lb	1.2	Apply after sorghum reaches the three-leaf stage but before it exceeds 12 inches tall. Do not use on sand or loamy sand soil. Broadleaf weeds must be 4 inches tall or less. See label for list of weeds controlled. Add 1 quart per acre of crop oil concentrate. If a postemergence application is made following an at-planting application, do not exceed a total of 2.5 pounds active ingredient per acre per season. Do not graze or feed forage from treated areas for 21 days following application. See label for details on set-back requirements from streams and lakes. Generic brands of atrazine are available.
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2 pt	0.75 to 1	Apply overtop or directed any time prior to heading. See label for weeds controlled and recommended weed size for treatment. Adding crop oil concentrate at 1 to 2 pints per acre will improve control. Do not apply more than 2 pints per acre per season. Basagran also controls or suppresses yellow nutsedge. May be tank mixed with atrazine. When tank mixing, see respective labels for application rates and directions and precautions. Do not graze treated fields for at least 12 days following Basagran application.
bromoxynil, MOA 6 (Buctril) 2 EC (Buctril 4 EC) 4 EC	 1.5 pt 0.75 pt	0.375	Can apply overtop of sorghum from the four-leaf stage until the preboot stage. See label for weeds controlled and recommended weed size for treatment. Do not apply when sorghum foliage is wet. May be tank mixed with atrazine, Banvel, Clarity, or 2,4-D. When tank mixing, see respective labels for application directions, precautions, and weeds controlled. Do not cut for feed or fodder or graze within 30 days of application.
carfentrazone, MOA 14 (Aim) 2 EC	0.5 fl oz	0.008	Apply from sorghum emergence through six-leaf stage. Add nonionic surfactant according to label directions. Controls small lambsquarters, morningglory, and pigweed.
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	 0.5 pt 0.5 pt	0.25	Apply from spike stage until sorghum is 8 inches tall. May be tank mixed with atrazine or Buctril. When tank mixing, see respective labels for application rates and directions and precautions. Do not cut for silage prior to mature grain stage. Do not remove animals from treated areas for slaughter prior to 30 days after application. For lactating dairy animals, wait 7 days before grazing or 37 days before harvest for hay. There is no waiting period between treatment and grazing for non-lactating animals. **Carefully follow all precautions on labels to avoid drift to sensitive crops**.
2,4-D amine formulation, MOA 4 (various brands) 3.8 SL	0.5 pt	0.24	Can apply overtop of sorghum 6 to 15 inches tall. Wait until secondary roots are well established. Sorghum is less tolerant of 2,4-D than is corn. Note that 2,4-D rates listed here are less than rates on most labels. Less than label-recommended rates are suggested to avoid injury to the crop. Do not apply during boot, flowering, or early dough stages. Do not forage or feed sorghum fodder for 7 days following application. **Use extreme caution to avoid drift to sensitive crops such as cotton and tobacco. Ester formulations of 2,4D may be applied to sorghum. However, use of ester formulations of 2,4-D or acid/ester mixes, such as Weedone 638, is not suggested if sensitive crops, especially cotton and tobacco, are located within 1 mile of the sorghum.**

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-10, Herbicide Resistance Management, for details.

Chemical Weed Control in Soybeans

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NOTES: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10, Herbicide Resistance Management, for details.

Control of witchweed is part of the State/Federal Quarantine Program. Contact the NC Department of Agriculture, Plant Industry Division, at 1-800-206-9333.

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preplant (foliar application), Conventional or Reduced Tillage, Control or suppression of emerged weeds to reduce tillage operations			
glyphosate, MOA 9 (numerous brands and) formulations)	See label	0.38 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared based on pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions. Recommended rates depend upon weed species and size; see labels for details. Higher rates can be used for specific situations. Delay tillage at least 3 days after application. Adjuvant recommendations vary by glyphosate brand; follow directions on label of brand used. May add 0.75 to 1 pint of 2,4-D for improved control of specific broadleaf weeds. Delay planting at least 7 days after application of ester formulations of 2,4-D or 15 days after application of amine formulations. Use only a brand of 2,4-D with the preplant application included on the label. Follow all precautions on the 2,4-D label. Use of an ester formulation of 2,4-D is discouraged within 1 mile of cotton.
Preplant Incorporated, Annual grasses			
ethalfluralin, MOA 3 (Sonalan) 3 EC	1.5 to 3 pt	0.56 to 1.12	Controls common annual grasses plus pigweed and lambsquarters. Incorporate in top 2 to 3 inches of seedbed within 2 days of application; immediate incorporation suggested. For broadleaf weed control, Sonalan may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel PCS) 8 EC (Parrlay) 8 EC (Stalwart) 8 EC	1 to 2 pt	1 to 2	See comments for S-metolachlor products. Products containing S-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pints of metolachlor product to get the activity one would get from 1 pint of S-metolachlor product.
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 L	1.2 to 3.6 pt 1.5 to 3 pt	0.5 to 1.5 0.7 to 1.4	Controls common annual grasses plus pigweed and lambsquarters. Incorporate in top 2 to 3 inches of seedbed within 7 days of application; immediate incorporation suggested. For broadleaf weed control, pendimethalin may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands are available.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC (EverpreX) 7.62 EC	1 to 2 pt	0.95 to 1.91	Controls annual grasses and pigweed. At higher rates, controls nightshade and yellow nutsedge. Better yellow nutsedge control if incorporated; see labels for incorporation details. Except for yellow nutsedge, preemergence application preferred. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Read labels and adjust rates for soil texture and organic matter. These herbicides may be applied at rates up to 2.5 pints on soils with 6% to 20% organic matter. For broadleaf weed control, S-metolachlor may be tank mixed with most broadleaf herbicides; do not mix with Valor. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
trifluralin, MOA 3 (Treflan) 4 EC (Treflan HFP) 4 EC	1 to 2 pt	0.5 to 1	Controls common annual grasses plus pigweed and lambsquarters. Incorporate in top 2 to 3 inches of seedbed within 8 hrs of application; immediate incorporation suggested. For broadleaf weed control, Treflan may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands are available.
Preplant Incorporated, Annual broadleaf weeds			
imazaquin, MOA 2 (Scepter) 70 WDG	2.8 oz	0.123	Controls most broadleaf weeds; a follow-up post-emergence herbicide application often needed for adequate sicklepod control. Follow all precautions on the label, including rotational restrictions. For annual grass control, Scepter may be tank mixed with alachlor, pendimethalin, S-metolachlor, or trifluralin. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
metribuzin, MOA 5 (Sencor) 75 WDG	0.33 to 0.67 lb	0.25 to 0.5	Controls many broadleaf weeds. Will not adequately control cocklebur or morningglory. Acceptable control of sicklepod may require a follow-up postemergence herbicide application. Activity of metribuzin is highly dependent upon soil texture and organic matter. Follow label directions for application rates, soil type restrictions. Do not use on sand with less than 1% organic matter. Do not use on loamy sand or sandy loam soils with less than 0.5% organic matter. Some varieties are particularly sensitive to metribuzin; see labels for details. Soybeans may be injured when metribuzin is applied to soil treated with organophosphate insecticides or nematicides; see precautions on label. For annual grass control, Sencor may be tank mixed with alachlor, pendimethalin, S-metolachlor, or trifluralin. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	14 to 21 fl oz	0.66 to 0.98	Incorporate 2 inches deep. Not effective on purple nutsedge. Follow label carefully for use rates on various soil types. Do not apply to sandy soils if organic matter is less than 3% and depth to groundwater is 30 feet or less.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel PCS) 8 EC (Parrlay) 8 EC (Stalwart) 8 EC	1 to 2 pt	1 to 2	See comments for S-metolachlor products. Products containing S-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pints of a metolachlor product to get the activity one would get from 1 pint of an S-metolachlor product.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC (EverpreX) 7.62 EC	1.33 to 2 pt	1.27 to 1.91	Incorporate 2 inches deep. Not effective on purple nutsedge.

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Burndown, No-Till Planting, Emerged grass and broadleaf weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared based on pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. The rate in the preceding column is expressed as a.e. See TABLE 7-9 for glyphosate rate conversions. Apply before crop emergence. Rate depends upon weed species and size; see labels for details. Higher rates (up to 3.75 pounds acid equivalent) may be used for perennial weeds. Adjuvant recommendations vary by glyphosate brand. See label of brand used for specific recommendations. For residual grass and broadleaf weed control, glyphosate may be tank mixed with most preemergence soybean herbicides. Refer to the label of the tank mix partner for application rates, directions, limitations, weeds controlled, and precautions.
glyphosate, MOA 9 + fomesafen, MOA 14 (Flexstar GT) 3.29 L	 3 to 4.5 pt	1 to 1.55 (lb a.e.) + 0.25 to 0.37	Apply before crop emergence. See label for adjuvant suggestions. May mix with 2,4-D or dicamba for improved burndown of specific weeds. See waiting intervals between application and planting on labels for 2,4-D or dicamba. Do not exceed 4.5 pints per acre of Flexstar GT per year. Also, do not exceed 0.375 pound a.i. of fomesafen per year from all sources.
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2 to 4 pt	0.5 to 1	Apply before crop emergence. Use 2 pints on weeds 1 to 3 inches, 3 pints on weeds 3 to 6 inches, and 4 pints on weeds 6 inches or taller. Use 2 pints for rye cover crop and 2.5 to 3 pints on wheat cover crops. Add crop oil concentrate or nonionic surfactant according to label directions. Generic brands of paraquat containing 3 pounds active per gallon are available. Apply these products at two-thirds of the rates mentioned here. Residual herbicides for grass and broadleaf weed control may be tank mixed with Gramoxone. Control of cutleaf eveningprimrose, wild radish, and most broadleaf weeds will be increased by adding 2,4-D at 0.75 to 1 pint. Delay planting at least 7 days after application of ester formulations of 2,4-D or 15 days after application of amine formulations of 2,4D. Use of ester formulations is discouraged if sensitive crops, especially cotton and tobacco, are located within 1 mile.
Burndown, No-Till Planting, Cutleaf eveningprimrose, wild radish, and vetch, plus other weeds controlled by glyphosate			
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL	See label + 0.5 to 1 pt	0.56 to 1.13 (lb a.e.) + 0.24 to 0.48	See comments for glyphosate alone. Apply ester formulations of 2,4-D at least 7 days ahead of planting. Apply amine formulations of 2,4-D at least 15 days ahead of planting. Plant soybeans at least 1 inch deep. See comments on 2,4-D labels concerning use on coarse-textured soils with less than 1% organic matter. For 2,4-D formulations other than 3.8 pounds per gallon, adjust rate accordingly. Use 0.5 pint 2,4-D for primrose; use 1 pint for other weeds. Use of ester formulations is discouraged if sensitive crops, particularly cotton or tobacco, are located within 1 mile.
pyraflufen-ethyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be used for limited suppression of small emerged summer annual and winter weeds. See label for adjuvant and spray volume recommendations Research with ET is limited in North Carolina.
Burndown, No-Till Planting, Glyphosate-resistant horseweed plus other weeds			
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14 (Valor SX) 51 WDG	See label + 1.5 to 2 pt + 2 to 3 oz	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.064 to 0.096	Glyphosate-resistant horseweed (marestail) is relatively common in eastern North Carolina, and continued spread is anticipated. See comments for glyphosate alone. Acceptable control of glyphosate-resistant horseweed requires both a residual herbicide (Valor SX, Valor XLT, Envive, Leadoff, or Trivence) and either 2,4-D or Clarity. An alternative approach would be application of glyphosate plus either 2,4-D or Clarity preplant followed by Gramoxone plus a residual herbicide at planting. Do NOT till or otherwise disturb the soil surface following application of Valor SX, Valor XLT, Envive, Leadoff, or Trivence. 2,4-D rates suggested for horseweed should be applied at least 30 days ahead of planting. For 2,4-D formulations other than 3.8 pounds per gallon, adjust rate accordingly. Use of ester formulations of 2,4-D is discouraged if sensitive crops, especially cotton and tobacco, are located within 1 mile. Following application of Clarity and accumulation of at least 1 inch rainfall, delay soybean planting at least 14 days. Follow precautions on Clarity label concerning drift to sensitive crops. Leadoff must be applied at least 30 days ahead of planting. Trivence may be applied any time from fall through spring, up to 3 days after planting. See label for recommended adjuvants. Rates are dependent upon soil texture and organic matter, see label for specific rate recommendations. See label for crop rotation restrictions. Afforia may be applied at 2.5 to 3.75 oz 7 days prior to planting soybean, the rate must be reduced to 2.5 oz if applying less than 7 days prior to planting. Rates are dependent upon soil texture and organic matter, see label for specific rate recommendations. See label for crop rotation restrictions. Horseweed cannot be controlled with a burndown prior to planting double-crop soybeans because the combine cuts off the horseweed, leaving little to no foliage to spray. If horseweed is present in wheat, apply 0.75 to 0.9 ounce of either Harmony SG or Harmony Extra with TotalSol plus 3 ounces of Clarity in February or early March.
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14, + chlorimuron, MOA 2 (Valor XLT) 40.3 WDG	See label + 1.5 to 2 pt + 3 to 5 oz	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.056 to 0.094 + 0.019 to 0.032	
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14, + pyroxasulfone, MOA 15 (Fierce) 76 WDG	See label + 1.5 to 2 pt + 3 to 3.75 oz	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.06 to 0.079 + 0.0796 to 0.0996	

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Burndown, No-Till Planting, Glyphosate-resistant horseweed plus other weeds (continued)			
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14 + chlorimuron, MOA 2 + thifensulfuron, MOA 2 (Envive) 41.3 WDG	See label + 1.5 to 2 pt 2.5 to 4 oz	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.046 to 0.074 + 0.0214 to 0.023 + 0.0045 to 0.007	
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14 + chlorimuron, MOA 2 + thifensulfuron, MOA 2 (Envive) 41.3 WDG	See label + 1.5 to 2 pt 2.5 to 4 oz	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.046 to 0.074 + 0.0214 to 0.023 + 0.0045 to 0.007	
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14 + cloransulam, MOA 2 (Surveil) 48 WG	See label + 1.5 to 2 pt + 2.8 to 4.2 oz	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.063 to 0.095 + 0.021 to 0.032	
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + rimsulfuron, MOA 2 + thifensulfuron, MOA 2 (Leadoff) 33.4 WDG	See label + 1.5 to 2 pt 1.5	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.0155 + 0.0155	
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14 + chlorimuron, MOA 2 + metribuzin, MOA 5 (Trivence) 61.3 DG	See label + 1.5 to 2 pt 6 to 8.7 oz	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.048 to 0.070 + 0.0146 to 0.021 + 0.167 to 0.243	
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14 + thifensulfuron, MOA 2 + tribenuron, MOA 2 (Afforia) 50.8 DG	See label + 1.5 to 2 pt + 2.5 to 3.75 oz	0.56 to 1.13 (lb a.e.) + 0.71 to 0.95 + 0.071 to 0.096 + 0.008 to 0.012 + 0.008 to 0.012	

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Burndown, No-Till Planting, Glyphosate-resistant horseweed plus other weeds (continued)			
saflufenacil, MOA 14 (Sharpen) 3.42 SL	1.0 fl oz	0.027 (lb a.i.)	Sharpen can be applied to control glyphosate-resistant horseweed. Applying Sharpen with other herbicides will broaden the spectrum of control. See label for specific information on adjuvant selection. **Interval between application and soybean planting for Sharpen varies by soil texture and organic matter content. See Sharpen label for specific information.**
glufosinate, MOA 10 (Liberty) 2.34 SL	29 to 36 fl oz	0.53 to 0.66	Liberty 280 SL can be applied prior to emergence of any transgenic or conventional soybean variety to control emerged weeds. See label for adjuvant use. In crop applications to **Liberty-Link soybeans** can be made at 22 to 29 fluid ounces following a burndown application with a maximum seasonal use of 65 ounces per acre. Thorough spray coverage is essential. Apply in minimum of 15 GPA; dense weed canopies require 20 to 40 GPA. Poor performance is likely if daytime temperatures are less than 75ºF or if weeds are drought stressed.
oxyfluorfen, MOA 14 (Goal 2XL) 2L (GoalTender) 4L	 1 to 2 pt 0.5 to 1 pt	0.25 to 0.5	Goal 2XL can be applied at 7 days or more prior to soybean planting to control common winter and summer annual weed species. A tank mix combination with glyphosate, paraquat, glufosinate, 2,4-D or dicamba is recommended. See label for tank mix recommendations.
halauxifen-methyl, MOA 4 (Elevore) 0.57 L	 1.0 fl oz	0.0045	Elevore can be applied 14 days or more prior to soybean planting. Applications should be made to actively growing weeds. Include either MSO or COC at 1% v/v. Do not make more than two preplant applications per year, with a maximum of 2.0 fl oz of Elevore per acre per growing season.
tiafeacil, MOA 14 (Reviton) 2.83 SC	 1 to 3 fl oz	0.022 to 0.067	Reviton can be applied 7 days or more prior to soybean planting to control common winter and summer annual weed species. A tank mix combination of Reviton with other burndown herbicides is recommended to broaden the spectrum of control. See label for specific information on adjuvant selection.
Burndown, No-Till Planting, Curly dock, vetch, and Carolina geranium plus other weeds controlled by glyphosate			
glyphosate, MOA 9 (numerous brands and formulations) + thifensulfuron, MOA 2 (Harmony SG) 50 WDG	See label + 0.75 oz	0.56 to 1.13 (lb a.e.) + 0.023	See comments for glyphosate alone. Harmony SG can be applied any time prior to soybean planting. Soybean planting should be delayed at least 14 days after application of Harmony Extra. Soybean may be planted 1 day after 0.5 ounce of FirstShot is applied, however planting should be delayed at least 7 days if higher rates are applied.
glyphosate, MOA 9 (numerous brands and formulations) + thifensulfuron, MOA 2 + tribenuron, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	See label + 0.75 oz	0.56 to 1.13 (lb a.e.) + 0.016 + 0.008	
glyphosate, MOA 9 (numerous brands and formulations) + thifensulfuron, MOA 2 + tribenuron, MOA 2 (FirstShot SG with TotalSol) 50 WDG	See label + 0.5 to 0.8 oz	0.56 to 1.13 (lb a.e.) + 0.008 to 0.013 + 0.008 to 0.013	
Burndown, No-Till Planting, Italian ryegrass, wheat, barley, and rye			
glyphosate, MOA 9 (numerous brands and formulations) + clethodim, MOA 1 (Select MAX) 0.97 EC	See label + 9 to 16 fl oz	0.56 to 1.13 (lb a.e.) + 0.067 to 0.12 (lb a.i.)	Apply to weeds 2 to 6 inches tall. See label for instructions on adjuvant used depending on glyphosate formulation.
Preemergence, No-Till or Conventional, Any Cultivar, Annual grasses			
alachlor, MOA 15 (Intrro) 4 EC (Micro-Tech) 4 FME	2 to 3 qt	2 to 3	Controls annual grasses except Texas panicum, shattercane, and seedling johnsongrass. Also controls pigweed and nightshade. For broadleaf weed control, alachlor may be tank mixed with most broadleaf herbicides; do not mix with Valor SX, Valor XLT, or Envive unless applied 14 or more days ahead of planting. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. May also be shallowly incorporated; see labels for details. Generic brands of alachlor are available.
clomazone, MOA 13 (Command 3 ME) 3 FME	1.3 to 3.3 pt	0.5 to 1.25	Controls most annual grasses; shattercane and Texas panicum are only suppressed. Also controls a number of broadleaf weeds. See label for weeds controlled. Read the label carefully and follow all precautions on label pertaining to off-site movement, buffer zones, drift control agents, and rotational restrictions. For broader spectrum control, Command 3 ME may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	12 to 21 fl oz	0.56 to 0.98	Use 12 to 18 fluid ounces on soils with less than 3% organic matter or 14 to 21 fluid ounces on soils with greater than 3% organic matter. Controls annual grasses except seedling johnsongrass, Texas panicum, and shattercane. Also controls pigweed and nightshade. See label for application directions and rates for various soils. May also be shallowly incorporated; see label for details. For broadleaf weed control, Outlook may be tank mixed with most broadleaf herbicides; do not mix with Valor SX, Valor XLT, or Envive unless applied 14 or more days ahead of planting. Do not apply to sandy soils if organic matter is less than 3% and depth to groundwater is 30 feet or less.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel PCS) 8 EC (Parrlay) 8 EC (Stalwart) 8 EC	1 to 2 pt	1 to 2	See comments for S-metolachlor products. Products containing S-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pints of a metolachlor product to get the activity one would get from 1 pint of S-metolachlor product.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC (EverpreX) 7.62 EC	1 to 2 pt	0.95 to 1.91	Controls annual grasses except Texas panicum, shattercane, and seedling johnsongrass. Also controls pigweed and nightshade on mineral soils. May also be shallowly incorporated; see label for details. For broadleaf weed control, S-metolachlor may be tank mixed with most broadleaf herbicides; do not mix with Valor SX or Valor XLT unless applied 14 or more days ahead of planting. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, No-Till or Conventional, Any Cultivar, Annual grasses (continued)			
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 L	 1.2 to 3 pt 1.5 to 2.5 pt	 0.5 to 1.2 0.7 to 1.2	Preemergence application of pendimethalin suggested only where annual grass pressure is expected to be light. Pendimethalin generally performs better when incorporated. For broadleaf weed control, pendimethalin may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands are available.
pyroxasulfone, MOA 15 (Zidua) 85 WG (Zidua SC) 4.17 SC	 1.5 to 3.5 oz 2.5 to 5.75 fl oz	0.0796 to 0.186	Use 1.5 to 2.1 ounces of Zidua (2.5 to 3.5 fluid ounces of Zidua SC) per acre on coarse soils, 2 to 3 ounces on medium soils, and up to 3.5 ounces (5.75 fluid ounces of Zidua SC) per acre on fine-textured soils. Controls most annual grasses, pigweed, and nightshade. Provides suppression of Texas panicum, seedling johnsongrass, and shattercane. May be tank mixed with most broadleaf herbicides; when tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. May be applied from preplant to V6 soybean. Does not control emerged weeds. See label for tank mix options to control emerged weeds.
pyroxasulfone, MOA 15 + fluthiacet-methyl, MOA 14 (Anthem) 2.15 L	6 to 11 oz	0.101 to 0.185	Use 6 to 6.5 ounces per acre on coarse soils, 6.5 to 9.5 ounces on medium soils, and up to 11 ounces per acre on fine-textured soils. Controls most annual grasses, pigweed, and nightshade. Provides suppression of Texas panicum, seedling johnsongrass, and shattercane. May be tank mixed with most broadleaf herbicides; when tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. May be applied to emerged soybean up to third trifoliate leaf stage. May provide some control of emerged broadleaf weeds (less than 2 inches). See label for tank mix options to control emerged weeds.
Preemergence, No-Till or Conventional, Any Cultivar, Annual broadleaf weeds			
clomazone, MOA 13 (Command 3 ME) 3 FME	1.3 to 3.3 pt	0.5 to 1.25	Command controls selected broadleaf weeds such as balloonvine, velvetleaf, spurred anoda, prickly sida, croton, Pennsylvania smartweed, common ragweed, lambsquarters, and jimsonweed. It also controls most annual grasses. Command does not control pigweed, morningglory, sicklepod, nightshade, and ladysthumb. See label for specific weeds controlled and rates for specific weeds. Read label carefully and follow all precautions on label pertaining to off-site movement, buffer zones, drift control agents, and rotational restrictions. For broader spectrum control, Command may be tank mixed with a number of soil-applied herbicides; see label for details. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
flumetsulam, MOA 2 (Python) 80 WDG	0.8 to 1.33 oz	0.04 to 0.067	Controls most broadleaf weeds; control of ragweed, cocklebur, and morningglory can be variable. Rates of 1.25 to 1.33 ounces suggested for sicklepod. Acceptable control of sicklepod may require a follow-up postemergence herbicide application. May be mixed with registered soil-applied grass control herbicides. See label for weeds controlled, **rotational restrictions,** and restrictions on soil type and organic matter.
flumioxazin, MOA 14 (Valor SX) 51 WDG (Rowel) 51 WDG	2 to 3 oz	0.063 to 0.094	Rate depends on weed species and soil texture; follow label directions when selecting rate. May be tank mixed with Prowl or Command for annual grass control. Valor SX, Valor XLT, Envive, Surveil or Gangster should not be mixed with alachlor, metolachlor, S-metolachlor, or dimethenamid-P and applied preemergence. Combinations of Valor SX, Valor XLT, Envive, Surveil or Gangster plus alachlor, metolachlor, S-metolachlor, or dimethenamid-P can be applied 14 or more days ahead of planting. Do not apply Valor XLT within 14 days before or after application of organophosphate insecticide or any variety that is not DuPont BOLT, STS or STS/RR due to injury potential. Check with University and Company recommendations concerning varietal sensitivity to metribuzin before using Trivence.
flumioxazin, MOA 14 + chlorimuron, MOA 2 (Valor XLT) 40.3 WDG (Rowel FX) 40.3 WDG	3 to 5 oz	0.056 to 0.094 + 0.019 to 0.032	
flumioxazin, MOA 14 + chlorimuron, MOA 2 + thifensulfuron, MOA 2 (Envive) 41.3 WDG	2.5 to 4 oz	0.046 to 0.074 + 0.0214 to 0.023 + 0.0045 to 0.007	
flumioxazin, MOA 14 + cloransulam, MOA 2 (Surveil) 48 WG	2.8 to 4.2 oz	0.063 to 0.095 + 0.021 to 0.032	
flumioxazin, MOA 14 + cloransulam, MOA 2 (Gangster, co-pack of Gangster V [51% flumioxazin] and Gangster FR [84% cloransulam])	1.5 to 3 oz + 0.3 to 0.6 oz	0.047 to 0.094 + 0.016 to 0.032	
flumioxazin, MOA 14 + chlorimuron, MOA 2 + metribuzin, MOA 5 (Trivence) 61.3 WDG	6 to 9 oz	0.048 to 0.072 + 0.015 to 0.022 + 0.167 to 0.25	
imazaquin, MOA 2 (Scepter) 70 WDG	2.8 oz	0.123	Controls most broadleaf weeds if adequate rainfall received for activation. A follow-up postemergence herbicide application often needed for adequate sicklepod control. Follow all precautions on the label, including rotational restrictions. For annual grass control, Scepter may be tank mixed with alachlor, Command, dimethenamid-P, pendimethalin, or S-metolachlor. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
linuron, MOA 7 (Linex) 4 L	0.66 to 3 pt	0.33 to 1.5	Rate depends greatly on soil texture and organic matter content; follow label directions carefully when selecting rates. Do not use on sand or loamy sand soils or any soil with less than 0.5% organic matter. Linuron controls pigweed, lambsquarters, and common ragweed. For annual grass control, linuron may be tank mixed with alachlor, Command, dimethenamid-P, pendimethalin, or S-metolachlor. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands may be available.
metribuzin, MOA 5 (Sencor) 75 DF	0.33 to 0.67 pt	0.25 to 0.5	Rate depends greatly on soil texture and organic matter content; follow label directions carefully when selecting rates. Do not use Sencor on sand soils with less than 1% organic matter or on any soil with less than 0.5% organic matter. Some varieties are particularly sensitive to metribuzin; see labels for details. Soybeans may be injured when metribuzin is applied to soil treated with organophosphate insecticides or nematicides. Does not adequately control cocklebur or morningglory. Adequate sicklepod control may require a follow-up postemergence herbicide application. For annual grass control, metribuzin may be tank mixed with alachlor, Command, dimethenamid-P, pendimethalin, or S-metolachlor. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, No-Till or Conventional, Any Cultivar, Annual broadleaf weeds (continued)			
sulfentrazone, MOA 14 + metribuzin, MOA 5 (Authority MTZ) 45 WDG	12 to 20 oz	0.135 to 0.225 + 0.20 to 0.34	Rate depends upon soil texture and organic matter; see label for application rates. Controls most broadleaf weeds, including Palmer amaranth, morningglory, and cocklebur; sicklepod suppressed. See statement on label concerning sensitive varieties. See label for rotational restrictions.
Preemergence, No-Till or Conventional, Any Cultivar, Annual grasses and broadleaf weeds — packaged herbicide mixtures			
S-metolachlor, MOA 15 + fomesafen, MOA 14 (Prefix) 5.29 L	2 to 3 pt	1.09 to 1.63 + 0.24 to 0.36	Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, common ragweed, Florida pusley, smartweed, and nightshade. Does not control sicklepod, and it only suppresses morningglory, cocklebur, and prickly sida.
flumioxazin, MOA 14 + pyroxasulfone, MOA 15 (Fierce) 76 WDG	3 to 3.75 oz	0.06 to 0.079 + 0.0796 to 0.0996	Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, common ragweed, Florida pusley, smartweed, and nightshade.
flumioxazin, MOA 14 + pyroxasulfone, MOA 15 + chlorimuron, MOA 2 (Fierce XLT) 62.41 WDG	3.75 to 4.5 oz	0.06 to 0.069 + 0.073 to 0.088 + 0.016 to 0.019	Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, common ragweed, Florida pusley, smartweed, and nightshade.
flumioxazin, MOA 14 + pyroxasulfone, MOA 15 + metribuzin, MOA 5 (Fierce MTZ) 2.64 SC (Kyber) 2.64 SC	1 to 1.5 pt	0.063 to 0.0938 + 0.08 to 0.12 + 0.1875 to 0.45	Rate depends upon soil texture and organic matter; see label for application rates. Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, common ragweed, Florida pusley, smartweed, and nightshade. See statement on label concerning sensitive varieties.
metribuzin, MOA 5 + S-metolachlor, MOA 15 (Boundary) 7.8 L	1 to 2.5 pt	0.19 to 0.47 + 0.79 to 1.96	See comments for metribuzin applied preemergence. Rate depends on soil texture and organic matter content; follow label directions carefully when selecting rate. Do not use on coarse-textured soils with less than 0.5% organic matter. Controls weeds normally controlled by Sencor and Dual Magnum. May be mixed with Command, FirstRate, Prowl, Python, or Scepter. Follow-up postemergence herbicide needed in most cases.
metribuzin, MOA 5 + S-metolachlor, MOA 15 + cloransulam-methyl, MOA 2 (Tendovo) 4.18 ZC	1.2 to 2.35 qt	0.19 to 0.377 + 1.04 to 2.04 + 0.02 to 0.04	See comments for metribuzin applied preemergence. Rate depends on soil texture and organic matter content; follow label directions carefully when selecting rate. Do not use on coarse-textured soils with less than 0.5% organic matter. Controls weeds normally controlled by Sencor and Dual Magnum plus additional control of horseweed and common ragweed. Tendovo may be applied preplant up to 30-45 days before planting.
imazethapyr, MOA 2 + saflufenacil, MOA 14 (OpTILL)	2 oz	0.022 + 0.63	Optill is labeled for application up to soybean emergence. Application to emerged soybean can result in significant injury. See label for adjuvant selection.
imazethapyr, MOA 2 + saflufenacil, MOA 14 + pyroxasulfone, MOA 15 (Zidua PRO) 4.09 SC	4.5 oz + 6 fl oz	0.0169 to 0.0225 + 0.0468 to 0.062 + 0.08 to 0.107	Zidua PRO is labeled for burndown application up to preemergence. Application to emerged soybean can result in significant injury. Delay soybean planting 30 days after application on coarse soils where organic matter is ≤2.0%. See label for adjuvant selection. See label for tank mixing information.
sulfentrazone, MOA 14 + S-metolachlor, MOA 15 (Broadaxe) 7 EC (Broadaxe XC) 7 EC	19 to 38.7 fl oz	0.104 to 0.212 + 0.94 to 1.90	Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, morningglory, prickly sida smartweed, and nightshade. Also provides control of yellow nutsedge. Does not control sicklepod or cocklebur.
acetochlor, MOA 15 + fomesafen, MOA 14 (Warrant Ultra) 3.45 L	48 to 70 fl oz	1.06 to 1.54 + 0.236 to 0.345	May be applied preplant, at-planting, preemergence or postemergence. May only be applied ONCE per growing season. Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, common ragweed, Florida pusley, smartweed, and nightshade. Does not control sicklepod, and it only suppresses morningglory, cocklebur, and prickly sida. See label for rate and timing information.
sulfentrazone, MOA 14 + cloransulam-methyl, MOA 2 (Sonic) 78 WG	6.45 to 8 oz	0.25 to 0.31 + 0.032 to 0.04	May be applied preplant incorporated, preplant, or preemergence within 3 days after planting. Apply 6.45 oz where organic matter is less than 3%. May be applied alone or in tank mix combination with other registered herbicides. Controls several annual grasses (except barnyardgrass, Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds such as pigweed species (including Palmer amaranth), lambsquarters, horseweed, cocklebur, morningglory, smartweed, and nightshade. Also provides control of purple and yellow nutsedge. Does not control sicklepod.
sulfentrazone, MOA 14 + pyroxasulfone, MOA 15 (Authority Supreme) 4.16 L	6 to 11.5 fl oz	0.065 to 0.186 + 0.065 to 0.186	Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, morningglory, prickly sida smartweed, and nightshade. Also provides control of purple and yellow nutsedge. Does not control sicklepod or cocklebur.
sulfentrazone, MOA 14 + pyroxasulfone, MOA 15 (Authority Edge) 4.25 L	5.9 to 15.7 fl oz	0.07 to 0.186 + 0.186 to 0.335	Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, morningglory, prickly sida smartweed, and nightshade. Also provides control of purple and yellow nutsedge. Does not control sicklepod or cocklebur. See label for specific rate recommendations and rotation restrictions.
sulfentrazone, MOA 14 + flumioxazin, MOA 14 (Zone Defense) 0.77 DG	3.5 to 5.0 oz	0.11 to 0.194 + 0.03 to 0.047	Rate depends upon soil texture and organic matter; see label for application rates. Controls most broadleaf weeds, including Palmer amaranth, morningglory, and cocklebur; sicklepod suppressed. Also provides control of purple and yellow nutsedge. See label for rotational restrictions.
Preemergence, No-Till or Conventional, Any Cultivar, Nutsedge			
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	14 to 21 fl oz	0.66 to 1	Dimethenamid and metolachlor control or suppress only yellow nutsedge. These herbicides are more effective on yellow nutsedge when incorporated. However, these herbicides applied preemergence may provide adequate control of lighter infestations of yellow nutsedge. Neither product controls purple nutsedge. Follow labels carefully for use rates on various soil types. Do not apply Outlook to sand soils if organic matter is less than 3% and depth to groundwater is 30 feet or less. Generic brands containing metolachlor, not S-metolachlor, are available. See previous comments concerning these products. Prefix, which contains S-metolachlor, will suppress or control yellow nutsedge.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC (EverpreX) 7.62 EC	1.33 to 2 pt	1.27 to 1.91	

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, No-Till or Conventional, Any Cultivar, Nutsedge (continued)			
sulfentrazone, MOA 14 + metribuzin, MOA 5 (Authority MTZ) 45 WDG	12 to 20 oz	0.135 to 0.225 + 0.20 to 0.34	See comments under Annual Grasses and Broadleaf Weeds. Controls yellow and purple nutsedge.
sulfentrazone, MOA 14 + *S*-metolachlor. MOA 15 (Broadaxe) 7 EC (Broadaxe XC) 7 EC	19 to 38.7 fl oz	0.104 to 0.212 + 0.94 to 1.90	See comments under Annual Grasses and Broadleaf Weeds. Controls yellow and purple nutsedge.
Preemergence, No-Till or Conventional, GT27 or isoxaflutole-resistant cultivars ONLY, Annual grasses and broadleaf weeds			
isoxaflutole (Alite 27) 4 SC	1.5 to 3 oz	0.047 to 0.094	May be applied preplant incorporated, preplant, or preemergence up to 21 days prior to planting. May be applied alone or in tank mix combination with other registered herbicides. Controls several annual grasses (except crowfootgrass and shattercane) and broadleaf weeds such as pigweed species (including Palmer amaranth), lambsquarters, horseweed, morningglory, smartweed, and nightshade. Does not control purple and yellow nutsedge. Does not control sicklepod and cocklebur. Do not apply with organophosphate or carbamate insecticides to emerged soybeans. Foliar applications of an organophosphate or carbamate insecticides should not be made within 7 days of an application or crop injury may result. If the water table (for example, level of saturation) is less than 25 feet below the ground surface or the depth to the water table is unknown, do not use if the surface soil texture is loamy sand or sand and the subsoil texture is loamy sand or sand, and the average organic matter (in the upper 12 inches) is less than 2% by weight.
Postemergence Overtop; Roundup Ready Cultivars, Annual grasses and broadleaf weeds plus suppression of perennial weeds—**Roundup Ready cultivars Only**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.5 (lb a.e.)	**Apply only to Roundup Ready Cultivars. See comments on resistance management in TABLE 7-10.** A preemergence herbicide is highly recommended to control weeds not controlled by glyphosate (such as Florida pusley), to reduce early season weed competition, to broaden the window of application for glyphosate, and to aid in resistance management. Any registered soil-applied herbicide can be used on Roundup Ready soybeans. Glyphosate controls most annual weeds; exceptions include dayflower, hemp sesbania, and Florida pusley. Timely application required for morningglory control. Can be applied from cracking stage throughout flowering. Multiple applications can be made, but do not exceed 2.2 pounds a.e. per acre per year during this period. Total glyphosate use (preplant, in-crop, and preharvest) should not exceed 6 pounds a.e. per acre per year. Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared based on pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions. Adjuvant recommendations vary by glyphosate product: see label of brand used for details. Rate depends upon weed species and size; see labels for details. Timely application is encouraged. The first application should be made 18 to 20 days after planting. Repeat applications can be made if needed. The following products can be mixed with at least some of glyphosate brands. Refer to label of tank mix partner or glyphosate product used for timing of application, weed sizes, and use of adjuvants. **Ultra Blazer** (1 pint): improves control of hemp sesbania, black nightshade, and larger morningglory. Minor antagonism sometimes noted on grasses and pigweed. Use 1.5 pints to control glyphosate-resistant Palmer amaranth up to 4 inches **Classic** (0.25 to 0.33 oz): improves control of hemp sesbania, spreading dayflower, and larger morningglory. **FirstRate** (0.2 to 0.3 fluid ounce): improves control of spreading dayflower, dove weed, and larger morningglory. **Harmony SG** (0.125 ounces/acre): improves control of lambsquarters and velvetleaf. Controls glyphosate-resistant Palmer amaranth unless it is also ALS resistant. Apply before Palmer amaranth exceeds 8 inches Apply after first trifoliate has fully expanded. See label for use of ammonium sulfate. Some soybean injury can be expected. **Reflex, Flexstar** (6 to 12 fluid ounces): improves control of hemp sesbania, black nightshade, and larger morningglory. Antagonism sometimes noted on grasses and pigweed. Must be applied at 16 fluid ounces to control glyphosate-resistant Palmer amaranth 4 inches tall, or at 24 fluid ounces if 6 inches tall. **Resource** (2 to 4 fluid ounces): improves control of larger morningglory. Minor antagonism sometimes observed on pigweed. Apply at 6 to 8 ounces for glyphosate-resistant Palmer amaranth up to 4 inches. **Synchrony XP** (0.375 ounce): improves control of lambsquarters, morningglory, and velvetleaf. Controls glyphosate-resistant Palmer amaranth unless it is also ALS resistant. Apply before Palmer amaranth exceeds 4 inches. **Storm** (0.75 to 1.5 pints): improves control of hemp sesbania, black nightshade, and larger morningglory. Minor antagonism sometimes noted on grasses and pigweed.
glyphosate, MOA 9 + fomesafen, MOA 14 (Flexstar GT) 3.29 L	 3 to 4.5 pt	1 to 1.5 (lb a.e.) + 0.25 to 0.37	Controls grasses and most annual broadleaf weeds. See label for suggested rates according to weed size. Also see label for adjuvant recommendations. Apply with flat fan nozzles. Do not exceed 4.5 pints per acre of Flexstar GT per year. Also do not exceed 0.375 pound a.i. of fomesafen per year from all sources.
glyphosate, MOA 9 + acetochlor, MOA 15 (Warrant) 3.0 ME	See label 1.5 qt	0.56 to 0.75 (lb a.e.) + 1.1	**Apply only to Roundup Ready cultivars.** Apply overtop soybean with glyphosate at V2-V3 soybean for best results. Apply prior to R3. Warrant can be directed at V5-V6. Warrant provides residual control only.
Postemergence Overtop; Roundup Ready Cultivars, Volunteer Roundup Ready corn in Roundup Ready soybeans			
glyphosate, MOA 9 (numerous brands and formulations) + clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	See label + 4 to 8 fl oz 6 to 12 fl oz	0.56 to 0.75 (lb a.e.) + 0.063 to 0.125 0.045 to 0.106	See comments for glyphosate alone. For corn up to 12 inches tall, apply 4 to 6 ounces of Select or 6 ounces of Select Max. For corn up to 24 inches tall, apply 6 to 8 ounces of Select or 9 ounces of Select Max. For corn up to 36 inches, apply 12 ounces Select Max. Add 2.5 pounds per acre ammonium sulfate or equivalent. If brand of glyphosate used does not contain surfactant, add nonionic surfactant at 0.25 to 0.5% by volume. If applying Select or Select Max alone, see labels for adjuvant recommendations.
glyphosate, MOA 9 (numerous brands and formulations) + fluazifop-p-butyl, MOA 1 (Fusilade DX) 2 EC	See label + 4 to 6 fl oz	0.56 to 0.75 (lb a.e.) + 0.063 to 0.094	See comments for glyphosate alone. Apply 4 ounces Fusilade for corn less than 12 inches Increase rate to 6 ounces for corn up to 24 inches Add any adjuvants suggested on the label of the glyphosate product used. Additionally, add 0.25% by volume of crop oil concentrate. If applying Fusilade alone, see label for adjuvant recommendations.
glyphosate, MOA 9 (numerous brands and formulations) + quizalofop-p-ethyl, MOA 1 (Assure II) 0.88 EC	See label + 5 to 8 fl oz	0.56 to 0.75 (lb a.e.) + 0.034 to 0.055	See comments for glyphosate alone. Apply Assure at 4 ounces to corn up to 12 inches, 5 ounces to corn up to 18 inches, and 8 ounces to corn up to 30 inches If the brand of glyphosate contains adjuvant, add 0.125% nonionic surfactant by volume. If the brand of glyphosate does not contain adjuvant, add surfactant according to the glyphosate label. If applying Assure alone, see label for adjuvant recommendations.

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence Overtop; Liberty Link or Enlist Cultivars, Annual grasses and broadleaf weeds			
glufosinate-ammonium, MOA 10 (Liberty SL) (Cheetah) 2.34 SL (Interline) 2.34 SL	29 to 43 fl oz	0.53 to 0.66 (lb a.i.)	**Apply only to Liberty Link or Enlist cultivars.** Can be applied as single or sequential applications up to R1 stage of soybean. Do not apply more than 43 ounces as a single application. If applied as a burndown prior to planting, Liberty SL can be applied in season to soybean with a maximum seasonal use of 87 ounces/acre. See product label for possible tank mixtures with other herbicides.
Postemergence Overtop; Xtend Cultivars, Annual broadleaf weeds - **Xtend cultivars ONLY**			
dicamba, N,N-Bis-(3-aminopropyl)methylamine salt, MOA 4 (Engenia) 5 SL	12.8 fl oz	0.5 (lb a.e.)	**Stewardship training is required for all applicators to ensure guidelines for application are followed. DO NOT APPLY when winds are greater than 10 mph. DO NOT APPLY when wind is blowing toward sensitive crops. DO NOT APPLY during temperature inversion.** Can be applied as single or sequential applications prior to R1 stage of soybean or no more than 45 days after planting, whichever occurs first. Apply in a minimum of 15 gallons of spray solution per acre. For best performance, control weeds early when they are less than 4 inches. Do not apply more than 12.8 fluid ounces as a single application in crop. If applied as a burndown prior to planting, Engenia can be applied in season to Xtend soybean with a maximum seasonal use of 51.2 ounces/acre. See product label and www.engeniaherbicide.com/tank-mix.html for possible tank mixtures with other herbicides, nozzle requirements, and additional spray drift management practices.
dicamba, diglycolamine salt, MOA 4 + S-metolachlor, MOA 15 (Tavium)	56.5 fl oz	0.5 (lb a.e.) + 1.0	**Stewardship training is required for all applicators to ensure guidelines for application are followed. DO NOT APPLY when winds are greater than 10 mph. DO NOT APPLY when wind is blowing toward sensitive crops. DO NOT APPLY during temperature inversion.** Can be applied as single or sequential applications through V4 stage of soybean or within 45 days after planting, whichever occurs first. Cannot be applied to double crop soybeans. Apply in a minimum of 15 gallons of spray solution per acre. For best performance, control weeds early when they are less than 4 inches. Do not apply more than 56.5 fluid ounces as a single application in crop. If applied as a burndown prior to planting, Tavium can be applied in season to Xtend soybean with a maximum seasonal use of 113 ounces/acre. See product label and www.taviumtankmix.com for possible tank mixtures with other herbicides, nozzle requirements, and additional spray drift management practices.
dicamba, diglycolamine salt, MOA 4 (Xtendimax)	22 fl oz	0.5 (lb a.e.)	**Stewardship training is required for all applicators to ensure guidelines for application are followed. DO NOT APPLY when winds are greater than 10 mph. DO NOT APPLY when wind is blowing toward sensitive crops. DO NOT APPLY during temperature inversion.** Can be applied as single or sequential applications prior to R1 stage of soybean or no more than 45 days after planting, whichever occurs first. Apply in a minimum of 15 gallons of spray solution per acre. For best performance, control weeds early when they are less than 4 inches. Do not apply more than 22 fluid ounces as a single application in crop. If applied as a burndown prior to planting, Xtendimax can be applied in season to Xtend soybean with a maximum seasonal use of 88 ounces/acre. See product label and www.roundupreadyxtend.com/pages/xtendimax-updates.aspx for possible tank mixtures with other herbicides, nozzle requirements, and additional spray drift management practices.
Postemergence Overtop; Enlist Cultivars, Annual broadleaf weeds - **Enlist cultivars ONLY**			
2,4-D choline salt, MOA 4 (Enlist One) 3.8 SL	1.5 to 2 pt	0.71 to 0.95 (lb a.e.)	**Stewardship training is required for all applicators to ensure guidelines for application are followed. DO NOT APPLY when winds are greater than 10 mph. DO NOT APPLY when wind is blowing toward sensitive crops. DO NOT APPLY during temperature inversion.** Can be applied as single or sequential applications any time after soybean emerges but no later than R2 stage of soybean. Apply in a minimum of 15 gallons of spray solution per acre. For best performance, control weeds early when they are less than 4 inches. Do not apply more than 2.0 pints as a single application in crop. If applied as a burndown prior to planting, Enlist One can be applied in season to Enlist soybean with a maximum seasonal use of 6 pints/acre. See product label and www.enlist.com/en/herbicides/approved-tank-mix.html for possible tank mixtures with other herbicides, nozzle requirements, and additional spray drift management practices.
Postemergence Overtop; Enlist Cultivars, Annual grasses and broadleaf weeds - **Enlist cultivars ONLY**			
2,4-D choline salt, MOA 4 (Enlist One) 3.8 SL + glyphosate, MOA 9	1.5 to 2 pt + See label	0.71 to 0.95 (lb a.e.) + 0.75 to 1.5 (lb a.e.)	**Stewardship training is required for all applicators to ensure guidelines for application are followed. DO NOT APPLY when winds are greater than 10 mph. DO NOT APPLY when wind is blowing toward sensitive crops. DO NOT APPLY during temperature inversion.** Can be applied as single or sequential applications any time after soybean emerges but no later than R2 stage of soybean. Apply in a minimum of 15 gallons of spray solution per acre. For best performance, control weeds early when they are less than 4 inches. Do not apply more than 4.75 pints of Enlist Duo as a single application in crop. If Enlist Duo is applied as a burndown prior to planting, Enlist Duo can be applied in season to soybean with a maximum seasonal use of 14.25 pints/acre. See product label and www.enlist.com/en/herbicides/approved-tank-mix.html for possible tank mixtures with other herbicides, nozzle requirements, and additional spray drift management practices.
2,4-D choline salt, MOA 4 + glyphosate, MOA 9 (Enlist Duo) 3.3 SL	 3.5 to 4.75 pt	0.7 to 0.95 (lb a.e.) + 0.74 to 1.0 (lb a.e.)	
2,4-D choline salt, MOA 4 (Enlist One) 3.8 SL + glufosinate, MOA 9	1.5 to 2 pt + 29 to 36 oz	0.71 to 0.95 (lb a.e.) + 0.53 to 0.66	**Stewardship training is required for all applicators to ensure guidelines for application are followed. DO NOT APPLY when winds are greater than 10 mph. DO NOT APPLY when wind is blowing toward sensitive crops. DO NOT APPLY during temperature inversion.** Can be applied as single or sequential applications any time after soybean emerges but no later than R1 stage of soybean. Apply in a minimum of 15 gallons of spray solution per acre. For best performance, control weeds early when they are less than 4 inches. Do not apply more than 2.0 pints of Enlist One as a single application in crop. If applied as a burndown prior to planting, Enlist One can be applied in season to Enlist soybean with a maximum seasonal use of 6 pints/acre. See product label and www.enlist.com/en/herbicides/approved-tank-mix.html for possible tank mixtures with other herbicides, nozzle requirements, and additional spray drift management practices.
Postemergence Overtop; Any Cultivar, Annual grasses			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	 6 to 8 fl oz 9 to 16 fl oz	 0.094 to 0.125 0.068 to 0.121	Apply to actively growing grasses not under drought stress. See label for specific rates and weed size to treat. Add crop oil concentrate at 1 quart per acre to Select. To Select Max, add nonionic surfactant at 0.25% volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Do not cultivate for 7 days before or after application. Generic brands are available.
fluazifop-p-butyl, MOA 1 (Fusilade DX) 2 EC	6 to 12 fl oz	0.094 to 0.188	Apply to actively growing grass not under drought stress. Suggested application rate varies by species; see label for application directions, rates, maximum weed sizes to treat. Add either 1% crop oil concentrate (1 gallon per 100 gallons) or 0.25% nonionic surfactant (1 quart per 100 gallons). Do not cultivate for 7 days before or after application.
quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC	5 to 8 fl oz	0.034 to 0.055	Apply to actively growing grass not under drought stress. Suggested application rate varies by species; see label for application directions, rates, maximum weed sizes to treat. Add 1% (1 gallon per 100 gallons) crop oil concentrate or 0.25% (1 quart per 100 gallons) nonionic surfactant. Do not cultivate for 7 days before or after application. Generic brands are available.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 16 fl oz 24 fl oz	0.19	Apply to actively growing grass not under drought stress. Consult label for maximum grass size to treat, application directions. Add 2 pints per acre of crop oil concentrate. Do not cultivate for 7 days before or after application.

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence Overtop; Any Cultivar, Annual broadleaf weeds			
acifluorfen, MOA 14 (Ultra Blazer) 2 SL	0.5 to 1.5 pt	0.13 to 0.38	See label for weeds controlled, recommended rates for specific weeds, and maximum weed size to treat. Label recommends nonionic surfactant at 1 to 2 pints per 100 gallons spray solution. For broader spectrum control, acifluorfen may be tank mixed with Basagran, Classic, FirstRate, Pursuit, Raptor, Resource, Scepter, Synchrony, or 2,4-DB. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
acifluorfen, MOA 14 + bentazon, MOA 6 (Storm) 4 SL	 1.5 pt	0.25 + 0.5	See label for weeds controlled and maximum weed size to treat. Add 1 pint per acre of crop oil concentrate or nonionic surfactant at 1 quart per 100 gallons. For broader spectrum control, Storm may be tank mixed with Basagran, Classic, FirstRate, Pursuit, Raptor, Resource, or Scepter. See respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	See label for weeds controlled, recommended rates for specific weeds, and maximum weed size to treat. Add 1.25% by volume (not to exceed 2 pints per acre) of crop oil concentrate when treating for lambsquarters, common ragweed, or hemp sesbania. If velvetleaf is primary target, add 0.5 to 1.0 gallon per acre of liquid nitrogen instead of crop oil. For broader spectrum control, Basagran may be tank mixed with Classic, Cobra, FirstRate, Flexstar, Pursuit, Raptor, Reflex, Resource, Scepter, Storm, Ultra Blazer, or 2,4-DB. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
cloransulam-methyl, MOA 2 (FirstRate) 84 WDG	0.3 oz	0.016	Controls cocklebur, jimsonweed, morningglory, ragweed, smartweed, velvetleaf, spreading dayflower, dove weed, and small horseweed. See label for recommended weed size to treat. FirstRate will usually control sicklepod in the cotyledonary to first leaf stage; larger sicklepod will not be controlled. Add either nonionic surfactant at 1 to 2 pints per 100 gallons or crop oil concentrate at 1.2 gallons per 100 gallons. If velvetleaf is the target weed, also add 2.5 gallons 30% UAN per 100 gallons. FirstRate can be applied twice per season. For broader spectrum control, FirstRate may be tank mixed with Basagran, Classic, Cobra, Flexstar, Pursuit, Raptor, Reflex, Resource, Storm, Synchrony, or Ultra Blazer.
chlorimuron ethyl, MOA 2 (Classic) 25 WDG	0.5 to 0.75 oz	0.008 to 0.012	See label for weeds controlled, recommended rates for specific weeds, maximum weed size to treat, rotational restrictions, and sprayer cleanup. Add 0.25% by volume (1 quart per 100 gallons) of nonionic surfactant. Under hot, dry conditions, 1% crop oil concentrate may be used instead of surfactant; crop oil increases potential for injury. See label for specific adjuvant recommendations when treating velvetleaf. For broader spectrum control, Classic may be tank mixed with Basagran, Ultra Blazer, Cobra, FirstRate, Flexstar, Harmony GT, Reflex, Resource, Storm, or Ultra Blazer. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
chlorimuron ethyl, MOA 2 + thifensulfuron methyl, MOA 2 (Synchrony XP) 28.4 WDG	 0.375 to 1.125 oz	0.005 to 0.015 + 0.0016 to 0.0049	**For non-BOLT, STS cultivars, use only 0.375 ounce rate.** Rate can be increased to 1.125 ounces on BOLT, STS cultivars. See label for weeds controlled, maximum weed size to treat, and rotational restrictions. Add crop oil concentrate at 1% by volume except when tank mixing with a product whose label precludes use of crop oil concentrate; in that case, use nonionic surfactant at 0.25% by volume. Under dry conditions, adding 2 quarts per acre of UAN may enhance control. Synchrony may be tank mixed with Cobra, FirstRate, Flexstar, Harmony GT, Reflex, Resource, or Ultra Blazer.
flumiclorac pentyl ester, MOA 14 (Resource) 0.86 EC	4 to 8 fl oz	0.027 to 0.054	Suggested for use where velvetleaf is a problem. Excellent control of velvetleaf. Also controls small lambsquarters, pigweed species, prickly sida, and common ragweed. See label for weeds controlled and recommended weed size for treatment. Add 1 quart per acre of crop oil concentrate. Resource may be tank mixed with Basagran, Classic, Cobra, FirstRate, Flexstar, Harmony GT, Pursuit, Raptor, Reflex, Scepter, Storm, Synchrony, or Ultra Blazer.
fomesafen, MOA 14 (Flexstar) 1.88 SL (Reflex) 2 SL (Dawn) 2 SL (Rhythm) 1.88 SL	1 to 1.5 pt	 0.25 to 0.38 0.24 to 0.35 0.24 to 0.35 0.25 to 0.38	See labels for weeds controlled, recommended rates for specific weeds, maximum weed size to treat, and rotational restrictions. Add 1% crop oil concentrate by volume (4 quarts per 100 gallons) or 0.25% nonionic surfactant (1 quart per 100 gallons). For broader spectrum control, Reflex or Flexstar may be tank mixed with Basagran, Classic, FirstRate, Harmony GT, Pursuit, Raptor, Resource, Scepter, Synchrony, or 2,4-DB. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions. Flexstar is somewhat more active than Reflex and can be more effective on lambsquarters, prickly sida, spurred anoda, and velvetleaf. Foliar burn on the crop may also be greater with Flexstar under conditions of high moisture and high temperatures. See label for tank mix partners with Dawn and Rhythm.
S-metolachlor, MOA 15 + fomesafen, MOA 14 (Prefix) 5.29 L	 2 to 2.33 pt	1.09 to 2.27 + 0.24 to 0.28	Apply from cracking to third trifoliate of soybean. Add 0.25% by volume of nonionic surfactant; do not use crop oil. Do not exceed 3 pints per acre of Prefix per year, and do not exceed 0.375 pound a.i. of fomesafen from all sources combined.
fomesafen, MOA 14 + fluthiacet methyl, MOA 14 (Marvel) 3 L	5 to 7.25 oz	0.117 to 0.17	Apply from preplant through full flowering (prior to R3). Add 0.25% by volume of nonionic surfactant, 0.5% by volume crop oil concentrate, or 0.5% by volume methylated seed oil. Crop oil or methylated seed oil are recommended under dry conditions. Do not exceed 0.375 pound a.i. of fomesafen from all sources combined. See label for tank mix partners.
imazamox, MOA 2 (Raptor) 1S L	5 fl oz	0.04	Controls many common broadleaf weeds. Foxtails, fall panicum, broadleaf signalgrass, seedling johnsongrass, and shattercane usually adequately controlled. Does not control sicklepod. May not adequately control ragweed, prickly sida, or Palmer amaranth. May tank mix with Basagran, FirstRate, Flexstar, Reflex, Resource, Storm, or Ultra Blazer for improved control of ragweed and Palmer amaranth; tank mixes may reduce grass control. Suppresses yellow and purple nutsedge. Add either crop oil concentrate at 2 pints per acre or nonionic surfactant at 1 quart per 100 gallons. See label concerning addition of nitrogen-containing fertilizer.
imazaquin, MOA 2 (Scepter) 70 WDG	1.4 to 2.8 oz	0.063 to 0.125	See label for weeds controlled, recommended rates for specific weeds, maximum weed size to treat, and rotational restrictions. Primarily for control of cocklebur and pigweed. Add 0.25% by volume (1 quart per 100 gallons) nonionic surfactant. Alternatively, a crop oil concentrate can be used at the rate recommended on crop oil label. For broader spectrum control, Scepter may be tank mixed with Basagran, Cobra, Flexstar, Reflex, Resource, Storm, or Ultra Blazer. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
imazethapyr, MOA 2 (Pursuit) 70 WDG	1.44 oz	0.063	See label for weeds controlled, recommended rates for specific weeds, maximum weed size to treat, and rotational restrictions. Also suppresses johnsongrass, broadleaf signalgrass, and foxtails. Add 0.25% by volume (1 quart per 100 gallons) nonionic surfactant or 1.5 to 2 pints per acre of crop oil concentrate. For broader spectrum control, Pursuit may be tank mixed with Basagran, Cobra, FirstRate, Flexstar, Harmony GT, Reflex, Resource, Storm, or Ultra Blazer. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
lactofen, MOA 14 (Cobra) 2 EC	6 to 12.5 fl oz	0.094 to 0.2	See label for weeds controlled, recommended rates, weed size to treat, and recommended adjuvants. At higher rates, Cobra usually causes excessive foliar burn on soybeans. Lower rates tank mixed with other herbicides may be of some value in specific situations. Cobra may be tank mixed with Basagran, Classic, FirstRate, Pursuit, Resource, Scepter, Synchrony, or 2,4-DB. See labels for weeds controlled and specific use directions.

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence Overtop; Any Cultivar, Annual broadleaf weeds (continued)			
thifensulfuron methyl, MOA 2 (Harmony SG) 50 WDG	0.125 oz	0.004	See label for weeds controlled, maximum weed size to treat, and sprayer cleanup. Add 0.125% to 0.25% by volume (1 to 2 pints per 100 gallons) of nonionic surfactant when applying Harmony SG alone or 0.125% in tank mixes. Under dry or cool conditions, a crop oil concentrate may be used; see label for details. In addition to surfactant or crop oil, Harmony SG label specifies use of an ammonium nitrogen fertilizer. This is usually of value only when treating for velvetleaf. For broader spectrum control, Harmony SG may be tank mixed with Classic, Flexstar, Pursuit, Reflex, Resource, or Synchrony. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
pyraflufen-ethyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be applied from emergence to V6 soybean to suppress small broadleaf weeds. Some leaf speckling can occur but is transient. Do not apply crop oil concentrate. See label for adjuvant and spray volume recommendations. Research with ET is limited in North Carolina.
Postemergence Overtop; Any Cultivar, Annual grasses and broadleaf weeds—tank mixtures			
quizalofop p-ethyl, MOA 1 (Assure II) + Basagran, Classic, Cobra, FirstRate, Flexstar, Harmony SG, Pursuit, Raptor, Reflex, Scepter, Storm, Synchrony STS, or Ultra Blazer (See TABLE 7-10 for MOAs)	See labels	See labels	The listed two-way tank mixes are covered on one or more of the respective labels. Consult the labels of the products to be used for specific application rates, directions, precautions, and adjuvant usage. Formulations and active ingredients of the various products can be found elsewhere in this publication. A number of three-way tank mixes (not listed here) also are registered. While mixing postemergence grass and broadleaf herbicides is convenient and saves time and trips across the field, best results often are obtained when the grass and broadleaf herbicides are applied separately. Antagonism of the grass herbicide (reduced grass control) often occurs when the grass herbicide is mixed with a broadleaf herbicide. Antagonism is more likely to occur under marginal spraying conditions, such as large grasses and dry weather. Some of the broadleaf herbicides also are more antagonistic than others. The antagonism may be partially or completely overcome by increasing the rate of the grass herbicide; labels for some of the grass herbicides suggest increased rates when tank mixing. The adjuvants needed for good activity of the grass herbicide also may enhance crop injury from the broadleaf herbicide; follow label directions carefully for use of adjuvants. Tank mixing should be considered only when the optimum timing for application of the grass and broadleaf herbicides coincides. Tank mixes generally should not be used when treating for rhizome johnsongrass or bermudagrass. If sequential applications are made, the recommended waiting interval between application of the grass and broadleaf herbicides varies depending upon the herbicides used and the order in which they are applied. See the labels for specific recommendations. However, the following are general guidelines: 1) If the grass herbicide is applied first, the broadleaf herbicide can be applied 24 hrs later; 2) if Basagran or Resource is applied first, the grass herbicide can be applied 24 hrs later; 3) if Classic, FirstRate, Harmony SG, or Synchrony STS is applied first, wait at least 3 days before applying the grass herbicide; 4) if Pursuit, Raptor, or Scepter is applied first, wait at least 5 days before applying the grass herbicide; and 5) if Cobra, Flexstar, Reflex, Storm, or Ultra Blazer is applied first, delay application of the grass herbicide until the grass resumes active growth with development of new leaves.
fenoxaprop-ethyl, MOA 1 (Fusilade DX) + Basagran, Classic, Cobra, Flexstar, Pursuit, Raptor, Reflex, Scepter, Storm, Synchrony STS, or Ultra Blazer (See TABLE 7-10 for MOAs)			
sethoxydim, MOA 1 (Poast or Poast Plus) + Basagran, Classic, Cobra, FirstRate, Flexstar, Pursuit, Reflex, Resource, Scepter, Storm, Synchrony STS, or Ultra Blazer (See TABLE 7-10 for MOAs)			
clethodim, MOA 1 (Select or Select Max) + Basagran, Classic, Cobra, FirstRate, Flexstar, Pursuit, Raptor, Reflex, Resource, Storm, Synchrony STS, or Ultra Blazer (See TABLE 7-10 for MOAs)			
Postemergence Overtop; Any Cultivar, Annual broadleaf weeds**,** Rhizome johnsongrass			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	 0.125 to 0.25 0.091 to 0.24	Apply when johnsongrass is 12 to 24 inches tall. If needed, make second application of 6 to 8 oz of Select or 9 to 24 fluid ounces of Select Max when regrowth is 6 to 18 inches Add crop oil concentrate at 1 quart per acre to Select. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Generic brands available.
fluazifop p-butyl, MOA 1 (Fusilade DX) 2 EC	12 fl oz	0.19	Apply when johnsongrass is 8 to 18 inches tall and before boot stage. Add either a nonionic surfactant at 0.25% by volume (1 quart per 100 gallons) or a crop oil concentrate at 1% by volume (1 gallon per 100 gallons). If needed, make second application of 8 fluid ounces when regrowth is 6 to 12 inches.
quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC	10 fl oz	0.07	Apply when johnsongrass is 10 to 24 inches tall. If needed, make second application of 7 fluid ounces per acre when regrowth is 6 to 10 inches. Add either crop oil concentrate at 1% (1 gallon per 100 gallons) or nonionic surfactant at 0.25% (1 quart per 100 gallons). Generic brands available.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 24 fl oz 36 fl oz	0.28	Apply to actively growing johnsongrass 20 to 25 inches tall. Add 2 pints per acre of crop oil concentrate. A second application of 16 ounces of Poast or 24 ounces of Poast Plus may be made when regrowth is 12 inches.
Postemergence Overtop; Any Cultivar, Bermudagrass			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	 0.125 to 0.25 0.091 to 0.24	Apply before bermudagrass runners exceed 6 inches. If needed, make second application of 8 to 16 ounces of Select or 12 to 32 fluid ounces of Select Max when regrowth is less than 6 inches Add crop oil concentrate at 1 quart per acre to Select. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Generic brands available.
fluazifop p-butyl, MOA 1 (Fusilade DX) 2 EC	12 fl oz	0.19	Apply when bermudagrass runners are 4 to 8 inches. If regrowth occurs, apply 8 fluid ounces when regrowth is 4 to 8 inches. Add crop oil concentrate at 1% by volume (1 gallon per 100 gallons) or nonionic surfactant at 0.25% by volume (1 quart per 100 gallons).
quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC	10 fl oz	0.07	Apply when bermudagrass is 3 inches tall or has up to 6-inch runners. If regrowth occurs, make second application of 7 fluid ounces/acre when runners are 6 inches. Add either crop oil concentrate at 1% (1 gallon per 100 gallons) or nonionic surfactant at 0.25% (1 quart per 100 gallons). Generic brands available.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 24 fl oz 36 fl oz	0.28	Apply to actively growing bermudagrass before runners exceed 6 inches. Add 2 pints per acre of crop oil concentrate. A second application of 16 ounces of Poast or 24 ounces Poast Plus may be made when regrowth is 4 inches.
Postemergence Overtop; Any Cultivar, Nutsedge			
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2 pt	0.75 to 1	For yellow nutsedge only; Basagran does not control purple nutsedge. Apply when yellow nutsedge is 6 to 8 inches tall. Add 2 pints per acre of crop oil concentrate. If needed, make second application of same rate 7 to 10 days later.
chlorimuron ethyl, MOA 2 (Classic) 25 WDG	0.5 to 0.75 oz	0.008 to 0.012	Controls yellow nutsedge; suppresses purple nutsedge. Apply when yellow nutsedge is 2 to 4 inches tall. Add surfactant according to label directions.
chlorimuron ethyl, MOA 2 + thifensulfuron methyl, MOA 2 (Synchrony STS SP) 42 WDG	0.5 oz	0.01 + 0.003	Controls yellow nutsedge; suppresses purple nutsedge. Apply when yellow nutsedge is 2 to 3 inches tall. Add crop oil concentrate according to label directions. **Apply only to BOLT, STS soybean.**

Table 7-5A. Chemical Weed Control in Soybeans

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence Overtop; Any Cultivar, Nutsedge (continued)			
imazethapyr, MOA 2 (Pursuit) 70 WDG	1.44 oz	0.063	Apply when nutsedge is 1 to 3 inches tall. Add surfactant or crop oil according to label directions. Pursuit is more effective on purple nutsedge than on yellow nutsedge.
Late Postemergence Overtop, Salvage Treatment; Any Cultivar, Cocklebur and morningglory			
2,4-DB, MOA 4 (various brands) 2 SL 1.75 SL 75 WP	 1 pt 1.1 pt 0.33 lb	0.25	Spray overtop soybeans from 1 week before bloom up to midbloom. This treatment may be used when needed as an aid to control cocklebur and morningglory and as a supplement to but not a replacement for early postemergence treatments. Salvage treatment only—substantial crop injury may occur. Do not add surfactant or crop oil. Not suggested for use on soybeans to be saved for seed.
Postemergence Directed; Any Cultivar, Small grasses and broadleaf weeds			
metribuzin, MOA 5 (Sencor) 75 WDG	0.33 to 0.67 lb	0.25 to 0.5	Apply only as a directed spray to soybeans at least 8 inches tall. Do not spray higher than 2 to 3 inches on the soybean stem. Add surfactant according to label directions. Do not use if soil has been wet for 2 to 3 days. Do not use on sandy soils or any soil having less than 0.5% organic matter. Some varieties of soybeans are sensitive to metribuzin; see label for details.
Postemergence Directed; Any Cultivar, Cocklebur and morningglory			
2,4-DB, MOA 4 (various brands) 2 SL 1.75 SL 75 WP	 13 fl oz 15 fl oz 4.3 oz	0.2	Soybeans must be at least 8 inches tall. Contact no more than the lower third of soybean plant. Follow other precautions on label.
Postemergence with Wiper Applicators; Any Cultivar, Certain weeds taller than crop, especially grasses			
glyphosate, MOA 9 (numerous brands and formulations)	Not applicable; see label	Not applicable; see label	Apply glyphosate above crop with wiper-type applicator. Follow label directions carefully. Do not let glyphosate contact crop plants. Johnsongrass and tall annual grasses such as fall panicum are very susceptible; broadleaf weeds are less susceptible. Use only as supplement to a good early season weed management program.
Postemergence with Hooded Sprayer; Any Cultivar, Annual and perennial grasses and broadleaf weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.38 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared based on pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-9 for glyphosate rate conversions. Glyphosate rate depends upon weed species and size; see labels for specific rates. Higher rates can be used for perennial weeds; see labels for details. Keep hoods as close to the ground as possible. Contact of spray with foliage of non-Roundup Ready soybeans will cause severe injury.
Harvest Aid; Any Cultivar, Annual and perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 2.25 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared based on pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-9 for glyphosate rate conversions. See labels for weeds controlled, maximum weed size to treat, and specific application rates for various species. Apply after pods have set and lost all green color. Apply at least 7 days before harvest. Can be applied by ground or air. Do not apply to soybeans grown for seed.
sodium chlorate (Defol 5) 5 L	4.8 qt	6	Apply when soybeans are mature and ready for harvest. Apply 7 to 10 days before anticipated harvest date. Apply in a minimum of 20 gallons of water per acre. Will control most grass and broadleaf weed species and desiccate soybean prior to harvest. Do not graze or harvest treated soybean for forage.
Harvest Aid; Any Cultivar, Annual grasses and broadleaf weeds			
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	8 to 16 fl oz	0.13 to 0.25	Apply when pods are fully developed and at least one-half of leaves have dropped and leaves left on plants are turning yellow. Can be applied by ground or air. Generic brands containing 3 pounds active per gallon are available. This product would be used at 5.3 to 10.7 fluid ounces.
Harvest Aid; Any Cultivar, Annual broadleaf weeds			
carfentrazone, MOA 14 (Aim) 2 EC	1.5 fl oz	0.023	Desiccates morningglory, pigweed, and cocklebur. Apply 3 or more days ahead of harvest. Add 1 gallon crop oil concentrate per 100 gallons spray solution. Thorough coverage is essential; use a minimum of 20 GPA by ground equipment. May be applied by air. May tank mix with Gramoxone. Tank mixes with Gramoxone should be applied 15 days ahead of harvest.
saflufenacil, MOA 14 (Sharpen) 2.85 SC	1.0 to 2.0 fl oz	0.022 to 0.044	Apply when soybeans have reached physiological maturity, no green color on pods and seeds. Apply 3 or more days ahead of harvest, allow up to 10 days for optimum desiccation. See label for specific directions on indeterminant and determinant varieties. Add 1 gallon methylated seed oil per 100 gallons spray solution plus ammonium-based adjuvant system (AMS or UAN) for optimum desiccation. Do not apply to soybeans grown for seed.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-10, Herbicide Resistance Management, for details.

Weed Response to Preplant Incorporated and Preemergence Herbicides in Soybeans

W. J. Everman, Crop and Soil Sciences Department

Ratings are based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-5B. Weed Response to Preplant Incorporated and Preemergence Herbicides in Soybeans

Species	Prowl or Treflan PPI	Sonalan PPI	Authority MTZ PRE	Command PRE	Dual Magnum, Dual II Magnum PRE	Envive PRE	Fierce	Fierce XLT	Intrro or Micro-Tech PRE	Linex PRE	Outlook PRE	Prefix PRE	Prowl PRE	Python PRE	Reflex PRE	Scepter PRE	Sencor PRE	Valor SX PRE	Valor XLT PRE	Zidua/Zidua SC
Bermudagrass	N	N	N	PF	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Broadleaf signalgrass	G	G	F	E	G	N	E	E	FG	P	FG	G	P	N	FG	PF	PF	N	N	E
Crabgrass	E	E	F	E	E	N	E	E	E	FG	E	E	F	P	FG	NP	F	N	N	E
Fall panicum	G	G	P	E	E	N	E	E	E	F	E	E	PF	N		NP	NP	N	N	E
Foxtails	E	E	F	E	E	N	E	E	E	FG	E	E	F	P		FG	NP	N	N	E
Goosegrass	E	E	FG	E	E	N	E	E	E	FG	E	E	PF	P		NP	F	N	N	E
Johnsongrass, Seedling	G	G		G	PF	N	F	F	PF	NP	PF	PF	PF	N		FG	PF	N	N	PF
Johnsongrass, Rhizome	P	P	N	N	N	N	N	N	N	N	N	N	N	N		N	N	N	N	N
Shattercane	G	G		F	P	N	G	G	P	N	P	P	PF	N		F	N	N	N	P
Texas panicum	G	G	PF	F	PF	N	F	F	PF	PF	PF	F	PF	N	F	NP	N	N	N	F
Nutsedge, Yellow	N	N	E	N	FG[3]	N	F	F	P	N	F	GE	N	N	GE	PF	N	N	N	F
Nutsedge, Purple	N	N	E	N	N	N	N	N	N	N	N		N	N		NP	N	N	N	N
Balloonvine	N	N		G	N		G	G	N	F	N		N	P		F	G			N
Eastern black nightshade	N	F		P	F	E	E	E	FG	NP	F		P	PF		PF	N	E	E	F
Burcucumber [1]	N	N		NP	N				N	N	N		N	P		PF	P			N
Cocklebur	N	N	G	F	N	FG	P	P	N	N	N	G	N	G	G	E	PF	P	FG	N
Cowpea	N	N		N	N				N	N	N		N	NP		N	PF			N
Crotalaria	N	N			N				N	N	N		N				NP			N
Florida beggarweed	N	N	G	FG	F	E	E	E	F	F	F	F	N	F	P	F	G	E	E	E
Florida pusley	E	E		P	G	GE	GE	GE	G	G	G	E	G	G	G	GE	G	GE	GE	G
Hemp sesbania	N	N	GE	N	N	G	G	G	N	F	N	P	N	N	P	N	GE	G	G	N
Jimsonweed	N	N	E	G	N	E	E	E	N	F	N		N	G		FG	G	E	E	F
Lambsquarters	G	G	E	G	F	E	E	E	F	GE	FG	E	G	E	E	G	E	E	E	FG
Morningglory	P	P	E	P[2]	N	G	G	G	N	P	N	PF	N	F	PF	G	P	G	G	N
Palmer amaranth	G	G	G	N	FG	E	E	E	GE	PF	G	E	PF	G [4]	E	GE [4]	G	E	E	E
Pigweed, Redroot and Smooth	G	G	E	N	G	E	E	E	GE	E	GE	E	FG	E	E	E	E	E	E	E
Prickly sida	N	N	GE	E	P	E	E	E	P	F	P		N	E		G	G	E	E	P
Ragweed, Common	N	N	GE	G	PF	G	G	G	PF	G	F	G	N	FG	G	G	G	G	G	F
Ragweed, Giant	N	N		PF	N	F	F	F	N	P	N	G	N	PF	G	G	P	F	F	N
Sicklepod	N	N	G	P	NP	F	P	F	PF	NP	NP	P	N	G	P	FG	G	P	F	N
Smartweed	N	N	E	E	N		F		N	F	N		N	G		G	G	F		F
Spurred anoda	N	N	G	E	N	E	E	E	N	P	N		N	E		P	G	E	E	N
Tropic croton	N	N		E	N	E	E	E	N	PF	N	FG	N		FG	NP	FG	E	E	N
Velvetleaf	N	N	GE	E	N	G	F	G	N	P	N		N	GE		F	G	F	G	F

[1] Multiple flushes of germination; one application of any herbicide will seldom be adequate.

[2] Fair on pitted morningglory.

[3] Good on yellow nutsedge when incorporated.

[4] Palmer amaranth resistant to ALS inhibitors is common in NC. This ALS-inhibiting herbicide will perform poorly on resistant biotypes.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Weed Response to Postemergence Herbicides in Soybeans

W. J. Everman, Crop and Soil Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-5C. Weed Response to Postemergence Herbicides in Soybeans

	Herbicides																						
Species	Assure II	Fusilade	Poast	Select, Select Max	Basagran	Classic	Cobra	Engenia, Tavium, Xtendimax[1]	Enlist One[2]	Enlist Duo[2]	FirstRate	Flexstar	Flexstar GT	Glyphosate[3]	Harmony SG	Pursuit	Raptor	Reflex	Resource	Scepter	Storm	Synchrony STS[4]	Ultra Blazer	Liberty
Bermudagrass	G	G	FG	G	N	N	N	N	N	G[5]	N	N		G[5]	N	N	N	N	N	N	N	N	N	N
Broadleaf signalgrass	GE	GE	E	E	N	N	N	N	N	E	N	N	E	E	N	G	G	N	N	N	NP	N	NP	G
Crabgrass	G	G	GE	GE	N	N	N	N	N	E	N	N	E	E	N	PF	PF	N	N	N	N	N	N	FG
Fall panicum	E	E	E	E	N	N	P	N	N	E	N	N	E	E	N	F	G	N	N	N	P	N	P	G
Foxtails	E	E	E	E	N	N	P	N	N	E	N	N	E	E	N	G	G	N	N	N	P	N	P	G
Goosegrass	GE	GE	GE	GE	N	N	N	N	N	E	N	N	E	E	N	NP	NP	N	N	N	N	N	N	P
Johnsongrass, Seedling	E	E	E	E	N	NP	P	N	N	E	N	N	E	E	N	GE	GE	N	N	N	P	NP	P	G
Johnsongrass, Rhizome	E	GE	G	GE	N	N	N	N	N	E	N	N	E	E	N	G[7]	G[7]	N	N	N	N	N	N	F
Shattercane	E	E	E	E	N	N	P	N	N	E	N	N	E	E	N	G	G	N	N	N	P	N	P	
Texas panicum	G	G	E	E	N	N	N	N	N	E	N	N	E	E	N	PF	PF	N	N	N	N	N	N	G
Nutsedge, Purple	N	N	N	N	NP	PF	N	N	N	G	PF	N	G	G	N	G		N	N	N	N	PF	N	P
Nutsedge, Yellow	N	N	N	N	G[5]	G	N	N	N	FG[6]	PF	F		FG[6]	N	FG	FG	F	N	P	F	G	N	P
Balloonvine	N	N	N	N	P	FG	GE	G	G	G	P	G	E	G		P		G	P	P	G	FG	GE	
Eastern black nightshade	N	N	N	N	P	F	G	E	F	G	N	G	E	FG	N	G	G	G	P	P	G	F	G	
Burcucumber[8]	N	N	N	N	P	G	G	F	E	E	F	FG	G	F	G	PF	PF	FG	F	P	F	G	FG	
Cocklebur	N	N	N	N	E	E	GE	E	E	E	E	E	E	E	FG	E	E	E	G	E	E	E	G	E
Cowpea	N	N	N	N	N	GE	F	E	E	E	P	PF	E	E		N		P		N	P	GE	PF	G
Crotalaria	N	N	N	N	P	G	G	G	G	G		G	E	G		N		G		N	E	G	E	
Florida beggarweed	N	N	N	N	N	E	FG	G	FG	G	FG	P	G	G		N		P	P	NP	P	E	PF	G
Hemp sesbania	N	N	N	N	P	E	G	E	E	E	PF	E	E	PF		N		E	P	N	GE	E	E	
Jimsonweed	N	N	N	N	E	E	GE	E	E	E	E	E	E	E	F	GE	E	E	G	NP	E	E	E	E
Lambsquarters	N	N	N	N	FG	N	P	E	E	E	PN	F	E	E	E	PF	G	PF	G	P	G	E	G	E
Morningglory	N	N	N	N	P	G	G	E	E	E	E	GE	E	FG[10]	FG	FG	FG	GE	FG	P	GE	G	GE	E
Palmer amaranth	N	N	N	N	N	F[13]	G	E	E	E[12]	P	G	E[12]	E[12]	GE[13]	GE[13]		G	FG	G[13]	G	E[13]	G	FG
Pigweed, Redroot or Smooth	N	N	N	N	N	G	E	E	E	E	P	GE	E	E	E	E	E	GE	G	E	E	E	E	G
Prickly sida	N	N	N	N	G	N	G	G	G	G	P	F	G	G	N	P	G	NP	N	PF	FG	P	N	G
Ragweed, Common	N	N	N	N	G[11]	G	E	E	E	E	E	GE	E	E	F	PF	F	GE	G	F	E	G	E	E
Ragweed, Giant	N	N	N	N	GE	FG	G	GE	E	E	GE	E	E	G	P	F	F	E	P	P	GE	FG	GE	E
Sicklepod	N	N	N	N	N	G	NP	GE	G	E	F[9]	P	E	E	P	N	N	P	N	FG	NP	G	NP	E
Smartweed	N	N	N	N	E	E	F	E	F	G	E	G	E	G	E	GE	G	G	P	FG	E	E	GE	GE
Spurred anoda	N	N	N	N	G	F	F	G	G	E	F	F	E	E	N	F	F	P	P	NP	F	F	P	P
Tropic croton	N	N	N	N	F	NP	G	GE	G	E	P	G	E	E	N	N	N	G	P	N	G	NP	G	G
Velvetleaf	N	N	N	N	G	F	G	E	G	E	G	F	E	E	G	F	E	P	E	NP	FG	G	PF	

1 Apply only to Xtend (dicamba-tolerant) cultivars only.
2 Apply to Enlist (2,4-D tolerant) cultivars only.
3 Apply to Roundup Ready (glyphosate-resistant) cultivars only.
4 Apply only to BOLT, STS cultivars.
5 Assumes two applications.
6 Yellow nutsedge control is good with two applications of glyphosate.
7 Follow-up treatment with a postemergence grass herbicide may be necessary.
8 Multiple flushes of germination; one application of any herbicide will seldom be adequate.
9 FirstRate is good on sicklepod if applied at cotyledonary to first leaf stage.
10 With good timing and a follow-up application as needed, morningglory control can be good.
11 Assumes addition of crop oil concentrate.
12 Palmer amaranth resistant to glyphosate is common in NC. Glyphosate will perform poorly on resistant biotypes.
13 Palmer amaranth resistant to ALS-inhibiting herbicides is common in NC. ALS-inhibiting herbicides will perform poorly on resistant biotypes.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Chemical Weed Control in Sunflowers

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10, Herbicide Resistance Management, for details.

Table 7-6. Chemical Weed Control in Sunflowers

Herbicide Type	Herbicide, Mode of Action Code, and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preplant Foliar, Burndown of weeds and cover crops before planting	glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply before or after planting but before sunflowers emerge. See labels for suggested weed sizes to treat and for application rates. Add nonionic surfactant or crop oil concentrate according to Gramoxone label. The need for an adjuvant with glyphosate depends upon the brand used; see the label of the brand used.
	paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2 to 4 pt	0.5 to 1	
Preplant Incorporated, Annual grasses and small-seeded broadleaf weeds	ethalfluralin, MOA 3 (Sonalan HFP) 3 EC	1.5 to 3 pt	0.56 to 1.13	Controls common annual grasses plus pigweed and lambsquarters. Incorporate into top 2 to 3 inches of seedbed. See label for application rate based upon soil texture. Generic brands of pendimethalin and trifluralin are available.
	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 L	1.2 to 3.6 pt 1.5 to 3.0 pt	0.5 to 1.5 0.71 to 1.43	
	trifluralin, MOA 3 (Treflan HFP) 4 EC	1 to 2 pt	0.5 to 1	
Preplant Incorporated, Annual grasses, pigweed, and yellow nutsedge	S-metolachlor, MOA 15 (Brawl) 7.62 EC (Dual Magnum) 7.62 EC	1 to 2 pt	0.95 to 1.91	Controls common annual grasses except Texas panicum, seedling johnsongrass, and shattercane. Also controls pigweed. At higher rates, controls yellow nutsedge. Incorporate into top 2 to 3 inches of seedbed. See label for application rate based upon soil texture.
Preemergence, Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 L (Prowl) 3.3 EC	1.5 to 3 pt 1.2 to 3.6 pt	0.71 to 1.43 0.5 to 1.5	See above comments for pendimethalin applied preplant incorporated. Pendimethalin is more consistently effective when incorporated.
	S-metolachlor, MOA 15 (Brawl) 7.62 EC (Dual Magnum) 7.62 EC	1 to 2 pt	0.95 to 1.91	See above comments for Dual Magnum applied preplant incorporated. Dual Magnum is more consistently effective on yellow nutsedge when incorporated.
Preemergence, Annual broadleaf weeds and nutsedge	sulfentrazone, MOA 14 (Spartan) 4 F	3 to 8 oz	0.094 to 0.25	Controls nutsedge and most common annual broadleaf weeds. Only fair control of cocklebur, and no control of ragweed or sicklepod. May tank mix with other registered preemergence herbicides for annual grass control. Adjust Spartan and Spartan Charge application rate according to soil texture and organic matter as specified on label. May also be shallowly incorporated in the top 2 inches of seed bed. Do not plant corn, sweet potatoes, or cotton for 10, 12, and 12 months, respectively, after Spartan or Spartan Charge application. See label for rotational restrictions on other crops.
	sulfentrazone, MOA 14 + carfentrazone, MOA 14 (Spartan Charge) 0.35 + 3.15 F	3.75 to 10.2 fl oz		
Postemergence, Annual grasses	clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	6 to 8 fl oz 9 to 16 fl oz	0.094 to 0.125 0.068 to 0.121	Apply to actively growing grasses not under drought stress. See label for grass size, application rates, and directions. Add 2 pints of crop oil concentrate to Select or Poast. To Select Max, add one of the following: nonionic surfactant at 0.25% by volume; crop oil concentrate at 1.0% by volume; or methylated seed oil at 1% by volume. Other formulations of clethodim are available.
	sethoxydim, MOA 1 (Poast) 1.5 EC	16 fl oz	0.19	
Postemergence, Bermudagrass	clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	6 to 8 fl oz 12 to 32 fl oz	0.094 to 0.125 0.091 to 0.24	Apply before bermudagrass runners exceed 6 inches If needed, make second application of 8 to 16 fluid ounces of Select or 12 to 32 fluid ounces of Select Max when regrowth is less than 6 inches Add crop oil concentrate to Select at 1 quart per acre. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1.0% by volume, or methylated seed oil at 1% by volume. Other formulations of clethodim are available.
	sethoxydim, MOA 1 (Poast) 1.5 EC	24 fl oz	0.28	Apply before bermudagrass runners exceed 6 inches If needed, make second application of 16 fluid ounces per acre when regrowth is less than 4 inches. Add crop oil concentrate at 1 quart per acre.
	clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	8 to 16 fl oz 12 to 32 fl oz	0.125 to 0.25 0.091 to 0.24	Apply when johnsongrass is 12 to 24 inches tall. If needed, make second application of Select at 6 to 8 fluid ounces or 9 to 24 fluid ounces of Select Max when regrowth is 6 to 18 inches Add crop oil concentrate to Select at 1 quart per acre. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1.0% by volume, or methylated seed oil at 1% by volume. Other formulations of clethodim are available.
	sethoxydim, MOA 1 (Poast) 1.5 EC	24 fl ounces	0.28	Apply when johnsongrass is 20 to 25 inches tall. If needed, make second application of 16 fluid ounces per acre when regrowth is 12 inches Add crop oil concentrate at 1 quart per acre.
	quizalofop, MOA 1 (Assure II) 0.88 EC	5 to 12 oz	0.034 to 0.069	Apply to rhizome johnsongrass 10 to 24 inches tall and repeat when regrowth is 6 to 10 inches. Apply to bermudagrass with runners up to 6 inches and repeat when regrowth is present. Apply with crop oil concentrate or nonionic surfactant based on label recommendations. Do not apply more than 18 oz per season and do not apply after seed set.
Postemergence, Annual grasses and broadleaf weeds: Clearfield Cultivars Only	imazamox, MOA 2 (Beyond) 1 L	4 fl oz	0.031	**APPLY ONLY TO CLEARFIELD CULTIVARS**. Beyond will severely injure or kill non-Clearfield cultivars. Apply to sunflower in the 2- to 8-leaf stage when broadleaf weeds are 3 inches or less. Add crop oil concentrate or nonionic surfactant plus nitrogen according to label directions. Controls many common broadleaf weeds plus some annual grasses. See label for weeds controlled.
Postemergence with Hooded Sprayer, Annual broadleaf weeds, annual and perennial grasses	glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared based on pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. Apply to row middles using hooded or shielded sprayer that allows no contact of sunflowers by spray solution.
	carfentrazone, MOA 14 (Aim) 2 EC	1.0 to 2.0 oz	0.016 to 0.032	Apply using hooded or shielded sprayers and avoid contact with sunflower foliage. Apply with 1 quart of nonionic surfactant per 100 gallons water. Very effective in controlling morning glory.

Chemical Weed Control in Tobacco

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10A Herbicide Modes of Action and Table 7-10B Herbicide Modes of Action for Crops, Pastures, and Lawns and Turf, for details. In addition to following each agrochemical label, tobacco farmers should also pay close attention to language contained in the buying contracts put forth by tobacco manufacturers and leaf merchants, as some contracts prohibit the use of certain pesticides.

Table 7-7A. Chemical Weed Control in Tobacco

Herbicide Type	Herbicide, Mode of Action Code,[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Flue-Cured Field (before transplanting - burndown), most annual grasses and broadleaf weeds that have emerged or cover crops	glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply to emerged weeds 30 or more days before transplanting and before weeds are 6 inches tall. Tillage should occur no more than 15 days after application.
Flue-Cured Field (before transplanting - burndown), most annual grasses and broadleaf weeds that have emerged or cover crops	paraquat, MOA 22 (Gramoxone SL 3.0)	1.6 to 2.5 pts	0.6 to 0.9	Apply to emerged weeds or cover crop measuring between 1 and 6 inches tall. Vegetation taller than 6 inches may not be controlled. Use a nonionic surfactant with ≥75% active agent at 0.25% v/v (2 pt/100 gallons concentration) or a crop oil concentration with 15-20% emulsifier at 1% v/v (1 gallon/100 gallons concentration). Apply at a minimum solution volume of 10 gallons/acre (>15 GPA preferred). Use higher rates for dense weed or cover crop populations. Weeds that emerge after the application will not be controlled. **Applicators must complete the Paraquat Dichloride Training for Certified Applicators as required by EPA. Visit www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators for more information.**
Flue-Cured Field (before transplanting - burndown), some broadleaf weeds that have emerged	flumioxazin, MOA 14 (Valor) EZ	1 to 2 fl oz	0.03 to 0.06	Apply to emerged weeds 30 or more days before transplanting. A minimum of one inch of rain or irrigation must also occur prior to transplanting.
Flue-Cured Field (before transplanting - burndown), some broadleaf weeds that have emerged	carfentrazone MOA 14 (Aim) 2 EC	0.8 to 1.5 oz	0.0125 to 0.024	Use a COC at 1% v/v (1 gallon/100 gallons concentration). Apply to emerged and actively growing weeds. Apply up to one day prior to transplanting. Control is best when weeds are ≤4 inches and rosettes <3 inches across.
Flue-Cured Field (before transplanting), Most annual grasses and some broadleaf weeds plus nutsedge suppression	pebulate, MOA 8 (Tillam) 6 EC	2.7 qt	4.0	Apply to soil surface before bedding and immediately incorporate according to label instructions. Transplant as soon as possible. Early season stunting may occur under unfavorable growing conditions. Does not control cocklebur, morningglory, ragweed, or perennial weeds. Cultivate tobacco at least twice. See label for tank mixes with other pesticides.
Flue-Cured Field (before transplanting), Some annual grasses and some broadleaf weeds	napropamide, MOA 17 (Devrinol) 2 XT (Devrinol) 50 DF	2 to 4 qt 2 to 4 lb (broadcast, see label for band application)	1.0 to 2.0 1.0 to 2.0	Lower rates usually adequate for most soils. Apply to soil surface and incorporate according to label instructions. Some early season stunting may occur under unfavorable growing conditions. Does not control cocklebur, morningglory, or perennial weeds. Gives some suppression of ragweed. NOTE: Do not seed crops not specified on label for 12 months after application.
Flue-Cured Field (before transplanting), Most annual grasses and some broadleaf weeds	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) H_2O (Helena-Pendimethalin)	2.4 to 3.0 pt 2.0 to 2.5 pt 2.4 to 3.0 pt	1.0 to 1.25 0.95 to 1.19 1.0 to 1.25	Can be applied up to 60 days before transplanting. Apply before bedding and incorporate into soil according to label instructions. Some early season stunting may occur under unfavorable growing conditions. Lower application rates should be used on coarser soil types with low organic matter content. Does not control cocklebur, morningglory, ragweed, or perennial weeds.
Flue-Cured Field (before transplanting), Annual grasses and some broadleaf weeds	clomazone, MOA 13 (Command) 3 ME (Willowood Clomazone) 3ME	2 to 2.67 pt 2 to 2.67 pt	0.75 to 1.0 0.75 to 1.0	Excellent annual grass control plus control of certain broadleaf weeds, such as prickly sida, jimsonweed, tropic croton, smartweed, and common ragweed. Partial control of cocklebur; does not control pigweed, sicklepod, or morningglory. Some whitening of lower leaves may occur, but plants should recover. Do not plant small grains or alfalfa in the fall or following spring after Command application. Apply no more than once per season.
Flue-Cured Field (before transplanting), Broadleaf weeds, nutsedges, and some grasses	sulfentrazone, MOA 14 (Spartan) 4F (Willowood Sulfentrazone) 4SC (Helm Sulfentrazone) 4F (Shutdown) 4.16 sulfentrazone + carfentrazone, 0.35 + 3.15 MOA 14 + 14 (Spartan Charge)	 4.5 to 12 fl oz 4.5 to 12 fl oz 4.5 to 12 fl oz 4.5 to 11.8 fl oz 5.7 to 15.2 fl oz	 0.14 to 0.38 0.14 to 0.38 0.14 to 0.38 0.15 to 0.38 0.16 to 0.41	Excellent control of pigweed, morninglories, and nutsedges. Application rate is based on soil type and organic matter. See appropriate label for rate determination and application methods. Early season stunting may occur especially when incorporated. Rainfall or irrigation needed within seven7 to 10 days of application for maximum weed control, particularly when surface applied. Observe rotational crop guidelines on label. Most formulations can be tank mixed with clomazone for improved control of grass and ragweed species, verify each label independently.
Flue-Cured Field (after transplanting), Most annual grasses and some broadleaf weeds	napropamide, MOA 17 (Devrinol) 2 XT (Devrinol) 50 DF	2 to 4 qt 2 to 4 lb (broadcast, see label for band application)	1.0 to 2.0 1.0 to 2.0	Apply overtop immediately after transplanting tobacco. See remarks for Devrinol under “Before Transplanting.” NOTE: Do not seed crops not specified on label for 12 months after application. Small grain seeded for cover crop in fall may be stunted. Do not use small grain for food or feed.

Table 7-7A. Chemical Weed Control in Tobacco

Herbicide Type	Herbicide, Mode of Action Code,[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Flue-Cured Field (after transplanting), Most annual grasses and Common Ragweed	clomazone, MOA 13 (Command) 3 FME (Willowood Clomazone) 3ME	2 to 2.67 pt 2 to 2.67 pt	0.75 to 1.0 0.75 to 1.0	Excellent annual grass control plus control of certain broadleaf weeds, such as prickly sida, jimsonweed, tropic croton, smartweed, and common ragweed. Partial control of cocklebur; does not control pigweed, sicklepod, or morningglory. Make a single broadcast application in a minimum of 20 gallons of water. Apply no more than once per season. Apply over the top of tobacco plants immediately or up to 7 days after transplanting but prior to emergence of weeds. Some whitening of lower leaves may occur, but plants should recover. Do not plant small grains or alfalfa in the fall or following spring after Command application.
Flue-Cured Field (after transplanting), Postemergence control of annual grasses	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.19 to 0.28	Apply to actively growing grass not under drought stress. Apply in 5 to 20 gallons of spray at 40 to 60 psi. Add 2 pints of crop oil concentrate per acre. Do not apply within 42 days of harvest. Do not apply more than 4 pints per acre per season. Complete coverage of grass required for control.
Flue-Cured Field (after transplanting), Postemergence control of some broadleaf weeds	carfentrazone MOA 14 (Aim) 2 EC	0.8 to 1.5 oz	0.0125 to 0.024	Apply using SHIELDED SPRAYER or HOODED SPRAYER to emerged, actively growing weeds PRIOR TO LAYBY. Do not apply when conditions favor drift. MUST PREVENT CONTACT OF SPRAY SOLUTION WITH TOBACCO PLANT. See Label for further instruction.
Flue-Cured Lay-by, Most annual grasses and some broadleaf weeds	napropamide, MOA 17 (Devrinol), 2 XT (Devrinol), 50 DF	2 to 4 qt 2 to 4 lb (band, see label for band application)	1 to 2	Apply in a band to row middles immediately after last cultivation. Lower rates usually adequate for most tobacco soils. Incorporate lightly or sprinkler irrigate, if no rainfall within 3 days after application. Do not apply more than a total of 4 lb of Devrinol per acre in a season. See remarks for Devrinol under "Before Transplanting" and "After Transplanting."
	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) H_2O (Helena-Pendimethalin)	1.8 to 2.4 pt 1.5 to 2.0 pt 1.8 to 2.4 pt	0.75 to 1.0 0.71 to 0.95 0.75 to 1.0	Apply to row middles immediately after last cultivation. Avoid contact with tobacco leaves. Use higher rate on medium- or fine-textured soils where grass infestation is heavy or if no herbicide was used previously. Rainfall or irrigation is needed within 7 days. Does not control emerged weeds.
Flue-Cured after first harvest, Postemergence control of some broadleaf weeds	carfentrazone MOA 14 (Aim) 2 EC	0.8 to 1.5 oz	0.0125 to 0.024	Apply AFTER FIRST HARVEST for control of actively growing, emerged weeds. Position nozzles 3 to 4 inches above the soil and directed underneath the crop canopy. Do not apply when conditions favor drift. MUST PREVENT CONTACT OF SPRAY SOLUTION WITH TOBACCO PLANT. See label for further instruction.
Burley Field (before transplanting), Most annual grasses and some broadleaf weeds plus nutsedge suppression	pebulate, MOA 8 (Tillam) 6 EC	2.7 qt	4.0	See remarks for Tillam under Flue-Cured. Tank mix suppresses hairy galinsoga under ideal conditions (ample rainfall after application).
Burley Field (before transplanting), Some annual grasses and broadleaf weeds	napropamide, MOA 17 (Devrinol), 2 XT (Devrinol), 50 DF	2 to 4 qt 2 to 4 lb (broadcast, see label for band application)	1.0 to 2.0 1.0 to 2.0	See remarks for Devrinol under Flue-Cured. Suppresses hairy galinsoga under ideal conditions (ample rainfall after application).
Burley Field (before transplanting), Most annual grasses and some broadleaf weeds	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) H_2O (Helena-Pendimethalin)	2.4 to 3.0 pt 2.0 to 2.5 pt 2.4 to 3.0 pt	1.0 to 1.25 0.95 to 1.19 1.0 to 1.25	See remarks for Prowl under Flue-Cured. The higher labelled rates may be needed for soils where burley tobacco is grown in NC due to higher organic matter content. Add hairy galinsoga to list of weeds not controlled.
Burley Field (before transplanting), Most annual grasses and Common Ragweed	clomazone, MOA 13 (Command 3 ME) 3 FME (Willowood Clomazone) 3ME	2 to 2.67 pt 2 to 2.67 pt	0.75 to 1 0.75 to 1.0	Excellent annual grass control plus control of certain broadleaf weeds, such as prickly sida, jimsonweed, tropic croton, smartweed, and common ragweed. Partial control of cocklebur; does not control pigweed, sicklepod, or morningglory. Some whitening of lower leaves may occur, but plants should recover. Do not plant small grains or alfalfa in the fall or following spring after Command application. Apply no more than once per season.
Burley Field (before transplanting), Broadleaf weeds, nutsedges, and some grasses	sulfentrazone, MOA 14 (Spartan) 4F (Willowood Sulfentrazone) 4SC (Helm Sulfentrazone) 4F (Shutdown) 4.16 sulfentrazone + carfentrazone, 0.35 + 3.15 MOA 14 + 14 (Spartan Charge)	4.5 to 12 fl oz 4.5 to 12 fl oz 4.5 to 12 fl oz 4.5 to 11.8 fl oz 5.7 to 15.2 fl oz	0.14 to 0.38 0.14 to 0.38 0.14 to 0.38 0.15 to 0.38 0.16 to 0.41	Excellent control of pigweed, morningglories, and nutsedges. Application rate is based on soil type and organic matter. See appropriate label for rate determination and application methods. Early season stunting may occur especially when incorporated. Rainfall or irrigation needed within 7 to 10 days of application for maximum weed control, particularly when surface applied. Observe rotational crop guidelines on label. Most formulations can be tank mixed with clomazone for improved control of grass and ragweed species, verify each label independently.
Burley Field (after transplanting), Most annual grasses and some broadleaf weeds	napropamide, MOA 17 (Devrinol), 2 XT (Devrinol) 50 DF	2 to 4 qt 2 to 4 lb (broadcast, see label for band application)	1.0 to 2.0	Apply overtop immediately after transplanting tobacco. See remarks for Devrinol under "After Transplanting" in flue-cured section. Suppresses hairy galinsoga under ideal conditions (ample rainfall after application).
Burley Field (after transplanting), Annual grasses and some broadleaf weeds	clomazone, MOA 13 (Command) 3 ME (Willowood Clomazone) 3ME	2 to 2.67 pt 2 to 2.67 pt	0.75 to 1 0.75 to 1.0	Excellent annual grass control plus control of certain broadleaf weeds, such as prickly sida, jimsonweed, tropic croton, smartweed, and common ragweed. Partial control of cocklebur; does not control pigweed, sicklepod, or morningglory. Make a single broadcast application in a minimum of 20 gallons of water. Apply no more than once per season. Apply over the top of tobacco plants immediately, or up to 7 days after transplanting, but prior to emergence of weeds. Some whitening of lower leaves may occur, but plants should recover. Do not plant small grains or alfalfa in the fall or following spring after applying Command.
Burley Field (after transplanting), Postemergence control of annual grasses	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.19 to 0.28	Apply to actively growing grass not under drought stress. Apply in 5 to 20 gallons of spray at 40 to 60 psi. Add 2 pints of crop oil concentrate per acre. Do not apply within 42 days of harvest. Do not apply more than 4 pints per acre per season. Complete coverage of grass required for control.

Table 7-7A. Chemical Weed Control in Tobacco

Herbicide Type	Herbicide, Mode of Action Code,[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Burley Field (after transplanting), Postemergence control of some broadleaf weeds	carfentrazone MOA 14 (Aim) 2 EC	0.8 to 1.5 oz	0.0125 to 0.024	Apply using SHIELDED SPRAYER or HOODED SPRAYER to emerged, actively growing weeds PRIOR TO LAYBY. Do not apply when conditions favor drift. MUST PREVENT CONTACT OF SPRAY SOLUTION WITH TOBACCO PLANT. See Label for further instruction.
Burley Lay-by, Most annual grasses and some broadleaf weeds	napropamide, MOA 17 (Devrinol), 2 XT (Devrinol) 50 DF	2 to 4 qt 2 to 4 lb (band, see label for band application)	1 to 2	Apply in a band to row middles immediately after last cultivation. Lower rates usually adequate for most tobacco soils. Incorporate lightly or sprinkler irrigate if no rainfall within 3 days after application. Do not apply more than a total of 4 pounds of Devrinol 50 WP per acre in a season. See remarks for Devrinol under “After Transplanting” in flue-cured section. Suppresses hairy galinsoga under ideal conditions (ample rainfall after application).
	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) H_2O (Helena-Pendimethalin)	1.8 to 2.4 pt 1.5 to 2.0 pt 1.8 to 2.4 pt	0.75 to 1.0 0.71 to 0.95 0.75 to 1.0	Apply to row middles immediately after last cultivation. Avoid contact with tobacco leaves. Use higher rate on medium- or fine-textured soils where grass infestation is heavy or if no herbicide was used previously. Rainfall or irrigation is needed within 7 days. Does not control emerged weeds.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-10A, Herbicide Modes of Action and Table 7-10B, Herbicide Modes of Action for Crops, Pastures, and Lawns and Turf, for details.

Weed Response to Herbicides in Tobacco

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Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-7B. Weed Response to Herbicides in Tobacco

	Preemergence Herbicides					Postemergence Herbicides	
Species	**Clomazone**	**Napropamide**	**Pebulate**	**Pendimethalin**	**Sulfentrazone**	**Carfentrazone**	**Sethoxydim**
Barnyardgrass	E	GE	GE	GE	F	N	E
Bermudagrass	PF	P	P	P	P	N	FG
Broadleaf signalgrass	E	G	P	G	F	N	E
Crabgrass	E	E	E	E	F	N	GE
Crowfootgrass	E	E	E	E	F	N	FG
Fall panicum	E	G	G	GE		N	E
Foxtails	E	E	E	E	F	N	E
Goosegrass	E	E	G	E	F	N	GE
Sandbur	G		G	G		P	FG
Seedling johnsongrass	G	F	G	G		N	E
Texas panicum	G		P	G	F	N	E
Nutsedge	P	P	FG	P	E	N	N
Cocklebur	F	P	P	P	FG	G	N
Common purslane	FG	E	G	P	G	G	N
Ragweed, Common	G	F	P	P	P	N	N
Ragweed, Giant	PF	PF	P	P		N	N
Hairy galinsoga	G	PF	P	P	G	P	N
Jimsonweed	G	P	P	P		G	N
Lambsquarters	G	G	G	G	E	G	N
Morningglory	P	P	P	P	E	E	N
Pigweed	P	G	G	G	E	E	N
Prickly sida	E	P	P	P	G	P	N
Sicklepod	P	P	P	P	P	P	N
Smartweed	G	P	P	P	E	G	N

KEY
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Chemical Weed Control in Wheat, Barley, Oats, Rye, and Triticale

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10, Herbicide Resistance Management, for details.

Table 7-8A. Chemical Weed Control in Wheat, Barley, Oats, Rye, and Triticale

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Wheat Preplant No-Till, Emerged annual broadleaf and grass weeds, volunteer corn, top-kill of perennials			
paraquat, MOA 22 (Gramoxone SL 2.0) 2 SL (Gramoxone SL 3.0) 3 SL	2 to 4 pt	0.5 to 1	Rate depends upon weed size; see label. Apply before crop emerges. Add nonionic surfactant at 1 pint per 100 gallons spray solution or crop oil concentrate at 1 gallon per 100 gallons spray solution. See application directions on label. May be tank mixed with Hoelon. Generic formulations of paraquat containing 3 pounds active ingredient per gallon are available. Apply these products at 1.3 to 2.7 pints.
Wheat Preplant No-Till, Emerged annual broadleaf and grass weeds, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.38 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions. Rate depends upon weed species and size; see label. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 inches tall, apply 4 to 6 fluid ounces of Select or 6 fluid ounces of Select Max. For corn up to 24 inches increase Select rate to 6 to 8 fluid ounces or Select Max rate to 9 fluid ounces. Select or Select Max must be applied at least 30 days ahead of wheat planting. Valor SX at 1 to 2 ounces per acre will suppress ryegrass and bluegrass and controls several broadleaf weeds. Do not till after application and apply at least 30 days prior to planting.
Wheat Preplant No-Till or Preemergence, Broadleaf weeds			
saflufenacil, MOA 14 (Sharpen) 3.42	1.0 to 2.0 fl oz	0.027 to 0.054	See label for broadleaf weeds controlled. Sharpen does not control grasses. Apply with ammonium sulfate (1 to 2 gallons/100 gallons) and methylated seed oil (1 gallon/100 gallons). Do not apply if wheat has germinated. See label for tank mixtures.
flumioxazin, MOA 14 (Valor SX) 51 WDG + paraquat, MOA 22 (Gramoxone SL 2.0) 2.0 SL OR glyphosate, MOA 9 (numerous brands and formulations)	2.0 oz 2 to 4 pt See label	0,063 0.5 to 1 0.38 to 1.13 (lb a.e.)	Use only on no-till or minimum till fields where stubble from the previous crop has not been incorporated. Valor SX must be applied at least 7 days ahead of planting wheat. Residual control of broadleaf weeds and Italian ryegrass. Apply with nonionic surfactant at 1 quart/100 gallons. Can be applied with nitrogen carriers. Do no perform tillage after application. Carefully follow label directions for sprayer cleaning after each day's use.
thifensulfuron, MOA 2 + tribenuron, MOA 2 (FirstShot SG with TotalSol) 50 WDG	0.5 to 0.8 oz	0.008 to 0.013 + 0.008 to 0.013	FirstShot does not control grasses. May be applied up to planting to control emerged broadleaf weeds. Add nonionic surfactant at 2 to 4 pints per 100 gallons spray solution or crop oil concentrate or methylated seed oil at 1 gallon per 100 gallons spray solution. In addition, add nitrogen fertilizer at a rate of 2 quarts per acre or ammonium sulfate at 2 pounds per acre. See label for tank mixtures.
Wheat Preplant No-Till or Preemergence, Emerged annual broadleaf weeds			
pyraflufen-ethyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be used for limited suppression of small emerged summer annual and winter weeds. See label for adjuvant and spray volume recommendations. Research with ET is limited in North Carolina.
Wheat Preemergence, Italian ryegrass and annual broadleaf weeds			
chlorsulfuron, MOA 2 + metsulfuron methyl, MOA 2 (Finesse) 75 WDG	0.5 oz	0.0195 + 0.0039	Ryegrass control is variable; expect only suppression. May stunt wheat on sandy soils. Suggested primarily for fields with Hoelon-resistant ryegrass. Also controls most annual broadleaf weeds. Do not use where a later application of Osprey or PowerFlex is anticipated. Plant only STS soybeans following wheat harvest. May cause severe injury in non-STS soybeans.
pyroxasulfone, MOA 15 + carfentrazone, MOA 14 (Anthem Flex) 4 SC	2.0 to 4.5 fl oz	0.058 to 0.13 + 0.004 to 0.009	Apply to wheat as a preemergence treatment from 2.0 to 4.5 fluid ounces depending on soil type. Read label and adjust rates for soil texture. Under extended periods of dry weather, adequate weed control may not be achieved, 0.5 inch of rainfall may be necessary for activation and optimal weed control. Do not apply to broadcast seeded wheat. Do not apply preemergence if 0.25 inch or more rain is expected within 48 hours of application. Plant wheat a minimum of 1 inch deep, but not over 1.5 inches deep.
Wheat Spike Stage, Italian ryegrass			
flufenacet, MOA 15 + metribuzin, MOA 5 (Axiom) 68 WDG	4 to 10 oz	0.136 to 0.034 + 0.34 to 0.085	Apply to wheat in the spike stage. Preemergence application can cause severe injury on coarse-textured soils. Application rate depends on soil type; see label. In general, North Carolina research has shown best results with 6 to 7 ounces on coarse soils and 8 to 9 ounces on medium and heavy soils. If rainfall is received timely, Axiom controls ryegrass well. It also controls chickweed, henbit, and wild radish.
pyroxasulfone, MOA15 (Zidua) 85 WG (Zidua SC) 4.17 SC	 0.7 to 2.0 oz/A 1.25 to 4 fl oz/A	0.037 to 0.106	Apply to wheat when 80% of germinated wheat seeds have a shoot at least 1/2-inch long until wheat spiking. May be applied as a broadcast spray to wheat at spiking up to the fourth-tiller. Will not control emerged weeds. Sequential application may be applied, but do not exceed a total of 2.25 ounces/acre Zidua (fl oz Zidua SC) in a season.
pyroxasulfone, MOA 15 + carfentrazone, MOA 14 (Anthem Flex) 4 SC	2.5 to 4.5 fl oz	0.073 to 0.13 + 0.005 to 0.009	Apply to wheat when 80% of germinated wheat seeds have a shoot at least 1/2-inch long until wheat spiking. May be applied as a broadcast spray to wheat at spiking up to the fourth-tiller. Early postemergence broadcast applications will provide suppression of emerged chickweed and henbit. Do not apply more than a maximum cumulative amount of 4.55 fluid ounces per acre in one cropping season.
flumioxazin, MOA 14 + pyroxasulfone, MOA 15 (Fierce) 76 WDG	1.5 oz	0.07	Apply to wheat when 95% of wheat is in the spike to 2-leaf stage of growth for control of ryegrass and wild radish. Wheat seed must be planted between 1 and 1.5 inches deep or injury may occur. Do not apply to fields where wheat seed has been broadcast and shallow incorporated. Do not tank mix with any adjuvant, fertilizer, or pest control product or severe injury will occur. Rainfall of at least 0.5 inch within 10 days after application is necessary for activation. Avoid applications to heavy sand and low organic matter areas or excessive injury may occur following heavy rainfall.
Wheat Postemergence, Italian ryegrass			
mesosulfuron, MOA 2 (Osprey) 4.5 WDG	4.75 oz	0.013	Apply when ryegrass is in one-leaf to two-tiller stage. Add adjuvant as directed on label. In North Carolina, nonionic surfactant at 1 to 2 quarts per 100 gallons spray solution plus 1 to 2 quarts of 30% liquid nitrogen per acre is preferred. See label for broadleaf weeds controlled. For additional control, Osprey may be mixed with Harmony Extra. Do not tank mix with 2,4-D or dicamba. Do not apply using liquid nitrogen as the carrier. Do not topdress wheat within 14 days of Osprey application. In fields with Hoelon-susceptible ryegrass, it is recommended that Osprey or PowerFlex and Axial XL be used on an alternating basis (for instance, rotated) as part of a resistance management strategy. See comments for Axial XL. Ryegrass with multiple resistance to Axial, Hoelon, Osprey, and PowerFlex HL occurs in North Carolina.

Table 7-8A. Chemical Weed Control in Wheat, Barley, Oats, Rye, and Triticale

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Wheat Postemergence, Italian ryegrass (continued)			
mesosulfuron, MOA 2 + thiencarbazone-methyl, MOA 2 (Osprey Xtra) 6 WDG	4.75 oz	0.013 + 0.004	Apply from emergence to jointing when ryegrass is in one-leaf to two-tiller stage. Add adjuvant as directed on label. In North Carolina, nonionic surfactant at 1 to 2 quarts per 100 gallons spray solution plus 1 to 2 quarts of 30% liquid nitrogen per acre is preferred. See label for broadleaf weeds controlled. For additional control, Osprey may be mixed with Harmony Extra. Do not tank mix with 2,4-D or dicamba. Do not apply using liquid nitrogen as the carrier. Do not topdress wheat within 14 days of Osprey application. In fields with Hoelon-susceptible ryegrass, it is recommended that Osprey or PowerFlex HL and Axial XL be used on an alternating basis (for instance, rotated) as part of a resistance management strategy. See comments for Axial XL. Ryegrass with multiple resistance to Axial XL, Hoelon, Osprey, and PowerFlex HL occurs in North Carolina.
pinoxaden, MOA 1 (Axial XL) 0.42 EC	16.4 fl oz	0.054	Apply to wheat with two or more leaves when ryegrass has one to five leaves on the main stem. More effective when applied to smaller ryegrass. May be tank mixed with Harmony Extra. When mixing, add Harmony Extra first, then Axial. No adjuvants are necessary. May be applied in water-nitrogen mixtures containing up to 50% liquid nitrogen by volume. Add water to tank, then add Axial. Mix thoroughly, and then add the nitrogen. Axial and Hoelon have the same mode of action. Ryegrass resistant to Hoelon may be cross-resistant to Axial, although in some cases Axial will control Hoelon-resistant ryegrass. If Hoelon resistance is expected, trial use of Axial on limited acreage is suggested to determine if the biotype is susceptible to Axial.
pinoxaden, MOA 1 + fenoxaprop-p-ethyl, MOA 1 (Axial Bold) 0.69 EC	15 fl oz	0.054 + 0.027	Apply to wheat from emergence to pre-boot stage when ryegrass has one to five leaves on the main stem. More effective when applied to smaller ryegrass. May be tank mixed with Harmony Extra. When mixing, add Harmony Extra first, then Axial Bold. No adjuvants are necessary. May be applied in water-nitrogen mixtures containing up to 50% liquid nitrogen by volume. Add water to tank, then add Axial Bold. Mix thoroughly, and then add the nitrogen. Axial XL, Axial Bold, and Hoelon have the same mode of action. Ryegrass resistant to Hoelon or Axial XL may be cross-resistant to Axial Bold, although in some cases Axial Bold will control Hoelon-resistant ryegrass. If Hoelon resistance is expected, trial use of Axial Bold on limited acreage is suggested to determine if the biotype is susceptible to Axial Bold.
pyroxsulam, MOA 2 (PowerFlex HL) 13 WDG	2.0 oz	0.0375	Can be applied to wheat from the 3-leaf stage until jointing. Apply after the majority of the ryegrass has emerged but before it exceeds the 2-tiller stage. Add nonionic surfactant at 1 to 2 quarts/100 gallons spray solution. See label for broadleaf weeds controlled. For additional control, PowerFlex may be mixed with Harmony Extra. Do not mix with dicamba or with amine formulations of 2,4-D or MCPA. Can be applied in water-nitrogen mixtures containing up to 50% liquid nitrogen by volume, or a maximum of 30 pounds/acre. If applying in liquid nitrogen, reduce surfactant rate to 1 pint/100 gallons. Rainfast in 4 hours. Do not apply to wet foliage. Current labeling specifies a 5-month rotation for soybeans. Limited research in North Carolina has shown no problems with soybeans double-cropped behind PowerFlex-treated wheat. Corn, cotton, or peanuts can be planted 9 months after application. See comments under mesosulfuron (Osprey) and pinoxaden (Axial) concerning resistance management.
Wheat Postemergence, Cheat			
pyroxsulam, MOA 2 (PowerFlex HL) 13 WDG	2.0 oz	0.0375	See comments for PowerFlex HL under Italian Ryegrass.
Wheat Postemergence, Annual bluegrass			
mesosulfuron, MOA 2 (Osprey) 4.5 WDG	4.75 oz	0.013	See comments for Osprey under Italian Ryegrass. Apply to bluegrass from the 1-leaf to 2-tiller stage. Application when plants are about the size of a quarter coin has worked well.
Wheat Postemergence, Wild garlic, curly dock, and most winter annual broadleaf weeds except cornflower and vetch			
thifensulfuron-methyl, MOA 2 + tribenuron-methyl, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	0.45 to 0.9 oz	0.0094 to 0.0188 + 0.0047 to 0.0094	Apply after the two-leaf stage of wheat but before flag leaf is visible. Use 0.45 to 0.6 ounce for most winter annual weeds. Use 0.75 to 0.9 ounce for wild garlic and wild radish. Wild garlic should be less than 12 inches tall and should have 2 to 4 inches of new growth. Control is enhanced when application is made during warm temperatures (50ºF or more) to actively growing garlic plants. Add 1 quart of nonionic surfactant per 100 gallons of spray solution. Liquid nitrogen may be used as the carrier. May tank mix Harmony Extra with 0.125 to 0.375 pound active ingredient of 2,4-D for improved control of wild radish. Follow mixing instructions on the label when using nitrogen as the carrier or when mixing with 2,4-D. Reduce surfactant rate according to label instructions when using nitrogen as the carrier or when mixing with 2,4-D. Do not tank mix with Hoelon. May be tank mixed with Axial or Osprey.
Wheat Postemergence, Most winter annual broadleaf weeds except chickweed, henbit, and knawel			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL 2,4-D acid/ester, MOA 4 (Weedone 638) 2.8 SL	 1 pt 1 pt 0.67 pt 1 pt	 0.48 0.48 0.48 0.35	Apply after wheat is fully tillered (usually 4 to 8 inches tall; stages 4 and 5 on Feekes scale) but before jointing. Spraying wheat too young or after jointing can cause deformed heads, reduced yields, and uneven ripening. Better results are obtained when daytime temperatures are above 50ºF. Increase the rate of 2,4-D by 50% to control corn cockle. Liquid nitrogen may be used as the carrier for 2,4-D. Ester formulations can be added directly to the nitrogen. If using amine formulation, premix in water (1 part 2,4-D to 4 parts water) and add mixture to nitrogen with strong agitation. Amine formulations give less burn than ester formulations in nitrogen.
Wheat Postemergence, Most winter annual broadleaf weeds			
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	0.25 pt	0.125	Apply after wheat is fully tillered but before jointing. Better results will be obtained if applied when daytime temperatures are above 50ºF. Liquid nitrogen may be used as the carrier.
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL + 2,4-D amine, MOA 4 (various brands) 3.8 SL OR 2,4-D ester, MOA 4 (various brands) 3.8 SL	 0.25 pt 0.25 pt + 0.5 to 0.75 pt or 0.5 to 0.75 pt	0.125 + 0.24 to 0.36 or 0.24 to 0.36	Apply after wheat is fully tillered (usually 4 to 8 inches tall; stages 4 and 5 on Feekes scale) but before jointing. Compared to dicamba alone, tank mixture is more effective on buttercup, cornflower, field pennycress, Virginia pepperweed, shepherdspurse, wild mustard, and wild radish. Use this tank mix only if both herbicides are necessary for weed control. Tank mix may injure wheat.
halauxifen-methly, MOA 2 + florasulam, MOA 4 (Quelex) 20WG	0.75 oz	0.009	Apply from 2-leaf to flag leaf stage when weeds are actively growing in the 2- to 4-leaf stage. May be tank mixed with other herbicides labeled for use on wheat. Do not apply within 60 days of crop harvest. Add 1.6 to 4 pt of nonionic surfactant per 100 gallons of spray solution, or a crop oil concentrate or methylated seed oil at 4 to 8 pt per 100 gallons. Liquid nitrogen may be used as the carrier, see label for guidelines.
pyraflufen-methyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be used to suppress small annual winter weeds. Although application is registered to flag leaf appearance, coverage of small weeds is necessary but difficult when wheat is tall. See label for adjuvant and spray volume and carrier recommendations. Research with ET is limited in North Carolina.

Table 7-8A. Chemical Weed Control in Wheat, Barley, Oats, Rye, and Triticale

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Wheat Preharvest, Annual broadleaf and grass weeds, suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply after hard dough stage of grain (30% or less grain moisture) and at least 7 days before harvest. Do not apply to wheat grown for seed. Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon solution and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions.
Wheat Preharvest, Annual broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL	1 to 2 pt	0.48 to 0.95	Apply when grain is in hard dough stage or later. Do not allow drift to sensitive crops (be especially careful with ester formulations). Amine formulations strongly encouraged if sensitive crops are nearby, especially cotton and tobacco.
2,4-D ester, MOA 4 (various brands) 3.8 SL	1 to 2 pt	0.48 to 0.95	
2,4-D ester, MOA 4 (various brands) 5.7 SL	0.67 to 1.3 pt	0.48 to 0.95	
2,4-D acid/ester, MOA 4 (Weedone 638) 2.8 SL	1 to 2 pt	0.35 to 0.7	
Barley Preplant No-Till, Emerged annual broadleaf and grass weeds, volunteer corn, top-kill of perennials			
paraquat, MOA 22 (Gramoxone SL 2.0) 2 SL (Gramoxone SL 3.0) 3 SL	2 to 4 pt	0.5 to 1	Rate depends upon weed size; see label. Apply before crop emerges. Add nonionic surfactant at 1 pint per 100 gallons spray solution or crop oil concentrate at 1 gallon per 100 gallons spray solution. See application directions on label. Generic formulations of paraquat containing 3 pounds active per gallon are available. Apply these products at 1.3 to 2.7 pints.
Barley Preplant No-Till, Emerged annual broadleaf and grass weeds, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions. Rate depends upon weed species and size; see labels. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 inches tall, apply 4 to 6 fluid ounces of Select or 6 fluid ounces of Select Max. For corn up to 24 inches increase Select rate to 6 to 8 fluid ounces or Select Max rate to 9 fluid ounces. Select or Select Max must be applied at least 30 days ahead of barley planting.
thifensulfuron, MOA 2 + tribenuron, MOA 2 (FirstShot SG with TotalSol) 50 WDG	0.5 to 0.8 oz	0.008 to 0.013 + 0.008 to 0.013	FirstShot does not control grasses. May be applied up to planting to control emerged broadleaf weeds. Add nonionic surfactant at 2 to 4 pints per 100 gallons spray solution or crop oil concentrate or methylated seed oil at 1 gallon per 100 gallons spray solution. In addition, add nitrogen fertilizer at a rate of 2 quarts per acre or ammonium sulfate at 2 pounds per acre. See label for tank mixtures.
Barley Postemergence, Italian ryegrass			
pinoxaden, MOA 1 (Axial XL) 0.42 EC	16.4 fl oz	0.054	Apply to barley with 2 or more leaves when ryegrass has one to five leaves on the main stem. More effective when applied to smaller ryegrass. May be tank mixed with Harmony Extra. When mixing, add Harmony Extra first, then Axial. May be applied in water/nitrogen mixtures containing up to 50% liquid nitrogen by volume. Add water to tank, then add Axial. Mix thoroughly and add the nitrogen. Axial and Hoelon have the same mode of action. Ryegrass resistant to Hoelon may be cross-resistant to Axial, although in some cases Axial will control Hoelon-resistant ryegrass. If Hoelon resistance is expected, trial use of Axial on limited acreage is suggested to determine if the ryegrass biotype is susceptible to Axial.
pinoxaden, MOA 1 + fenoxaprop, MOA 1 (Axial Bold) 0.69 EC	15 fl oz	0.054 + 0.027	Apply to wheat from emergence to pre-boot stage when ryegrass has one to five leaves on the main stem. More effective when applied to smaller ryegrass. May be tank mixed with Harmony Extra. When mixing, add Harmony Extra first, then Axial Bold. No adjuvants are necessary. May be applied in water-nitrogen mixtures containing up to 50% liquid nitrogen by volume. Add water to tank, then add Axial Bold. Mix thoroughly, and then add the nitrogen. Axial XL, Axial Bold, and Hoelon have the same mode of action. Ryegrass resistant to Hoelon or Axial XL may be cross-resistant to Axial Bold, although in some cases Axial Bold will control Hoelon-resistant ryegrass. If Hoelon resistance is expected, trial use of Axial Bold on limited acreage is suggested to determine if the biotype is susceptible to Axial Bold.
Barley Postemergence, Wild garlic, curly dock, and most winter annual broadleaf weeds except cornflower and vetch			
thifensulfuron-methyl, MOA 2 + tribenuron-methyl, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	0.45 to 0.9 oz	0.0094 to 0.0188 + 0.0047 to 0.0094	Apply after the 2-leaf stage of barley but before flag leaf is visible. Use 0.45 to 0.6 ounce for most winter annual weeds. Use 0.75 to 0.9 ounce for wild garlic and wild radish. Wild garlic should be less than 12 inches tall and should have 2 to 4 inches of new growth. Control is enhanced when application is made during warm temperatures (50ºF or more) to actively growing garlic plants. Add 1 quart of nonionic surfactant per 100 gallons of spray solution. Liquid nitrogen may be used as the carrier. May tank mix Harmony Extra with 0.125 to 0.375 pound a.i. of 2,4-D for improved control of wild radish. Follow mixing instructions on the label when using nitrogen as the carrier or when mixing with 2,4-D. Reduce surfactant rate according to label instructions when using nitrogen as the carrier or when mixing with 2,4-D. Do not tank mix with Hoelon.
Barley Postemergence, Most winter annual broadleaf weeds except chickweed, henbit, and knawel			
2,4-D amine, MOA 4 (various brands) 3.8 SL	1 pt	0.48	Apply after barley is fully tillered but before jointing. Spraying barley too young or after jointing can cause deformed heads, reduced yields, and uneven ripening. Better results are obtained when daytime temperatures are above 50ºF. Increase the rate of 2,4-D by 50% to control corn cockle. Liquid nitrogen may be used as the carrier for 2,4-D. Ester formulations can be added directly to the nitrogen. If using amine formulation, premix in water (1 part 2,4-D to 4 parts water) and add mixture to nitrogen with strong agitation. Amine formulations give less burn than ester formulations in nitrogen.
2,4-D ester, MOA 4 (various brands) 3.8 SL	1 pt	0.48	
2,4-D ester, MOA 4 (various brands) 5.7 SL	0.67 pt	0.48	
2,4-D acid/ester, MOA 4 (Weedone 638) 2.8 SL	1 pt	0.35	

Table 7-8A. Chemical Weed Control in Wheat, Barley, Oats, Rye, and Triticale

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Barley Postemergence, Most winter annual broadleaf weeds			
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	0.25 pt	0.125	Apply before jointing stage of growth. Risk of crop injury is least if applied after winter dormancy and before grain begins to joint. Better results will be obtained if applied when daytime temperatures are above 50ºF. Liquid nitrogen may be used as the carrier.
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL + 2,4-D amine, MOA 4 (various brands) 3.8 SL OR 2,4-D ester, MOA 4 (various brands) 3.8 SL	 0.25 pt 0.25 pt + 0.5 pt or 0.5 pt	0.125 + 0.24 or 0.24	Apply after barley is fully tillered but before jointing. Compared to dicamba alone, tank mixture is more effective on buttercup, cornflower, field pennycress, Virginia pepper-weed, shepherdspurse, and wild mustard. Use this tank mix only if both herbicides are necessary for weed control. Tank mix may injure barley.
halauxifen-methly, MOA 2 + florasulam, MOA 4 (Quelex) 20WG	0.75 oz	0.009	Apply from 2-leaf to flag leaf stage when weeds are actively growing in the 2- to 4-leaf stage. May be tank mixed with other herbicides labeled for use on barley. Do not apply within 60 days of crop harvest. Add 1.6 to 4 pt of nonionic surfactant per 100 gallons of spray solution, or a crop oil concentrate or methylated seed oil at 4 to 8 pt per 100 gallons. Liquid nitrogen may be used as the carrier, see label for guidelines.
Barley Preharvest, Annual broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL 2,4-D acid/ester, MOA 4 (Weedone 638) 2.8 SL	1 to 2 pt 1 to 2 pt 0.67 to 1.3 pt 1 to 2 pt	0.48 to 0.95 0.48 to 0.95 0.48 to 0.95 0.35 to 0.7	Apply when grain is in hard dough stage or later. Do not allow drift to sensitive crops (be especially careful with ester formulations). Amine formulations strongly encouraged if sensitive crops are nearby, especially cotton or tobacco.
Barley Preharvest, Annual broadleaf and grass weeds, suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply after hard dough stage of grain (and 20% or less moisture) and at least 7 days before harvest. Do not apply to barley grown for seed. Glyphosate is available as an isopropylamine salt and a potassium salt. Compare glyphosate formulations and application rates on the basis of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions.
Oats Preplant No-Till, Emerged annual broadleaf and grass weeds, volunteer corn, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions. Rate depends upon weed species and size; see labels. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 inches tall, apply 4 to 6 fluid ounces of Select or 6 fluid ounces of Select Max. For corn up to 24 inches, increase Select rate to 6 to 8 fluid ounces or Select Max rate to 9 fluid ounces. Select or Select Max must be applied at least 30 days ahead of planting oats.
Oats Postemergence, Wild garlic, curly dock, and most winter annual broadleaf weeds except cornflower and vetch			
thifensulfuron-methyl, MOA 2 + tribenuron-methyl, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	 0.45 to 0.6 oz	0.0094 to 0.0125 + 0.0047 to 0.0063	Apply after the two-leaf stage of oats but before flag leaf is visible. Wild garlic should be less than 12 inches tall and should have 2 to 4 inches of new growth. Control is enhanced when application is made during warm temperatures (50ºF or more) to actively growing garlic plants. Add 1 quart of nonionic surfactant per 100 gallons of spray solution. Liquid nitrogen may be used as the carrier. May tank mix Harmony Extra with 0.125 to 0.375 pound a.i. of 2,4-D for improved control of wild radish. Follow mixing instructions on the label when using nitrogen as the carrier or when mixing with 2,4-D. Reduce surfactant rate according to label instructions when using nitrogen as the carrier or when mixing with 2,4-D. Oats are more sensitive to 2,4-D than wheat.
Oats Postemergence, Most winter annual broadleaf weeds except chickweed, henbit, and knawel			
2,4-D amine, MOA 4 (various brands) 3.8 SL	1 pt	0.48	Apply after oats are fully tillered but before jointing. Spraying oats too young or after jointing can cause deformed heads, reduced yields, and uneven ripening. Also, oats are less tolerant of 2,4-D than wheat. Better results are obtained when daytime temperatures are above 50ºF. Liquid nitrogen may be used as the carrier for 2,4-D. Premix in water (1 part 2,4-D to 4 parts water) and add mixture to nitrogen with strong agitation.
Oats Postemergence, Most winter annual broadleaf weeds			
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	 0.25 pt 0.25 pt	0.125	Apply before jointing stage of growth. Risk of crop injury is least if applied after winter dormancy and before grain begins to joint. Better results will be obtained if applied when daytime temperatures are above 50ºF. Liquid nitrogen may be used as the carrier.
Oats Preharvest, Annual broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL	1 to 2 pt 1 to 2 pt	0.48 to 0.95	Apply when grain is in hard dough stage or later. Do not allow drift to sensitive crops, especially cotton and tobacco. Amine formulations strongly encouraged if sensitive crops are nearby, especially cotton or tobacco.
Rye Preplant No-Till, Emerged annual broadleaf and grass weeds, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions. Rate depends upon weed species and size; see labels. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 inches tall, apply 4 to 6 fluid ounces of Select or 6 fluid ounces of Select Max. For corn up to 24 inches, increase Select rate to 6 to 8 fluid ounces or Select Max rate to 9 fluid ounces. Select or Select Max must be applied at least 30 days ahead of planting rye.
Rye Postemergence, Most winter annual broadleaf weeds except chickweed, henbit, and knawel			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL	1 pt 1 pt 0.67 pt	0.48	Apply after rye is fully tillered but before jointing. Spraying rye too young or after jointing can cause deformed heads, reduced yields, and uneven ripening. Better results are obtained when daytime temperatures are above 50ºF. Increase the rate of 2,4-D by 50% to control corn cockle. Liquid nitrogen may be used as the carrier for 2,4-D. Ester formulations can be added directly to the nitrogen. If using amine formulation, premix in water (1 part 2,4-D to 4 parts water) and add mixture to nitrogen with strong agitation. Amine formulations give less burn than ester formulations in nitrogen.

Table 7-8A. Chemical Weed Control in Wheat, Barley, Oats, Rye, and Triticale

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Rye Preharvest, Annual broadleaf weeds			
2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL	 1 to 2 pt 0.67 to 1.3 pt	0.48 to 0.95	Apply when grain is in hard dough stage or later. Do not allow drift to sensitive crops, especially cotton and tobacco. Amine formulations are strongly encouraged if sensitive crops are nearby, especially cotton or tobacco.
Triticale Preplant No-Till, Emerged annual broadleaf and grass weeds, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-9 for glyphosate rate conversions. Rate depends upon weed species and size; see labels. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 inches tall, apply 4 to 6 fluid ounces of Select or 6 fluid ounces of Select Max. For corn up to 24 inches, increase Select rate to 6 to 8 fluid ounces or Select Max rate to 9 fluid ounces. Select or Select Max must be applied at least 30 days ahead of planting triticale.
thifensulfuron, MOA 2 + tribenuron, MOA 2 (FirstShot SG with TotalSol) 50 WDG	0.5 to 0.8 oz	0.008 to 0.013 + 0.008 to 0.013	FirstShot does not control grasses. May be applied up to planting to control emerged broadleaf weeds. Add nonionic surfactant at 2 to 4 pints per 100 gallons spray solution or crop oil concentrate or methylated seed oil at 1 gallon per 100 gallons spray solution. In addition, add nitrogen fertilizer at a rate of 2 quarts per acre or ammonium sulfate at 2 pounds per acre. See label for tank mixtures.
Triticale Preemergence, Italian ryegrass and annual broadleaf weeds			
chlorsulfuron, MOA 2 + metsulfuron methyl, MOA 2 (Finesse) 75 WDG	0.5 oz	0.0195 + 0.0039	See comments under Wheat, Preemergence.
Triticale Postemergence, Wild garlic and annual broadleaf weeds			
thifensulfuron-methyl, MOA 2 + tribenuron-methyl, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	0.45 to 0.9 oz	0.0094 to 0.0188 + 0.0047 to 0.0094	Apply after 2-leaf stage of triticale but before flag leaf is visible. See comments for Harmony Extra under Wheat-Postemergence.
Triticale Postemergence, Annual broadleaf weeds			
2,4-D, MOA 4 (Amine 4 2,4-D) 3.8 SL (Weedar 64) 3.8 L	1 pt	0.48	See comments for 2,4-D under Wheat- Postemergence.
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	0.25 oz	0.125	See comments for dicamba under Wheat- Postemergence.
halauxifen-methly, MOA 2 + florasulam, MOA 4 (Quelex) 20WG	0.75 oz	0.009	See comments for dicamba under Wheat- Postemergence.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-10, Herbicide Resistance Management, for details.

Weed Response to Herbicides in Small Grains

W. J. Everman, Crop and Soil Sciences Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Table 7-8B. Weed Response to Herbicides in Small Grains

	Herbicide											
	Preemergence						Postemergence					
Species	Anthem Flex	Axiom	Fierce	Valor SX	Zidua	Finesse[1]	2,4-D	Axial XL/ Axial Bold	Banvel/Clarity	Harmony Extra	Osprey/Osprey Xtra	PowerFlex[6]HL
Annual bluegrass	E[3]	G[3]	E[3]	F[3]	E[3]	N	N	N	N	N	G	N
Annual ryegrass	E[3]	G[3]	E[3]	GE[3]	E[3]	F	N	GE[5]	N	N	E[4]	E[4]
Buttercup						G	G	N	F	G		
Chickweed, common	F[3]	G	E[3]	E[3]	F[3]	G	P	N	G	G	FG	FG
Cornflower			-			F	G	N	FG	P	P	P
Curly dock	N	N	N	N	N		P	N	F	E	P	P
Cutleaf eveningprimrose			E[3]	E[3]			E	N	G	G	P	P
Field pennycress			E[3]	E[3]		G	G	N	F	G		
Henbit	F[3]	GE[3]	E[3]	E[3]	F[3]	G	P	N	F	G	G	G
Knawel							P	N	G	G		
Shepherd's-purse			E[3]	E[3]		G	GE	N	FG	E		
Swinecress							G	N	G	E	E	
Vetch							G	N	E	P	N	N
Virginia pepperweed			G[3]	G[4]			E	N	F	G		
Wild garlic	N	N	N	N[4]	N	P	F	N	F	E	P	P
Wild mustard	P[3]	G[3]	E[3]	E[3]	P[3]	G	GE	N	F	G	E[2]	GE
Wild radish	P[3]	G[3]	E[3]	E[3]	P[3]	G	GE	N	F	G	E[2]	GE

[1] Applied preemergence.
[2] Rating assumes mustard or radish is 1 to 2 inches Osprey is less effective on larger plants.
[3] Assumes adequate rainfall for activation prior to weed emergence.
[4] A biotype of ryegrass resistant to Osprey and PowerFlex has been found in the southern piedmont.
[5] May not control Hoelon-resistant ryegrass. See comments under "Wheat-Postemergence."
[6] Inadequate research has been conducted in North Carolina to determine response of most broadleaf weeds to PowerFlex. The label claims control of a number of broadleaf species, including Carolina geranium, chickweed, hairy bittercress, field pennycress, shepherdspurse, buttercup, Virginia pepperweed, and vetch.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Glyphosate Formulations

C. W. Cahoon, Associate Professor and Extension Weed Specialist, Crop and Soil Sciences Department

Table 7-9. Glyphosate Formulations

Formulation salt	% formulated salt by weight	Concentration (lb formulated salt/gal)	lb acid equivalent (a.e.) /gal	Equivalent rates	
				lb a.e./acre	fl oz product/acre
Diammonium	34.0	3.6	3.0	0.375 0.560 0.750 1.125	16 24 32 48
Dimethylamine	50.2	5.07	4.0	0.375 0.560 0.750 1.125	12 18 24 36
Isopropylamine	41.0	4.0	3.0	0.375 0.560 0.750 1.125	16 24 32 48
	50.2	5.0	3.75	0.375 0.560 0.750 1.125	12.8 19.1 25.6 38.4
	53.8	5.5	4.0	0.375 0.560 0.750 1.125	12 18 24 36
Isopropylamine + Monoammonium	37.54 + 3.42	3.64 + 0.33	2.7 + 0.3	0.375 0.560 0.750 1.125	16 24 32 48
Isopropylamine + Potassium	30.94 + 22.99	3.33 + 2.5	2.5 + 2.0	0.375 0.560 0.750 1.125	10.7 15.9 21.3 32
Potassium	44.9	5.0	4.17	0.375 0.560 0.750 1.125	11.5 17.2 23 34.5
	48.8	5.5	4.5	0.375 0.560 0.750 1.125	10.7 15.9 21.3 32
	51.2	5.88	4.8	0.375 0.560 0.750 1.125	10 15 20 30
	52.3	6.0	5.0	0.375 0.560 0.750 1.125	9.6 14.3 19.2 28.8

Herbicide Resistance Management

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Herbicide resistance is becoming a serious problem in North Carolina and across the country. Herbicide resistance is not a new phenomenon in North Carolina. Goosegrass resistant to dinitroaniline herbicides was first reported in North Carolina in the 1970s. Since then, smooth pigweed and common lambsquarters resistant to triazines, cocklebur resistant to organoarsenicals and ALS inhibitors, Palmer amaranth resistant to ALS inhibitors, Italian ryegrass resistant to ACCase inhibitors and ALS inhibitors, and common ragweed resistant to ALS inhibitors have been observed. Of greatest concern is weed resistance to glyphosate. Horseweed (2003), Palmer amaranth (2005), common ragweed (2006), and Italian ryegrass (2009). resistant to glyphosate have been found. Resistance of common lambsquarters to glyphosate is suspected. Weed resistance to glyphosate is a highly significant concern in light of the extensive use of glyphosate for burndown in conservation tillage systems and in Roundup Ready cotton, soybeans, and corn.

Crop rotation, along with appropriate herbicide rotation, should be employed to the extent possible. Also, cultivation, where feasible, can be very helpful in herbicide resistance management. However, the most important component of a resistance management strategy is rotation of herbicide modes of action and use of multiple herbicide modes of action within each crop.

Mode of action describes the process whereby an herbicide kills susceptible plants. Table 7-10 lists the mode of action, along with the chemical family, of all the herbicides likely to be used on agronomic and horticultural crops in North Carolina. Each herbicide mode of action is assigned a numerical code for ease of use. Wherever possible, at least two modes of action should be used within each crop. This can be accomplished by preemergence herbicide applications followed by postemergence applications and by tank mixtures of herbicides with two or more modes of action. Also, within a rotation, one should try to avoid dependence on herbicides with the same mode of action in all crops in the rotation. For example, in a corn and soybean rotation, it is best not to use an ALS inhibitor (#2) in each crop. Alternatively, if an ALS inhibitor is used in each crop, herbicides with other modes of action should also be included. Similarly, it would be best to not rely exclusively on glyphosate in both crops.

In Roundup Ready corn and soybeans, it is recommended that glyphosate plus herbicides with at least one other mode of action be used. In Roundup Ready cotton, it is recommended that at least two modes of actions, in addition to glyphosate, be used.

Table 7-10A. Herbicide Modes of Action

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
AAtrex	atrazine	triazine	5
Accent Q	nicosulfuron	sulfonylurea	2
Acumen	pendimethalin	dinitroaniline	3
Aim	carfentrazone	triazolinone	14
Alachlor	alachlor	chloroacetamide	15
Alanap	naptalam	phthalamate semicarbazone	19
Armezon	topramezone	triketone	27
Arrow	clethodim	cyclohexanedione	1
Atrazine	atrazine	triazine	5
Assure II	quizalofop	aryloxyphenoxy-propionate	1
Authority Assist	sulfentrazone + imazethapyr	triazolinone + imidazolinone	14 + 2
Authority First	sulfentrazone + cloransulam	triazolinone + triazolopyrimidine	14 + 2
Authority MTZ	sulfentrazone + metribuzin	triazolinone + triazinone	14 + 5
Axial	pinoxaden	phenylpyrazoline	1
Axiom	flufenacet + metribuzin	oxyacetamide + triazinone	15 + 5
Balance FLEXX	Isoxaflutole	Isoxazole	27
Banvel	dicamba	benzoic acid	4
Banvel-K + Atrazine	dicamba + atrazine	benzoic acid + triazine	4 + 5
Basagran	bentazon	benzothiadiazinone	6
Beyond	imazamox	imidazolinone	2
Bicep II Magnum	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Blazer	acifluorfen	diphenylether	14
Boundary	s-metolachlor + metribuzin	chloroacetamide + triazinone	15 + 5
Brawl, Brawl II	s-metolachlor	chloroacetamide	15
Brawl II ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Breakfree ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Break-Up	pronamide	benzamide	3
Buctril	bromoxynil	nitrile	6
Bullet	alachlor + atrazine	chloroacetamide + triazine	15 + 5
Butoxone	2,4-DB	phenoxy-carboxylic acid	4
Butyrac	2,4-DB	phenoxy-carboxylic acid	4
Cadre	imazapic	imidazolinone	2
Callisto	mesotrione	triketone	27
Camix	mesotrione + s-metolachlor	triketone + chloroacetamide	27 + 15
Canopy	metribuzin + chlorimuron	triazine + sulfonylurea	5 + 2
Canopy EX	chlorimuron + tribenuron	sulfonylurea + sulfonylurea	2 + 2
Canopy XL	sulfentrazone + chlorimuron	diphenylether + sulfonylurea	14 + 2
Caparol	prometryn	triazine	5
Capreno	tembotrione + thiencarbazone	benzoyl pyrazole + triazolone	27 + 2
Celebrity, Celebrity Plus	nicosulfuron + dicamba	sulfonylurea + benzoic acid	2 + 4
Charger Basic	s-metolachlor	chloroacetamide	15
Cinch	s-metolachlor	chloroacetamide	15
Cinch ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Clarity	dicamba	benzoic acid	4
Classic	chlorimuron	sulfonylurea	2
Clethodim	clethodim	cyclohexanedione	1
Clopyr AG	clopyralid	pyridine carboxylic acid	4
Cobra	lactofen	diphenylether	14
Command	clomazone	isoxazolidinone	13
Confidence	acetochlor	chloroacetamide	15
Confidence Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Corvus	Isoxaflutole + thiencarbazone-methyl	isoxazole + triazolone	27 + 2
Cotoran	fluometuron	urea	7
Cotton-Pro	prometryne	triazine	5
Curbit	ethalfluralin	dinitroaniline	3
Dacthal	DCPA	benzoic acid	3
Dawn	fomesafen	diphenyl ether	14
Define	flufenacet	oxyacetamide	15
Degree	acetochlor	chloroacetamide	15
Degree Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Devrinol	napropamide	acetamide	15
Diablo	dicamba	benzoic acid	4
Dicamba DMA Salt	dicamba	benzoic acid	4
Direx	diuron	urea	7
Distinct	dicamba + diflufenzopyr	benzoic acid + semicarbazone	4 + 19
Diuron	diuron	urea	7
Double Team	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
DSMA, numerous brands	DSMA	organoarsenical	17
Dual II, Dual II Magnum	s-metolachlor	chloroacetamide	15
Envive	flumioxazin + chlorimuron + thifensulfuron	n-phenylphthalimide + triazolopyrimidine + sulfonylurea	14 + 2 + 2
Envoke	trifloxysulfuron	sulfonylurea	2
Eptam	EPTC	thiocarbamate	8
Equip	formasulfuron + iodosulfuron	sulfonylurea	2 + 2
Eradicane	EPTC	thiocarbamate	8
Establish	dimethenamid	chloroacetamide	15
Establish ATZ	dimethenamid + atrazine	chloroacetamide + triazine	15 + 5
ET	pyraflufen ethyl	phenylpyrazole	14

Table 7-10A. Herbicide Modes of Action

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Evik	ametryne	triazine	5
Expert	glyphosate + s-metolachlor + atrazine	glycine + chloroacetamide + triazine	9 + 15 + 5
Express	tribenuron	sulfonylurea	2
Extreme	glyphosate + imazethapyr	glycine + imidazolinone	9 + 2
Fierce	flumioxazin + pyroxasulfone	n-phenylphthalimide + chloroacetamide	14 + 15
Finesse	chlorsulfuron + metsulfuron	sulfonylurea + sulfonylurea	2 + 2
Firestorm	paraquat	bipyridylium	22
Firstrate	cloransulam	triazolopyrimidine	2
Flexstar	fomesafen	diphenylether	14
Fultime	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Fusilade DX	fluazifop	aryloxyphenoxy-propionate	1
Fusion	fluazifop + fenoxaprop	aryloxyphenoxy-propionate + aryloxyphenoxy-propionate	1 + 1
Galigan	oxyfluorfen	diphenylether	14
Gangster	flumioxazin + cloransulam	n-phenylphthalimide + triazolopyrimidine	14 + 2
Guardsman Max	dimethenamide + atrazine	chloroacetamide + triazine	15 + 5
Glyphosate (numerous brands)	glyphosate	glycine	9
Goal	oxyflurofen	diphenylether	14
Goal Tender	oxyfluorfen	diphenylether	14
Gramoxone (Inteon)	paraquat	bipyridylium	22
Halex GT	s-metolachlor + glyphosate + mesotrione	chloroacetamide + glycine + triketone	15 + 9 + 27
Harmony Extra	thifensulfuron + tribenuron	sulfonylurea + sulfonylurea	2 + 2
Harmony GT, Harmony SG	thifensulfuron	sulfonylurea	2
Harness	acetochlor	chloroacetamide	15
Harness Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Hoelon	diclofop	aryloxyphenoxy-propionate	1
Ignite, Ignite 280	glufosinate	phosphinic acid	10
Impact	topramezone	triketone	27
Intrro	alachlor	chloroacetamide	15
Karmex	diuron	urea	7
Kerb	pronamide	benzamide	3
Keystone NXT	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Lariat	alachlor + atrazine	chloroacetamide + triazine	15 + 5
Laudis	tembotrione	benzoyl pyrazole	27
Layby Pro	diuron + linuron	urea + urea	7 + 7
Leadoff	rimsulfuron + thifensulfuron	sulfonylurea	2 + 2
Lexar	mesotrione + s-metolachlor + atrazine	triketone + chloroacetamide + triazine	27+15+5
Liberty	glufosinate	phosphinic acid	10
Liberty ATZ	glufosinate + atrazine	phosphinic acid + triazine	10 + 5
Lightning	imazethapyr + imazapyr	imidazolinone + imidazolinone	2 + 2
Linex	linuron	urea	7
Lorox	linuron	urea	7
Lumax	mesotrione + s-metolachlor + atrazine	triketone + chloroacetamide + atrazine	27+15+5
Marksman	dicamba + atrazine	benzoic acid + triazine	4 + 5
Matrix	rimsulfuron	sulfonylurea	2
Medal, Medal II	s-metolachlor	chloroacetamide	15
Medal II AT	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Me-Too-Lachlor	metolachlor	chloroacetamide	15
Metribuzin	metribuzin	triazinone	5
Metri DF	metribuzin	triazinone	5
Micro-Tech	alachlor	chloroacetamide	15
Moxy	bromoxynil	nitrile	6
MSMA (numerous brands)	MSMA	organoarsenical	17
OpTILL	imazethapyr + saflufenacil	imidazolinone + pyrimidinedione	2 + 14
Option	foramsulfuron	sulfonylurea	2
Osprey	mesosulfuron	sulfonylurea	2
Outlook	dimethenamid	chloroacetamide	15
OxiFlo	oxyfluorfen	diphenylether	14
Parallel, Parallel PCS	metolachlor	chloroacetamide	15
Parallel Plus	metolachlor + atrazine	chloroacetamide + atrazine	15 + 5
Parazone	paraquat	bipyridylium	22
Parrlay	metolachlor	chloroacetamide	15
Peak	prosulfuron	sulfonylurea	2
Pendant	pendimethalin	dinitroaniline	3
Pendimax	pendimethalin	dinitroaniline	3
Permit	halosulfuron	sulfonylurea	2
Poast, Poast Plus	sethoxydim	cyclohexanedione	1
PowerFlex	pyroxsulam	triazolopyrimidine	2
Prefar	bensulide	phosphorodithioate	8
Prefix	s-metolachlor + fomesafen	chloroacetamide + diphenylether	15 + 14
Princep	simazine	triazine	5
Prometryn	prometryn	triazine	5
Prowl, Prowl H_2O	pendimethalin	dinitroaniline	3
Pursuit	imazethapyr	imidazolinone	2
Pyramin	pyrazon	pyridazinone	6
Python	flumetsulam	triazolopyrimidine	2
Raptor	imazamox	imidazolinone	2
Realm Q	rimsulfuron + mesotrione	sulfonylurea + triketone	2 + 27
Reflex	fomesafen	diphenylether	14
Resicore	acetochlor + mesotrione + clopyralid	chloroacetamide + triketone + pyridine carboxylic acid	15 + 27 + 4

Table 7-10A. Herbicide Modes of Action

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Resolve	rimsulfuron	sulfonylurea	2
Resolve Q	rimsulfuron + thifensulfuron	sulfonylurea + sulfonylurea	2 + 2
Resource	flumiclorac-pentyl	n-phenylphthalimide	14
Ro-Neet	cycloate	thiocarbamate	8
Roundup (and other brands)	glyphosate	glycine	9
Rhythm	fomesafen	diphenyl ether	14
Sandea	halosulfuron	sulfonylurea	2
Scepter	imazaquin	imidazolinone	2
Select, Select Max	clethodim	cyclohexanedione	1
Sencor	metribuzin	triazinone	5
Sequence	glyphosate + s-metolachlor	glycine + chloroacetamide	9 + 15
Sharpen	saflufenacil	pyrimidinedione	14
Simazine	simazine	triazine	5
Sim-Trol	simazine	triazine	5
Sinbar	terbacil	uracil	5
Sonalan	ethalfluralin	dinitroaniline	3
Sonic	sulfentrazone + cloransulam	triazolinone + triazolopyrimidine	14 + 2
Spartan	sulfentrazone	triazolinone	14
Spartan Charge	sulfentrazone + carfentrazone	triazolinone + triazolinone	14 + 14
Spin-Aid	phenmedipham	phenyl-carbamate	6
Squadron	imazaquin + pendimethalin	imidazolinone + dinitroaniline	2 + 3
Stalwart, Stalwart C	metolachlor	chloroacetamide	15
Stalwart Xtra	metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Staple	pyrithiobac	pyrimidinyl(thio)benzoate	2
Status	dicamba + diflufenzopyr	benzoic acid + semicarbazone	4 + 19
Steadfast Q	nicosulfuron + rimsulfuron	sulfonylurea + sulfonylurea	2 + 2
Steadfast ATZ	nicosulfuron + rimsulfuron + atrazine	sulfonylurea + sulfonylurea + triazine	2 + 2 + 5
Stealth	pendimethalin	dinitroaniline	3
Sterling	dicamba	benzoic acid	4
Stinger	clopyralid	pyridine carboxylic acid	4
Storm	acifluorfen + bentazon	diphenylether + benzothiadiazinone	14 + 6
Strategy	ethalfluralin + clomazone	dinitroaniline + isoxazolidinone	3 + 13
Strongarm	diclosulam	triazolopyrimidine	2
Suprend	prometryn + trifloxysulfuron	triazine + sulfonylurea	5 + 2
Sutan+	butylate	thiocarbamate	8
SureStart	acetochlor + flumetsulam + clopyralid	chloroacetamide + triazolopyrimidine + pyridine carboxylic acid	15 + 2 + 4
Surpass	acetochlor	chloroacetamide	15
Synchrony XP	chlorimuron + thifensulfuron	sulfonylurea + sulfonylurea	2 + 2
Targa	quizalofop	aryloxyphenoxy-propionate	1
Tillam	pebulate	thiocarbamate	8
TopNotch	acetochlor	chloroacetamide	15
Treflan	trifluralin	dinitroaniline	3
Triangle	metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Trifluralin	trifluralin	dinitroaniline	3
Trigger	clethodim	cyclohexanedione	1
Trilin	trifluralin	dinitroaniline	3
Trizmet II	atrazine + metolachlor	triazine + chloroacetamide	5 + 15
Trust	trifluralin	dinitroaniline	3
Ultra Blazer	acifluorfen	diphenylether	14
Valor SX	flumioxazin	n-phenylphthalimide	14
Valor XLT	flumioxazin + chlorimuron	n-phenylphthalimide + sulfonylurea	14 + 2
Vision	dicamba	benzoic acid	4
Volley	acetochlor	chloroacetamide	15
Volley ATZ	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Volunteer	clethodim	cyclohexanedione	1
Warrant	acetachlor	chloroacetamide	15
Weedmaster	2,4-D + dicamba	phenoxy-carboxylic acid + benzoic acid	4 + 4
Yukon	halosulfuron + dicamba	sulfonylurea + benzoic acid	2 + 4
Zidua	pyroxasulfone	chloroacetamide	14
2,4-D (numerous brands)	2,4-D	phenoxy-carboxylic acid	4
2,4-DB (numerous brands)	2,4-DB	phenoxy-carboxylic acid	4

Mode of Action Code Key:
1 ACCase inhibition
2 ALS inhibition
3 Microtubule assembly inhibition
4 Synthetic auxin
5 Photosystem II inhibition, different binding behavior than groups 6 and 7
6 Photosystem II inhibition, different binding behavior than groups 5 and 7
7 Photosystem II inhibition, different binding behavior than groups 5 and 6
8 Inhibition of lipid synthesis - not ACCase inhibition
9 EPSP synthase inhibition
10 Glutamine synthase inhibition
12 Inhibition of carotenoid biosynthesis at PDS
13 Inhibition of carotenoid biosynthesis, unknown target
14 PPO inhibition
15 Inhibition of very long-chain fatty acids
17 Unknown mode of action
19 Auxin transport inhibition
22 Photosystem I electron diversion
27 Inhibition of HPPD

Herbicide Modes of Action for Hay Crops, Pastures, Lawns, and Turf

Table 7-10B. Herbicide Modes of Action for Hay Crops, Pastures, Lawns, and Turf

Brands listed were registered for sale and use in North Carolina in 2020 according to www.kellysolutions.com/nc/searchbychem.asp. Active ingredients enclosed within parentheses are prepackaged herbicides.

Active Ingredient(s)	Brand Names	Chemical Family	Mode of Action[1]
(2, 4-D + mecoprop + dichlorprop)	Spoiler, Triamine	phenoxycarboxylic acid + phenoxyalkanoic acid + chlorinated phenoxy	4 + 4 + 4
2,4-D amine	(4 SL): various trade names	phenoxy-carboxylic acid	4
(2,4-D + aminopyralid)	GrazonNext HL	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
(2,4-D ester + carfentrazone-ethyl)	Rage D-Tech	phenoxy-carboxylic acid + triazolinone	4 + 14
(2,4-D + clopyralid + dicamba)	Millennium Ultra 2	phenoxycarboxylic acid + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
(2,4-D amine + cloypyralid)	Curtail	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
(2,4-D + dicamba)	Brash, Range Star, Rifle-D, Weedmaster	phenoxy-carboxylic acid + benzoic acid	4 + 4
(2,4-D + fluroxypyr + dicamba)	E-2, Escalade 2	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
(2,4-D + glyphosate)	Campaign	phenoxy-carboxylic acid + glycine	4 + 9
(2,4-D + mecoprop + dicamba)	3-D, Three-Way Selective Herbicide, Triplet SF, various Trimec formulations	phenoxycarboxylic acid + phenoxyalkanoic acid + benzoic acid	4 + 4 + 4
(2,4-D + picloram)	Grazon P+D, Trooper P+D	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
(2,4-D + triclopyr)	Candor, Crossbow	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
2,4-DB	(1.75 EC): 2,4-DB 175 (2 EC): 2,4-DB 200, Butyrac 200	phenoxy-carboxylic acid	4
amicarbazone	Xonerate	triazolinone	5
aminopyralid	Milestone	pyradinecarboxylic acid	4
(aminopyralid + metsulfuron methyl)	Chaparral	pyradinecarboxylic acid + sulfonylurea	4 + 2
asulam	Asulox	carbamate	18
atrazine	(4 L): AAtrex 4 L, Atrazine 4 L (90 DF, 90 WDG): Aatrex Nine-O, Atrazine 90 WDG, Atrazine 90 DF	triazine	5
benefin	Lebanon Balan 2.5 G, The Andersons Crabgrass Preventer with 2.5 Balan	dinitroaniline	3
(benefin + trifluralin)	Fertilizer with Team Pro 0.86%	dinitroaniline + dinitroaniline	3 + 3
bensulide	(4 EC): Bensumec 4 LF (8.5 G): Weedgrass Preventer (12.5 G): Pre-San Granular	organophosphorus	8
(bensulide + oxadiazon)	Goosegrass / Crabgrass Control	organophosphorus + oxadiazole	8 + 14
bentazon	Basagran Sedge Control, Basagran T/O, Bentazon 4, Lescogran	benzothiadiazole	6
bispyribac-sodium	Velocity	pyrimidinyloxybenzoic acid	2
bromoxynil	(2 EC): Broclean, Maestro 2 EC (4 EC): Buctril 4 EC	nitrile	6
carfentrazone-ethyl	Aim EC, QuickSilver T&O	triazinone	14
(carfentrazone + 2,4-D ester + mecoprop + dicamba)	(2.2 EC): Speed Zone (0.81 EC): Speed Zone Southern	triazinone + phenoxycarboxylic acid + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
(carfentrazone + MCPA + mecoprop + dicamba)	Power Zone	triazinone + phenoxy + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
(carfentrazone + quinclorac)	SquareOne	triazinone + quinoline carboxylic acid	14 + (27 + 4)
chlorsulfuron	Alligare Chlorsulfuron 75, Telar XP	sulfonylurea	2
clethodim	(2 EC): Arrow 2 EC, Avatar S2, Cleanse 2 EC, Clethodim 2 LC, Clethodim 2 E, Dakota, Section 2 EC, Shadow, Tide Clethodim 2 EC, Select 2 EC, Volunteer, Willowood Clethodim 2 EC (0.97 EC): Envoy Plus, TapOut	cyclohexanedione	1
cloypyralid	Lontrel T&O	pyridinecarboxylic acid	4
dicamba / diglycolamine	Banvel, Clarity, Clash, Detonate, Rifle, Strut, Topeka, Vanquish	benzoic acid	4
diclofop-methyl	Illoxan	aryloxyphenoxy propionate	1
(diflufenzopyr-sodium + dicamba)	Overdrive	semicarbazone + benzoic acid	19 + 4
dimethenamid	Tower	chloroacetamide	15
(dimethenamid + pendimethalin)	Freehand	chloroacetamide + dinitroaniline	15 + 3
diquat	Diquash, Diquat., Diquat SPC, Harvester, Priceto Diquat 2 L, Reward LS, Tribune	bipyridylium	22
diuron	Direx 4 L, Diuron 4 L	phenylurea	7
dithiopyr	(2 EW, 2 L): Armortech CGC 2 L, Dimension 2 EW, Dithiopyr 2 L (40 WP): Armortech CGC 40, Dimension Ultra, Dithiopyr 40 WSP	pyridine	4
EPTC	Eptam 7-E	thiocarbamate	8
ethofumesate	(1.5 EC): Prograss (4 EC): Phoenix Thrasher, PoaConstrictor, Prograss SC	benzofuranes	8
fenoxaprop	Acclaim Extra	aryloxyphenoxy propionate	1
flazasulfuron	Katana	sulfonylurea	2
florasulam	Defendor	triazolopyrimidine	2
fluazifop	Fusilade II	aryloxyphenoxy propionate	1
flumioxazin	Sureguard	N-phenylphthalimide	14
foramsulfuron	Revolver	sulfonylurea	2
glufosinate	Finale	organophosphorus	10
glyphosate – Roundup formulations	(4 SL, 5 SL, 5.4 SL, 5.5 SL): various trade names	glycine	9
glyphosate – Touchdown formulations	(3 SL): Touchdown Pro (4.17 SL): Touchdown Total (5 SL): Touchdown HiTech		
(glyphosate + diquat)	Razor Burn, Roundup QuikPRO	glycine + bipyridylium	9 + 22
halosulfuron	HiYield Nutsedge Control, Nutgrass Killer II, Profine 75, Sandea	sulfonylurea	2

Table 7-10B. Herbicide Modes of Action for Hay Crops, Pastures, Lawns, and Turf

Brands listed were registered for sale and use in North Carolina in 2020 according to www.kellysolutions.com/nc/searchbychem.asp. Active ingredients enclosed within parentheses are prepackaged herbicides.

Active Ingredient(s)	Brand Names	Chemical Family	Mode of Action[1]
imazapic	Imazapic 2 SL, Impose, Panoramic, Plateau	imadazolinone	2
imazaquin	Image 70 DG	imidazolinone	2
imazethapyr	Pursuit, Slay, Thunder	Imidazolinone	2
imazosulfuron	Celero	sulfonylurea	2
indaziflam	(20 WSP): Specticle 20 WSP (0.0224 G): Specticle G (0.622F): Specticle Flo	benzamide	21
(indaziflam + diquat bromide + glyphosate)	Specticle Total	benzamide + bipyridylium + glycine	21 + 22 + 9
isoxaben	Gallery, Isoxaben	benzamide	21
(MCPA + mecoprop + dicamba)	Ortho Weed B Gon Pro Southern, Tri-Power	mcpa + phenoxyalkanoic acid + benzoic acid	4 + 4 + 4
(MCPA amine + fluroxypyr ester + dicamba)	Change Up	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
(MCPA amine + fluroxypyr ester + triclopyr amine)	Battleship III	phenoxy + pyridinecarboxylic acid + pyridinecarboxylic acid	4 + 4 + 4
(MCPA amine + triclopyr amine + dicamba)	Horsepower, Lesco Eliminate	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
(MCPA ester + triclopyr ester + dicamba)	Cool Power, Lesco Three-Way Ester II, Monterey Spurge Power	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
mecoprop	MCPP-p4 Amine, Mecomec 2.5, Mecomec 4	phenoxyalkanoic acid	4
mesotrione	Tenacity	benzoylcyclohexanedione	27
metolachlor	Pennant Magnum	chloroacetamide	15
metribuzin	(75 DF): Dimetric DF, Glory, Metribuzin 75, Tricor DF 4 L, 4 F): Glory 4L, Tricor 4 F	triazinone	5
metsulfuron methyl	Accurate, Amtide MSM 60 DF, Amitide MSM Turf, Manor, MSM 60 DF, MSM Turf, Ortho Weed B Gon Pro St. Augustine, Plotter, Purestand, Rometsol	sulfonylurea	2
(metsulfuron + 2,4-D + dicamba)	Cimarron Max	sulfonylurea + phenoxy-carboxylic acid + benzoic acid	2 + 4 + 4
(metsulfuron + chlorsulfuron)	Chisom, Cimarron Plus	sulfonylurea + sulfonylurea	2 + 2
(metsulfuron methyl + rimsulfuron)	Negate	sulfonylurea + sulfonylurea	2 + 2
monosodium methylarsonate	(6 SL): Target 6 Plus, Drexel MSMA 6 Plus (6.6 SL): Target 6.6 Plus, Drexel MSMA 6.6 Plus	organic arsenical	17
napropamide	Devrinol 50 DF	acetamide	15
(nicosulfuron + metsulfuron methyl)	Pastora	sulfonylurea + sulfonylurea	2 + 2
oryzalin	(4 AS, 4 L): Monterey Weed Impede 4 AS, Oryzalin 4 AS, Phoenix Harrier 4 L, Surflan AS (85WDG): Surflan WDG	dinitroaniline	3
oxadiazon	(2 G): Oxadiazon 2 G, Ronstar G (50 WP): Oxadiazon 50 WSB, Ronstar 50 WSB (3.17 SC): Oxadiazon SC, Phoenix Starfighter L, Ronstar Flo	oxadiazole	14
(oxadiazon + prodiamine)	Pro-mate Ronstar + Barricade 1.2 G, Regalstar II	oxadiazole + dinitroaniline	14 + 3
paraquat	(2 SL): Cyclone SL 2.0, Gramoxone Inteon, Gramoxone SL (3 SL): Bonedry, Firestorm, Helmquat 3 SL, Parazone 3 SL	bipyridylium	22
pendimethalin	(3.8 CS): HydroCap, Pendulum AquaCap, Pre-M AquaCap, Prowl H2O, Satellite HydroCap (3.3 EC): Drexel Pin-Dee 3.3 T&O (2 G): Pendulum 2 G (0.86 G): fertilizers – Pendimethalin, Pre-M, Propendi, Pro-mate Pendi (1.29 G): Step 1 Crabgrass Preventer, Turf Builder with Halts	dinitroaniline	3
penoxsulam	(0.31 L): Sapphire (0.03 G): Harrels Fert. with Penoxsulam, Iesco LockUp, Pennington Seed LockUp (014 G): Harrels Fert. with Penoxsulam	triazolopyrimidine	2
(picloram + fluroxypyr)	Surmount	pyradinecarboxylic acid + pyradinyloxyacetic acid	4 + 4
prodiamine	(65 WDG): Armortech Kade, Barricade, Cavalcade, Halts Pro, Phoenix Knighthawk, ProClipse, Prodiamine, Quali-Pro Prodiamine, RegalKade, Resolute, Stonewall (4 FL): Barricade, Evade, Resolute (0.5 G): RegalKade, Signature Crabgrass Preventer, Turf Pride	dinitroaniline	3
pronamide	(50 WP): Kerb 50-W (3.3 SC): Kerb SC T&O, Willowood Pronamide 3.3SC	benzamide	3
pyraflufen ethyl	Octane 2% SC	phenylpyrazole	14
quinclorac	(75 DF): Armortech Quinclorac Pro, Quinclorac, Quinclorac SPC, Quinstar (1.5 SL): Drive XLR8, Quinclorac 1.5 L	quinoline carboxylic acid	(27 + 4)
(quinclorac + mecoprop + dicamba)	Onetime	quinoline carboxylic acid + phenoxyalkanoic acid + benzoic acid	(27 + 4) + 4 + 4
(quinclorac + sulfentrazone + 2,4-D amine + dicamba)	Q4 Plus	quinoline carboxylic acid + triazinone + phenoxy-carboxylic acid + benzoic acid	(27 + 4) + 14 + 4 + 4
rimsulfuron	Rimsulfuron	sulfonylurea	2
sethoxydim	(1.5 EC): Poast (1 EC): Poast Plus, Segment, Sethoxydim SPC	cyclohexanedione	1
siduron	Tupersan	phenylurea	7
simazine	(4 L): Princep Liquid, Simazine, Sim-Trol (90 DF, 90 WDG): Simazine, Sim-Trol, Princep Caliber 90	triazine	5
sulfentrazone	Dismiss Turf	triazinone	14
(sulfentrazone + 2,4-D + mecoprop + dicamba)	Surge	triazinone + phenoxycarboxylic acid + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
(sulfentrazone + imazethapyr)	Dismiss South	triazinone + imidazolinone	14 + 2
(sulfentrazone + metsulfuron-methyl)	Blindside	triazinone + sulfonylurea	14 + 2
(sulfentrazone + prodiamine)	Echelon	triazinone + dinitroaniline	14 + 3

Table 7-10B. Herbicide Modes of Action for Hay Crops, Pastures, Lawns, and Turf

Brands listed were registered for sale and use in North Carolina in 2020 according to www.kellysolutions.com/nc/searchbychem.asp. Active ingredients enclosed within parentheses are prepackaged herbicides.

Active Ingredient(s)	Brand Names	Chemical Family	Mode of Action[1]
(sulfentrazone + quinclorac)	Solitare	triazinone + quinoline carboxylic acid	14 + (27 + 4)
sulfosulfuron	Certainty, Outrider	sulfonylurea	2
tebuthiuron	(20 P): Spike 20 P, Alligare 20 P (80 DF, 80 WG): Spike 80 DF, Alligare 80 WG	thiadiazolyurea	7
terbacil	Sinbar 80 WDG	uracil	5
(thiencarbazone + foramsulfuron + halosulfuron)	Tribute Total	triazolinone + sulfonylurea + sulfonylurea	14 + 2 + 2
(thiencarbazone + iodosulfuron + dicamba)	Celsius WG	triazolinone + sulfonylurea + benzoic acid	14 + 2 + 4
(thiencarbazone + iodosulfuron + foramsulfuron)	Derigo	triazolinone + sulfonylurea + sulfonylurea	14 + 2 + 2
topramezone	Pylex	benzoylpyrazole	27
triclopyr	Monterey Turflon Ester, Remedy Ultra, Turflon Ester Ultra	pyradinecarboxylic acid	4
(triclopyr + cloypyralid)	Confront, 2-D	pyradinecarboxylic acid + pyradinecarboxylic acid	4 + 4
(triclopyr + fluroxypyr)	PastureGard HL	pyradinecarboxylic acid + pyradinyloxyacetic acid	4 + 4
(triclopyr + sulfentrazone + 2,4-D + dicamba)	Tzone SE	pyridinecarboxylic acid + triazinone + phenoxy-carboxylic acid + benzoic acid	4 + 14 + 4 + 4
trifloxysulfuron	Monument	sulfonylurea	2
trifluralin	(10 G): Treflan TR-10, Trifluralin 10 G (4 EC): Treflan HFP, Trifluralin 4 EC	dinitroaniline	3

Chemical Weed Control in Clary Sage

R. B. Batts, IR-4 Project

Table 7-11. Chemical Weed Control in Clary Sage

Herbicide Type	Herbicide, Mode of Action Code,[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preplant Injection, Weeds, diseases, and nematodes.	metam sodium (Vapam H**L**) 42% (Sectagon-42) 42% metam potassium (K-PAM HL, Sectagon-K54) 54%	 37.5 to 75 gal 15 to 75 gal 30 to 62 gal	 160 to 320 64 to 320 174 to 360	Rates are dependent on soil types and weeds known to be present. Apply when soil moisture is at field capacity required by the product label. Read label thoroughly for regulatory, safety and application instructions. Interval to planting is usually 14 to 21 days but can be as long as 30 days in certain environments.
Preplant and preemergence, Annual and perennial grass and broadleaf weeds. Stale bed application.	flumioxazin, MOA 14 (Valor SX) 51 WDG	1 to 3 oz	0.032 to 0.095	Special Local Needs (SLN) label in North Carolina. Apply preplant, 30 days or more before planting. Application rate varies based on preplant interval. Treated area must receive a minimum of 0.5 inches of rainfall/irrigation between application and planting. Sequential preplant applications are prohibited. Some soil texture restrictions apply. See label for details.
	glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL (Roundup Weather Max) 5.5 L	 1 to 3 pt 0.8 to 2.4 pt 11 to 32 oz	 0.5 to 1.5	Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulation formulated with nonionic surfactant may result in reduced weed control.
	d-limonene, MOA unclassified (Avenger AG) 55%	7 to 10%	—	Apply broadcast at least 2 days prior to transplanting or broadcast anytime prior to seeded crop emergence. Higher rate recommended for larger and tough to control weeds.
	pelargonic acid, MOA unclassified (Scythe) 4.2 EC	3 to 10%	—	Label recommends application in 75 to 200 gallons of solution per acre when applied alone. When tank mixing with other herbicides, delivery rates can be reduced to 10 to 75 gallons per acre. See label for recommended ratio to apply on different types of weeds and other instructions.
	ammonium nonanoate, MOA unclassified (Axxe) 3.3	6.15%	—	Rate is dependent on weed type and size at application.
	caprylic acid + capric acid MOA unclassified (Fireworxx, Homeplate)	3 to 9%	---	Rate is dependent on weed type and size at application. Label recommends application in 75 to 200 gallons of solution per acre.
Postemergence, residual weed control.	flumioxazin, MOA 14 (Valor SX) 51 WDG	1 to 2 oz	0.032 to 0.064	Special Local Needs (SLN) label in North Carolina. Apply to crop that is a minimum of 4 inches in diameter. Do not apply after crop begins to enter reproductive stage. Do not add adjuvant, fertilizer or other pest control products. Do not use on clary sage grown for food or feed purposes.
Postemergence, Cutleaf eveningprimrose and certain other broadleaf weeds.	linuron, MOA 7 (Linex) 4 L	1 to 1.5 pt	0.5 to 0.75	Special Local Needs (SLN) label in North Carolina. Crop must be a minimum of 4 inches in diameter for application. Do not use on clary sage grown for food or feed purposes. Do not use on sands or loamy sands or on soils with less than 1% organic matter. Temporary yellowing or stunting of crop may occur.
Postemergence, Henbit and other winter annual broadleaf weeds.	oxyfluorfen, MOA 14 (Goal 2XL) 2EC (Galigan, Oxystar, others) 2 E (GoalTender) 4E (Galigan H_2O) 4EC	 0.5 to 1 pt 0.5 to 1 pt 0.25 to 0.5 pt 0.25 to 0.5 pt	 0.12 to 0. 25	Apply to 2-4 leaf henbit. Additional applications may be needed for subsequent henbit emergence. Do not apply more than 6 pints of Goal 2XL or Galigan per acre per year. Do not apply more than 3 pints of GoalTender or Galigan H2O per acre per year. Clary sage may exhibit phytotoxicity on leaf margins after application, but recovery should occur quickly.

Table 7-11. Chemical Weed Control in Clary Sage

Herbicide Type	Herbicide, Mode of Action Code,[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Emerged weeds.	paraquat MOA 22 (Gramoxone) 3SL	2 to 32 oz	0..047 to 0.75	Special Local Needs (SLN) label in North Carolina. Application rate varies based on size and physiological status of the crop. See product label for specific rates and timings. Do not exceed 1.125 pounds per growing season. Do not use clary sage for food or feed.
	carfentrazone, MOA 14 (Aim) EC	Up to 2 oz	Up to 0.031	Hooded/shielded application to row middles. Do not allow crop contact. Do not apply more than 6.1 ounces per acre per season. See label for details.
	pelargonic acid, MOA unclassified (Scythe) 4.2 EC	3 to 10%	—	Hooded/shielded application to row middles. Do not allow crop contact. Label recommends application in 75 to 200 gallons of solution per acre when applied alone. When tank mixing with other herbicides, delivery rates can be reduced to 10 to 75 gallons per acre. See label for recommended ratio to apply on different types of weeds and other instructions.
	ammonium nonanoate, MOA unclassified (Axxe) 3.3	6.15%	—	Hooded/shielded application to row middles. Do not allow crop contact. Rate is dependent on weed type and size at application.
	caprylic acid + capric acid MOA unclassified (Fireworxx, Homeplate)	3 to 9%	---	Hooded/shielded application to row middles. Do not allow crop contact. Rate is dependent on weed type and size at application.
	d-limonene, MOA unclassified (Avenger AG) 55%	7 to 10%	---	Hooded/shielded application to row middles. Do not allow crop contact. Rate is dependent on weed type and size at application.
Postemergence, Emerged annual and perennial grasses.	clethodim, MOA 1 (Arrow, Clethodim, others) 2EC	6 to 8 oz	0.09 to 0.125	Arrow and Clethodim require addition of crop oil concentrate to spray mixture. See label for precautions regarding crop oil concentrates. Do not apply within 14 days of harvest.
	(Select Max) 1 EC	9 to 32 oz	0.07 to 0.25	Select Max allows the use of a nonionic surfactant, methylated seed oil, or crop oil concentrate in the mixture. Label suggests different rate ranges for annual and perennial grasses. See label for details. Do not apply within 14 days of harvest.
	(Intensity One, Tapout) 1 EC	9 to 16 oz	0.07 to 0.125	Label recommends the inclusion of nonionic surfactant at 0.25% v/v. Do not apply more than 64 fluid ounces per acre per crop. Do not apply within 14 days of harvest.

[1]Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-10, Herbicide Resistance Management, for details.

Chemical Weed Control in Small Fruit Crops

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10A, Herbicide Modes of Action, for details.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Blackberries	PREPLANT-SITE PREPARATION Annual and perennial weeds	glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL (Roundup WeatherMax) 5.5 L	1 to 3 pt 0.8 to 2.4 pt 11 to 32 oz	0.5 to 1.5	Apply to emerged weeds at least 30 days before crop transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. See label for further instructions.
	PREEMERGENCE applied as a directed spray to control annual broadleaf and grass weeds	indaziflam, MOA 29 (Alion) 1.67 SC	3.5 to 5 fl oz	0.045 to 0.13	Use in plantings established 1 year or longer exhibiting good growth and vigor. Apply **ONLY** as a dormant application between late fall and early spring prior to bud swell. Two applications may be applied so long as there are at least 90 days between applications. DO NOT use on caneberries grown in sand or soils having a gravel content more than 20%. Total use rate cannot exceed more than 7 fl oz/A in soils having < 1% OM or 10 fl oz/A in soils having ≥ 1% OM. DO NOT allow spray to contact green stems, flowers, fruit, or foliage or unacceptable injury may occur. Tank mix with paraquat for non-selective POST weed control.
		pendimethalin, MOA 3 (Satellite HydroCap) 4 AS	2 to 6.3 qt	4 to 6	Apply as directed to spray at 2 to 6.3 qt per acre. May be applied as a single or sequential application as long as there are 30 days between applications and total use does not exceed 6.3 qt per acre per year. Satellite HydroCap has a 30-day PHI. Can be applied to newly planted caneberry either before or after transplanting (see label for details)
		mesotrione, MOA 27 (Callisto, Motif) 4L	3 to 6 oz	0.094 to 0.185	May be applied as split applications of 3 oz per acre followed by 3 oz per acre. If 2 applications are made, there must be at least 14 days between applications. Do not apply more than 6 ounces per acre per year. Do not apply after the onset of bloom stage or illegal residues may occur. The addition of crop oil concentrate at a rate of 1% v/v (1 gallon per 100 gallons of spray solution) is recommended for POST weed control.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Blackberries (continued)	PREEMERGENCE applied as a directed spray to control annual broadleaf and grass weeds (continued)	norflurazon, MOA 12 (Solicam) 80 DF	1.25 to 5	1 to 4	Apply to dormant caneberries established at least 1 year. Tank mix with paraquat for control of emerged weeds. The addition of simazine will expand spectrum of PRE control. Solicam has a 60-day PHI. In areas prone to soil movement injury to ground cover planted in row middles can occur.
		terbacil, MOA 5 (Sinbar) 80 WDG	1 to 2	0.8 to 1.6	Apply as a directed spray in early fall, winter, or spring before fruit set. Do not allow contact with desirable foliage. Sinbar has a 70-day PHI. Do not use on loamy sand and sandy soils or on soils having less than 1% organic matter. Do not use on eroded areas where subsoil is exposed. Tank mix with paraquat for non-selective POST weed control. Sinbar has POST emergence activity on some weeds like horseweed.
		simazine, MOA 5 (Princep or Simazine) 4L (Princep or Simazine) 90 DF	1 to 4 qt 1.1 to 4.4 lb	1 to 4	Use half rate on caneberries established less than 6 months. Rate is soil texture dependent therefore higher rates cannot be used on sandy loam, loamy sand, or sand soils. See label for soil texture precautions. Apply as a single application in spring or as a split application of 2 quarts/acre in spring followed by 2 quarts/acre in the fall. Do not apply when fruit is present or illegal residues may occur. Tank mix with pendimethalin or norflurazon for expanded residual control of annual grasses like crabgrass and goosegrass. Simazine may be applied in combination with paraquat for non-selective POST weed control.
		dichlobenil, MOA 20 (Casoron) 4G	100 lb	4 2 to 4	Apply in January or February. Rainfall or snow is needed for activation. Warm temperatures increase herbicide loss due to volatilization.
		sulfentrazone + carfentrazone, MOA 14 (Zeus Prime XC)	8 to 15 fl oz	0.22 to 0.41	Use in blackberry plantings that have been established at least 2 years. Zeus Prime may be applied twice per year so long as use rate does not exceed 15 fluid ounces per acre on a broadcast basis. Rainfall is needed within 2 weeks of application to ensure herbicide activation. Applications made after bud break must be made using hooded application equipment. There must be at least 60 days between sequential applications. Zeus Prime has a 3-day PHI. Tank mix with non-selective POST herbicides for broad spectrum control of emerged weeds. The addition of pendimethalin is necessary for expanded residual control of annual grass weeds. **Zeus will control yellow nutsedge.**
		rimsulfuron, MOA 2 (Solida, Matrix, Grapple) 25 WG	4 oz	0.063	Rimsulfuron has POST and PRE activity on broadleaf and some grass weeds. For broad spectrum residual control of annual grass weeds, tank mix rimsulfuron with pendimethalin or Sinbar. For nonselective POST weed control, tank mix rimsulfuron with paraquat. Do not treat blackberry plantings established less than 1 year. Rainfall for herbicide activation is necessary within 2 to 3 weeks of application. Do not apply within 21 days of harvest. The pH of spray solution should be in the range of 4 to 8. Rimsulfuron may be applied as a sequential application so long as total use rate does not exceed 4 ounces per acre per year and application is made in band to less than 50% of orchard floor. Allow at least 30 days between sequential applications. To reduce the risk of primocane injury, apply prior to primocane emergence or wait until primocanes are 3 feet tall. If primocanes are emerged at the time of application, chlorosis and stunting is likely but in most instances those primocanes recover.
		isoxaben, MOA 21 (Trellis SC) 4.16 SC	16 to 31 fl oz	0.52 to 1.0	Trellis may be tank mixed with pendimethalin to provide residual control of annual grass weeds. Do not apply more than twice per crop year and total use rate cannot exceed 1.0 lb ai per acre (31 fl oz) per crop year. For non-selective POST weed control tank mix with paraquat.
		flumioxazin, MOA 14 (Zaltus SX) 51 WDG (Chateau EZ) 4 SC (Tuscany) 4 SC	6 oz 6 fl oz	0.188	Apply as a directed spray. Use ONLY a single application per year. Flumioxazin has a 7-day PHI for caneberries. Tank mix with paraquat for non-selective POST weed control.
		fluridone, MOA 12 (Brake On!) 1.2 EC	21 to 43 fl oz	0.2 to 0.4	Apply as a directed spray for residual control of annual grass and broadleaf weeds. DO NOT apply more than 43 fl oz per acre per crop year or use in same area for more than 2 consecutive years. The PHI for Brake On! is 30 days. Sequential applications may be used. If using rates less than 32 fl oz another PRE herbicide should be included as a tank mix partner. Rimsulfuron, Diuron, and Simazine are tank mix options. For non-selective POST weed control tank mix with paraquat.
	POSTEMERGENCE Annual broadleaf weeds like pigweed, morningglory, lambsquarter, purslane, nightshade, tropical spiderwort, and smartweed	carfentrazone, MOA 14 (Aim) 2 EC	0.8 to 2 oz	0.013 to 0.03	Do not allow spray solution to contact desirable vegetation, foliage, flowers, or fruit. Every precaution should be taken to avoid herbicide injury related to herbicide drift. Use rate should not exceed 25 ounces/acre per year and there must be at least a 14-day interval between applications. The addition of a non-ionic surfactant at 0.25% v/v (1 quart per 100 gallons of spray solution) or crop oil concentrate at 1 to 2% v/v (1 to 2 gallons per 100 gallons of spray solution) is necessary for optimum herbicide performance. Aim has a 15-day PHI. Aim may be used to suppress primocane emergence. See label for instructions and rate information relative to primocane suppression.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Blackberries (continued)	POSTEMERGENCE Broadleaf and grass weeds including crabgrass, foxtail, morningglory sp., prickly lettuce, clover, and field bindweed	quinclorac, MOA 4 (Quinstar) 4L	12.6 fl. oz	0.375	Apply as a directed spray. Make no more than two applications per year. Allow at least 30 days between applications. The PHI for quinclorac in caneberries is 30 days. Include COC at rate of 2 pt per acre in the spray mixture.
	POSTEMERGENCE Non-selective broadleaf and grass weed control	paraquat, MOA 22 (Gramoxone, Firestorm, Parazone, Paraquat Concentrate or other brands) 3 SL	1.3 to 2.7 pt	0.5 to 1.0	Do not allow herbicide to directly contact desirable foliage or green canes. Young plants must be shielded, or severe crop injury or death will result. The addition of a non-ionic surfactant at 0.25% v/v (1 quart/100 gallons of spray solution) is necessary for adequate control. Paraquat can be tank mixed with PRE herbicides. DO NOT make more than 5 applications per year.
	POSTEMERGENCE Annual and perennial grass weeds	clethodim, MOA 1 (Select Max) 1 EC (Arrow) 2 EC	9 to 16 oz 6 to 8 oz	0.07 to 0.125	Low rates are for annual grass weeds. Use higher rates and sequential applications for perennial grass (bermudagrass or johnsongrass) control. Select Max and Intensity One need to be applied in combination with a non-ionic surfactant. Select and other generic formulations of clethodim require the addition of either a non-ionic surfactant or a crop oil concentrate. See label for specific information related to spray adjuvants. **The Select Max and Arrow brands are the ONLY formulations labeled for bearing caneberries and have a 7-day PHI. ALL other clethodim formulations are registered for use in non-bearing caneberries ONLY unless otherwise stated on the label.**
		fluazifop, MOA 1 (Fusilade DX) 2 EC	12 to 24 oz	0.19 to 0.38	Sequential applications will be necessary for perennial grass control. The addition of a non-ionic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gallon/100 gallons of spray solution) is necessary. Fusilade has a 1-day PHI. Total use rate cannot exceed 48 fl oz. per acre per year. Do not apply more than 24 fl oz/A in a single application or make more than 2 applications per year.
		sethoxydim, MOA 1 (Poast) 2 EC	1 to 2.5 pt	0.25 to 0.63	Sequential application will be necessary for perennial grass control. The addition of a non-ionic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gal/100 gal of spray solution) is necessary for optimum herbicide performance. Poast has a 50-day PHI.
Blueberries	PREPLANT-SITE PREPARATION Annual and perennial weeds	glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL (Roundup WeatherMax) 5.5 L	1 to 3 pt 0.8 to 2.4 pt 11 to 32 oz	0.5 to 1.5	Apply to emerged weeds at least 30 days before crop transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. See label for further instruction.
	PREEMERGENCE Annual weeds, some perennial (goldenrod), and woody weeds	hexazinone, MOA 5 (Velpar) 2 SL (Velpar) 75 DF	0.5 to 1 gal 1.3 to 2.6 lb	1 to 2	Apply as a directed spray to soil and weeds before blueberry leaf emergence but at least 50 (Velpar L CU) or 90 (Velpar DF CU) days before harvest. Use lower rates on poorly drained or sandy soils. Bushes must be established for at least 3 years.
	PREEMERGENCE Annual grass and broadleaf weeds	indaziflam, MOA 29 (Alion) 1.67 SC	3.5 to 5 fl oz	0.045 to 0.13	Use in plantings established 1 year or longer exhibiting good growth and vigor. Apply to blueberry where the soil has completely settled around the bushes and there are no exposed roots, open channels or depressions in the soil that would allow the product to move into the root zone or injury may occur. Apply **ONLY** as a dormant application between late fall and early spring prior to bud swell. Two applications may be applied so long as there are at least 90 days between applications. DO NOT use on blueberries grown in sand or soils having a gravel content more than 20%. Total use rate cannot exceed more than 7 fl oz/A in soils having < 1% OM or 10 fl oz/A in soils having ≥ 1% OM. DO NOT allow spray to contact green stems, flowers, fruit, or foliage or unacceptable injury may occur. Tank mix with paraquat for non-selective POST weed control.
	PREEMERGENCE Annual weeds (crabgrass, chickweed) and some perennial (dogfennel) weeds	dichlobenil, MOA 20 (Casoron) 4 G (Casoron CS) 1.4 L	100 to 150 lb 1.4 to 2.8 gal	4 to 6 2 to 3.92	Granular formulation should be applied in January or February. Rainfall or snow is needed for activation. Warm temperatures increase herbicide loss due to volatilization. The liquid formulation should be used during warmer temperatures (up to 70ºF) as it is less likely to volatilize. As with the granular formulation, it needs to be activated with rainfall. The liquid formulation may be tank mixed with other herbicides like paraquat.
	PREEMERGENCE Annual broadleaf weeds (Maryland meadowbeauty, pigweed spp., morninglory spp.) and some annual grasses (large crabgrass)	flumioxazin, MOA 14 (Chateau) 51 WDG	6 to 12 oz	0.19 to 0.375	Apply as a directed treatment to the base of the bush. Chateau should be tank-mixed with a registered burndown herbicide to control emerged weeds. Residual weed control will be reduced if vegetation prevents Chateau from reaching soil surface. PHI = 7 days. Do not apply to blueberries established less than 2 years unless they are protected from spray contact by nonporous wrap, grow tubes, or waxed containers. Do not apply more than 12 ounces per acre during a 12-month period. If a sequential application is applied, it must occur no earlier than 60 days after the first application. Do not apply more than 6 ounces per application to bushes less than 3 years old on soils having a sand plus gravel content greater than 80%.
	PREEMERGENCE Directed to the soil surface Annual grass and broadleaf weeds, yellow nutsedge suppression	*S*-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	0.67 to 1.33 pt	0.64 to 1.27	This is a Section 24(c) North Carolina Special Local Need Label. Growers must obtain label prior to making Dual Magnum applications. Growers must obtain label at www.syngenta-us.com/labels/indemnified-label-login. Avoid contact with crop foliage, or crop injury may occur. See label for rate range based on soil type. Blueberry plants less than 1 year may be more sensitive.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Blueberries (continued)	PREEMERGENCE Annual broadleaf weeds (morningglory, chickweed) and some annual grasses (large crabgrass)	diuron, MOA 7 (Karmex) 80 DF (Direx) 4 L	 1.5 to 2 lb 1.2 to 1.6 qt	1.2 to 1.6	Use only in fields that have been established for at least 1 year. Apply as a band treatment at the base of bushes. The addition of a surfactant will kill many small emerged weeds. May be applied in the spring and again in the fall after harvest.
	PREEMERGENCE Annual broadleaf weeds (pigweed, common purslane) and some annual grasses (crabgrass spp., fall panicum)	simazine, MOA 5 (Princep Caliber 90) 90 WDG (Princep) 4 L	 2.2 to 4.4 lb 2 to 4 qt	2 to 4	Apply half the maximum annual application in the spring before buds break and weeds emerge, and half after harvest. Do not apply more than 1 pound a.i. simazine on newly planted blueberries. Apply in minimum of 40 gallons of water per acre.
	PREEMERGENCE + POSTEMERGENCE Directed Underneath Bushes, Broadleaf weeds and some annual grasses	rimsulfuron, MOA 2 (Matrix) 25 WG (Solida) 25 WG (Grapple) 25 WG	4 oz	0.063	Application after bud break may cause temporary chlorosis and/or stunting of leaves contacted by the spray solution. For broad spectrum residual control, tank mix rimsulfuron with oryzalin. For nonselective POST weed control, tank mix rimsulfuron with glyphosate, paraquat, or glufosinate. Do not treat blueberries established less than 1 year. The best residual control is obtained when at least 0.5 inches of rain or overhead irrigation comes within the first week after application. The pH of spray solution should be in the range of 4 to 8. Do not use on soils classified as a Sand. Rimsulfuron may be applied as a sequential application so long as total use rate does not exceed 4 ounces per acre per year and application is made in band to less than 50% of floor. Do not apply within 21 days of first harvest.
	PREEMERGENCE Annual broadleaf weeds (chickweed, red sorrel from seed) and some annual and perennial grasses	pronamide, MOA 3 (Kerb) 3.3 SC (Kerb 50-W) 50 WG	2.5 to 5 pt 2 to 4 lb	1 to 2	Apply in the fall or winter. May be applied to newly planted bushes as long as roots are well established. Do not apply more than 2 lb ai or make more than 1 application per year.
	PREEMERGENCE Most annual broadleaf and grass weeds plus many perennials	terbacil, MOA 5 (Sinbar) 80 WDG	0.5 to 2 lb	0.4 to 1.6	Apply as directed spray in early spring or in fall after harvest. May be applied before weeds emerge or shortly after they emerge. Use only in plantings established 1 year or longer. Do not use on sandy soils with less than 3% organic matter. This herbicide can be very active but injurious on blueberries. See label for further information.
	PREEMERGENCE Annual broadleaf weeds	mesotrione, MOA 27 (Callisto) 4L	3 to 6 oz	0.094 to 0.185	May be applied as a split application of 3 ounces per acre followed by 3 ounces per acre no less than 14 days apart. Do not apply more than 6 oz per acre per year. Do not apply after the onset of bloom stage or illegal residues may occur.
	PREEMERGENCE Broadleaf weeds including corn spurry, common cocklebur, dayflower, horseweed, smartweed, wild mustard, wild radish, and pigweed	halosulfuron, MOA 2 (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.047	Do not apply to plants established less than 1 year. Rate dependent on age of bushes. Apply as a directed treatment to avoid contact with the crop. Occasional injury may occur. For nutsedge control, apply Sandea postemergence to the nutsedge (see Sandea listed below for postemergence control). PHI = 14 days.
	PREEMERGENCE Annual grasses and small seeded broadleaf weeds	napropamide, MOA 15 (Devrinol, Devrinol DF-XT) 50 DF (Devrinol) 10 G (Devrinol 2-XT)	 8 lb 40 lb 8 qt	4	Apply to weed-free soil surface. Enough irrigation or rainfall to wet the soil to a depth of 4 inches is necessary within 24 hours of application. Apply as a directed spray to the base of the blueberry plant. May be used on first-year plantings. If using Devrinol DF-XT or Devrinol 2-XT, time between application and irrigation is extended to 48 hours.
	PREEMERGENCE Annual broadleaf (morningglory, pigweed spp., common purslane) and annual grasses (crabgrass spp., barnyardgrass)	oryzalin, MOA 3 (Oryzalin or Surflan) 4 AS	2 to 4 qt	2 to 4	This treatment may be used on first year plants.
	PREEMERGENCE Broadleaf, grasses and sedge weeds	sulfentrazone, MOA 14 (Zeus XC) 4L	12 oz	0.375	Apply to crop that has been growing for at least 3 years and is in good condition. Avoid direct or indirect spray contact to foliage and green bark. Apply as a uniform broadcast soil application in a minimum of 10 gallons of water per acre. For best control, Zeus XC should be applied when there are no weeds present. If weeds are present, tank mix with a postemergence herbicide to eliminate emerged weeds. Do not apply more than 0.375 lb ai per acre per 12-month period. Appropriate soil moisture at time of application or at least ½ inch of rainfall or irrigation within 2 weeks after application is required to achieve desired level of weed control. Preharvest interval is 3 days.
	PREEMERGENCE Broadleaf weeds	isoxaben, MOA 21 (Trellis SC) 4.16 SC (Trellis) 0.75	1.33 lb	1.0	Trellis SC may be applied in bearing and non-bearing blueberry. Trellis 0.75 may only be applied in non-bearing blueberry. Apply as a uniform broadcast soil application in a minimum of 10 gallons of water per acre. For best control, Trellis should be applied when there are no weeds present. Appropriate soil moisture at time of application or at least ½ inch of rainfall or irrigation within 21 days after application is required to achieve desired level of weed control.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Blueberries (continued)	POSTEMERGENCE NON-SELECTIVE Most annual broadleaves and grasses and a few perennials	glufosinate, MOA 10 (Reckon 280 SL) 2.34 SL (Rely 280) 2.34 SL	48 to 82 oz	0.88 to 1.5	Apply as a directed spray to emerged weeds in a minimum of 20 gallons water per acre. Do not allow spray to contact desirable foliage or green bark. Preharvest interval is 14 days. The addition of a spray grade ammonium sulfate will enhance activity on difficult to control weeds. The use of additional surfactants or crop oil is not needed and/or may increase potential for crop injury.
		glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL (Roundup WeatherMax) 5.5 L	1 to 3 pt 0.8 to 2.4 pt 11 to 32 oz	0.5 to 1.5	DO NOT SPRAY GREEN CANES, BARK, OR FOLIAGE. Apply as a directed shielded spray to base of established plants. Do not apply within 14 days of harvest. Wiper applications may also be used. Perennial weeds may require higher rates of glyphosate. Certain glyphosate formulations require the addition of a surfactant. See label for specific rates for herbicide and surfactant.
	POSTEMERGENCE NON-SELECTIVE Contact kill of all green foliage	paraquat, MOA 22 (Gramoxone, Parazone, or other brands) 3 SL	1.3 to 2.7 pt	0.50 to 1	Apply as a directed spray to weeds before new canes emerge. The addition of a non-ionic surfactant at 0.25% v/v (1 quart/100 gallons of spray solution) is necessary for adequate control. Avoid paraquat contact with new canes, as injury will occur. Use of paraquat in rabbiteye blueberry can increase incidence of stem blight if herbicide contacts green stems. Rabbiteye producers should consider using other non-selective herbicides.
	POSTEMERGENCE	pelargonic acid, MOA 27 (Scythe) 4.2 SL	3 to 10% soln.		Apply as a directed or shielded spray.
	POSTEMERGENCE Broadleaf weeds up to 4 inches tall or 3 inches in diameter	carfentrazone-ethyl, MOA 14 Aim 2EC	1 to 2 oz	0.015 to 0.031	Apply as a hooded spray with application equipment designed to prevent spray deposit on green stems, leaf tissue, flowers, or fruit. Use in established fields only; do not use on newly set plants. May be used alone or tank-mixed with other herbicides. May be a good option for sodded middles as it does not control grasses. Add crop oil concentrate at 1% by volume (1 gal/100 gal of spray solution) or a nonionic surfactant at 0.25% by volume (1 qt/100 gal of spray solution).
	POSTEMERGENCE Yellow nutsedge and some broadleaf weeds	bentazon, MOA 6 (Basagran) 4SL	1.5 to 2 pt	0.75 to 1	NONBEARING ONLY. For yellow nutsedge control, 2 applications may be needed. Apply when plants are 6 to 8 inches tall. If needed, make a second application at the same rate 7 to 10 days later. Add crop oil concentrate to the spray solution at a rate of 2 pints in 20 to 50 gallons of water per acre.
	POSTEMERGENCE Goldenrod, dandelion, suppresses dock species	2,4-D choline salt, MOA 4 (Embed Extra) 3.8SL	3.0 pt	1.4	Make directed or shielded application in spring. Make directed application to row middles in summer or fall after harvest. Limited to one application per year to each growth stage. Do not allow spray solution to contact the blueberry foliage. Maximum of 6 pt per acre per year. PHI = 30 days. Do not spray under conditions when spray drift might occur.
	POSTEMERGENCE Yellow and purple nutsedge, pigweed, common ragweed, wild radish, wild mustard velvetleaf, smartweed, common cocklebur, dayflower, rice flatsedge	halosulfuron, MOA 2 (Sandea) 75 DG	0.75 to 1 oz	0.036 to 0.047	Do not apply to plants established less than 1 year. Apply as a directed treatment to avoid contact with the crop. Occasional injury may occur. See label for further instructions regarding nutsedge control. PHI = 14 days.
	POSTEMERGENCE Annual and perennial grasses	clethodim, MOA 1 (Arrow, Select, and others) 2 EC (Select Max and others) 1 EC	6 to 8 oz 9 to 16 oz	0.09 to 0.125 0.07 to 0.125	Select formulation is for use on nonbearing crop only (within 1 year of harvest). Select Max formulation may be applied as a directed spray to nonbearing and bearing crop. Select Max formulation requires the use of a nonionic surfactant rather than crop oil concentrate. PHI for Arrow and Select Max is 14 days.
		fluazifop, MOA 1 (Fusilade DX) 2 EC	16 to 24 oz	0.25 to 0.38	USE ON NONBEARING CROP ONLY. Postemergence grass control. Check label for specific rates and timings. Do not apply within 1 year of the first harvest. Use of a crop oil or surfactant will be necessary. Sequential applications are necessary for adequate control of perennial grasses.
		sethoxydim, MOA 1 (Poast) 1.5 EC	1.5 to 2.5 pt	0.3 to 0.5	Check label for specific rates and timings. Use a crop oil at a rate of 1 qt per acre. May be used on bearing blueberries. PHI = 30 days.
Grapes	PREEMERGENCE Directed Underneath Vines, Annuals and many perennials	dichlobenil, MOA 20 (Casoron) 4 G	100 to 150 lb	4 to 6 2 to 4	Do not apply Casoron 4G within 4 weeks of transplanting. Apply in January and February. High rate is necessary for perennial weed control.
	PREEMERGENCE Directed Underneath Vines, Annual broadleaf and grass weeds	simazine, MOA 5 (Princep Simazine) 90 WDG (Princep Simazine) 4 L	2.2 to 4.4 lb 2 to 4 qt	2 to 4	Apply before germination of annual weeds. Do not apply in vineyards less than 3 years old. Tank mix with glyphosate, paraquat, or glufosinate for POST weed control. Tank mixing simazine with pendimethalin will improve residual control of annual grasses and certain broadleaf weeds.
	PREEMERGENCE Directed Underneath Vines, Annual broadleaf weeds	isoxaben, MOA 21 (Trellis SC) 4.16	16 to 31 fl oz	0.5 to 1	Apply as a directed spray in newly planted vineyards once soil has settled after transplanting or in bearing vineyards. Total use rate per year (from harvest to harvest) cannot exceed 31 fl oz/A. Trellis SC has a 60-day PHI. Tank mix with pendimethalin for preemergence control of annual grasses.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Grapes (continued)	PREEMERGENCE Directed Underneath Vines, Annual broadleaf weeds (continued)	flumioxazin, MOA 14 (Zaltus SX, Flumi, Tuscany) 51 SW (Tuscany) 4 SC (Chateau EZ) 4 SC	6 to 12 oz 6 to 12 fl oz	0.19 to 0.375	Apply as a directed spray using hooded or shielded application equipment. The trunks of grape vines established less than 2 years must be shielded from contact with spray solution using grow tubes. Do not apply after flowering unless using hooded or shielded application equipment and applicator can ensure spray material does not contact fruit or desirable foliage. DO NOT tank mix with glyphosate when applying flumioxazin after bud break due to increased injury potential. Do not apply more than 6 ounces per acre per application to vines less than 3 years old on soils having a sand plus gravel content greater than 80%. DO NOT apply sequential applications closer than 30 days apart. Total use rate cannot exceed 24 ounces/acre per year. Flumioxazin has a 60-day PHI.
		diuron, MOA 7 (Diuron, Karmex XP)	2 to 3 lb	1.6 to 2.4	Apply before germination of annual weeds. Vineyards must be at least 3 years old. Higher rate may be used on soils with greater than 2% organic matter and high clay content. Do not use on sandy loam or coarser soils. Tank mix with glyphosate, paraquat, or glufosinate for POST weed control. Applications in vineyards having less than 2% organic matter may cause injury if heavy rainfall occurs soon after application. This risk is assumed by user.
		indaziflam, MOA 29 (Alion) 1.67 SC	3.5 to 5 fl oz	.045 to .065	Use in vineyards established 3 years or longer and on vines having good growth and vigor. Grapes must have a 6-inch barrier between the soil surface and a major portion of the vine's root system. DO NOT use on grapes planted in sand soils. Rate is soil-texture dependent. See label for details. Total use rate cannot exceed 5 fl oz/A in a 12-month period. When making more than 1 application per year allow at least 90 days between applications. Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control.
	PREEMERGENCE Directed Underneath Vines, Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O or Satellite HyrdroCap) 4E	2 to 6.3 qt	2 to 6	In newly planted grapes allow soil to settle after transplanting before applying pendimethalin. Use only during dormancy (prior to bud swell) when applying around newly planted and 1-year-old vines. In bearing vineyards apply any time after harvest, during winter dormancy, in spring, and in season before harvest. Use rate cannot exceed 6.3 quarts/acre per year. Pendimethalin has a 21-day PHI. Tank mix with simazine or rimsulfuron for expanded residual control of broadleaf weeds. Apply in combination with paraquat, glyphosate, or glufosinate for non-selective POST weed control.
	PREEMERGENCE + POSTEMERGENCE Directed Underneath Vines for control of broadleaf weeds and some annual grasses	sulfentrazone + carfentrazone, MOA 14 (Zeus Prime XC)	8 to 15 fl oz	0.22 to 0.41	Use in vineyards that have been establish at least 2 years. When applied in a band treating less than 50% of the vineyard floor, Zeus Prime may be applied twice per year so long as use rate does not exceed 15 fluid ounces per acre on a broadcast basis. Rainfall is needed within 2 weeks of application to ensure herbicide activation. Applications made after bud break must be made using hooded application equipment. There must be at least 60 days between sequential applications. Zeus Prime has a 3-day PHI. Tank mix with non-selective POST herbicides for broad spectrum control of emerged weeds. The addition of pendimethalin is necessary for expanded residual control of annual grass weeds. **Zeus will control yellow nutsedge.**
		indaziflam + rimsulfuron MOA 29 and 2 (Centrus)	3 to 4.3 oz	0.076 to 0.110	Use in vineyards established 3 years or longer. Grapes must have a 6-inch barrier between the soil surface and a major portion of the vine's root system. DO NOT use on grapes planted in sand soils. Rate is soil-texture dependent. See label for details. Tank mix with paraquat, glufosinate, or glyphosate for non-selective POST weed control.
	+ POSTEMERGENCE Directed Underneath Vines for control of broadleaf weeds and some annual grasses	flazasulfuron, MOA 2 (Mission) 25 WG	2.14 to 2.85 oz	0.033 to 0.045	Use in vineyards established at least 3 years. Use of grow tubes is required in 3rd year vines to minimize potential for injury. Allow at least 90 days between sequential applications. Mission has a 75 day PHI. DO NOT apply more than 5.7 oz per acre per year. Tank mix with glyphosate or glufosinate for non-selective POST weed control. For expanded residual control tank mix with pendimethalin, simazine, or diuron.
	PREEMERGENCE Directed Underneath Vines, Broadleaf weeds and some annual grasses	rimsulfuron, MOA 2 (Matrix, Pruvin, Solida or Grapple) 25 WG	4 oz	0.063	Rimsulfuron has POST and PRE activity on broadleaf and some grass weeds. For broad spectrum residual control, tank mix rimsulfuron with pendimethalin, or diuron. For nonselective POST weed control, tank mix rimsulfuron with glyphosate, paraquat, or glufosinate. Do not treat vineyards established less than 1 year. Rainfall for herbicide activation is necessary within 2 to 3 weeks of application. Do not apply within 14 days of harvest. The pH of spray solution should be in the range of 4 to 8. Rimsulfuron may be applied as a sequential application so long as total use rate does not exceed 4 ounces/acre per year and application is made in band to less than 50% of vineyard floor.
	POSTEMERGENCE Directed Underneath Vines, Non-selective weed control	paraquat, MOA 22 (Gramoxone, Paraquat Concentrate, Parazone or other various brands) 3 SL	1.7 to 2.7 pt	0.66 to 1	Apply in 20 gallons per acre spray mix when grass and weeds are 1 to 6 inches high and succulent for best results. Direct spray with low pressure to avoid contact with foliage or bark less than 1 year old. Add a nonionic surfactant at a rate of 32 ounces per 100 gallons of spray solution. May be used for sucker suppression. See label for details.
		glyphosate, MOA 9 (various brands and formulations)	See label	1 to 2	DO NOT SPRAY GREEN BARK OR FOLIAGE. Apply preplant or as a directed spray to base of established vines. Do not treat within 14 days of harvest. Wiper applications may also be used. Perennial weeds may require higher rates of glyphosate. See label for specific rates. Do not apply in late summer or fall. Some formulations may require the addition of a surfactant.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Grapes (continued)	POSTEMERGENCE Directed Underneath Vines, Non-selective weed control (continued)	glufosinate, MOA 10 (Cheetah, Reckon, Rely, Innerline, Surmise, and various brands) 2.34 SL	48 to 82 oz	0.88 to 1.5	Apply as a directed spray to emerged weeds in a minimum of 20 gallons water per acre with a minimum of 30 psi spray pressure when weeds are 1 to 6 inches high. For spot application, use 1.7 ounces per gal of water and spray to wet but not runoff; however, spot spray solution should not contact vines or injury can occur. Do not allow spray to contact desirable foliage or green bark. Do not apply within 14 days of harvest. See label for specific rates. Do not make more than 3 applications per year. The addition of a spray grade ammonium sulfate will enhance Rely 280 activity on difficult to control weeds. The use of additional surfactants or crop oil is not needed and may increase potential for crop injury.
	POSTEMERGENCE, Directed Underneath Vines, Annual broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Broadloom) 4	1.5 to 2 pt	0.75 to 1	Non-bearing use ONLY! Do not apply more than 2 pt per acre per application and total use for the year cannot exceed 4 pts per acre. Do not allow herbicide to contact green stems, bark or foliage. For yellow nutsedge control, apply 2 pts per acre when nutsedge is 6 to 8" tall and make a second application of the same rate 7 to 10 days later. Use in combination with a crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution).
	POSTEMERGENCE, Directed Underneath Vines, Annual broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.5 to 1.6 oz	0.008 to 0.025	Apply as a directed spray or as a hooded spray. DO NOT allow spray solution to contact green tissue, leaves, flowers, or fruit. Aim may be used alone, or tank mixed with other herbicides; see label for tank mixing instructions. Aim controls cocklebur, pigweed, nightshade, velvetleaf, carpetweed, and spreading dayflower. Do not apply within 3 days of harvest. Apply in minimum spray volume of 20 GPA. Apply in combination with crop oil concentrate at 1% v/v (1 gal/100 gal of spray solution) or a nonionic surfactant at 0.25% v/v (1 qt/100 gal of spray solution). Do not use on newly transplanted vines.
		clethodim, MOA 1 (Arrow, Select, others) 2 EC (Select Max and others) 1 EC	6 to 8 oz 9 to 16 oz	0.07 to 0.125	USE ON NONBEARING CROP ONLY. Postemergence grass control. Very effective in controlling bluegrass. Do not apply within 1 year of harvest. See label for all other instructions. Sequential applications necessary for adequate control of perennial grass weeds. Always apply 80% active ingredient nonionic surfactant at a rate of 0.25% volume per volume (1 pt/50 gal of spray).
		fluazifop, MOA 1 (Fusilade DX) 2 EC	16 to 24 oz	0.25 to 0.38	Sequential applications will be necessary for perennial grass control. Check label for rates and timings for specific weeds. Do not apply within 50 days of harvest. Use of a crop oil or surfactant will be necessary.
		sethoxydim, MOA 1 (Poast) 1.5 EC	1.5 to 2.5 pt	0.3 to 0.5	Postemergence grass control. Check label for rates and timings for specific grasses. Use a crop oil at a rate of 1 quart per acre. Do not apply within 50 days of harvest. Sequential applications necessary for adequate control of perennial grass weeds.
Strawberries (matted row)	PREEMERGENCE Most annual grasses and small-seeded broadleaf weeds	napropamide, MOA 15 (Devrinol, Devrinol DF-XT) 50 DF (Devrinol) 2 EC	4 to 8 lb 8 qt	2 to 4	Apply to established plants before weed emergence anytime, except the interval between bloom and harvest. Apply to established plantings in fall to early spring prior to bloom. See label for notes on irrigation requirement.
	PREEMERGENCE Most annual broadleaf weeds and grass weeds	terbacil, MOA 5 (Sinbar) 80 WDG	2 to 6 oz	0.1 to 0.3	For planting year: apply 2 to 3 ounces of Sinbar per acre after transplanting but before new runner plants start to root. If strawberry transplants are allowed to develop new foliage prior to Sinbar application, apply 0.5 to 1 inch irrigation or rainfall immediately after application. For control of winter weeds: apply 2 to 6 ounces Sinbar per acre in late summer or early fall. If crop is not dormant, the application must be followed immediately by 0.5 to 1 inch irrigation or rainfall. To extend weed control through harvest of the following year, apply 2 to 4 ounces Sinbar per acre just prior to mulching in the late fall. For harvest years: after postharvest renovation and before new growth begins in midsummer, apply 4 to 6 ounces of Sinbar per acre. To extend weed control through harvest of the following year, apply 4 to 6 ounces of Sinbar per acre just prior to mulching in late fall. Do not apply within 110 days of harvest. See label for more information.
	PREEMERGENCE Henbit, chickweed, cutleaf evening primrose, wild radish	flumioxazin, MOA 14 (Chateau) 51 SW	3 oz	0.096	**Crop row**. Apply to **dormant** strawberries for the preemergence control of weeds. Crop oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v may be added to help control small emerged broadleaf weeds. **Row middle.** Use a hooded or shielded applicator. DO NOT apply over strawberries. Apply prior to weed emergence. Crop spotting may occur if adjuvant is used. DO NOT APPLY AFTER FRUIT SET.
	PREEMERGENCE Yellow nutsedge, purple nutsedge, corn spurry, yellow woodsorrel, henbit, chickweed	sulfentrazone, MOA 14 (Spartan) 4F	4 to 8 oz		Please refer to label for soil type restrictions.
	POSTEMERGENCE Broadleaf weeds including vetch, clover, dock, sowthistle, and thistle	clopyralid, MOA 4 (Stinger) 3 EC	Spring: 0.67 pt Post harvest: 0.33 to 0.67 pt	0.125 to 0.25	Apply postemergence in spring or postharvest to control emerged broadleaf weeds in established strawberries. Do not tank mix with surfactant or other pesticides. PHI = 30 days.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Strawberries (matted row) (continued)	POSTEMERGENCE Annual broadleaf weeds	2,4-D amine, 4, MOA 1 (Amine 4 2,4-D Weed Killer) 4 SL	2 to 3 pt	1 to 1.5	Apply to well-established strawberries after harvest and before runners form or when crop is dormant. Not more than 2 treatments per year. Do not apply during bud, flower, or fruit stage. Timing is very critical to avoid damage. Do not apply unless possible injury to crop is acceptable.
		acifluorfen, MOA 14 (UltraBlazer) 2 L	0.5 to 1.5 pt	0.125 to 0.375	**Crop row**. Apply after last harvest or following bed renovation. A second application can be made in late fall or early spring when plants are dormant. **Row middle.** May be applied up to 1.5 pints/acre. PHI = 120 days.
	POSTEMERGENCE NON-SELECTIVE Contact kill of all green foliage	paraquat, MOA 22 (Gramoxone, Parazone) 3 SL	1.3 pt	0.5 to 1	For control of emerged broadleaf and grass weeds, use shields and direct spray between the rows to prevent contact with strawberry foliage. Use a nonionic surfactant at a rate of 32 ounces per 100 gal spray mix or 1 gallon approved crop oil concentrate per 100 gal spray mix. Do not apply within 21 days of harvest.
	POSTEMERGENCE Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of emerged grasses in strawberries. With Arrow and Select, add 1 gallon crop oil concentrate per 100 gallons spray mix. With Select Max, add 0.25% nonionic surfactant, 1 quart per 100 gallons spray mix. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 4 days of harvest.
		fluazifop, MOA 1 (Fusilade DX) 2 EC	16 to 24 oz	0.25 to 0.38	USE ON NONBEARING CROP ONLY. Postemergence grass control. Check label for rates and timings for specific weeds. Do not apply within 1 year of the first harvest. Use of a crop oil or surfactant will be necessary.
		sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 quart of crop oil concentrate per acre. Do not apply on days that are unusually hot and humid. Do not apply within 7 days of harvest.
Strawberries (plasticulture) Preplant	PREEMERGENCE Yellow and purple nutsedge, broadleaf and grass weeds	EPTC, MOA 15 (Eptam) 7E	3.5 to 7 pt	3 to 6	No research has been conducted in NC. For best control of nutsedge, soil must have enough moisture for tuber sprouting. Allow 10 to 14 days for nutsedge tuber sprouting to occur, then lightly till to destroy shoots and dry the soil surface. Apply and incorporate Eptam 7E to prevent volatilization, immediately incorporate into soil to a depth of approximately 2 to 4 inches. If possible, use a leveling device behind the incorporating equipment to leave soil surface as smooth as possible. Field traffic, excessive rainfall, or irrigation and other soil disturbances will reduce the level of nutsedge suppression. To avoid injury to following crops, irrigating at least 30 days prior to planting is recommended. Do not plant crops not on Eptam 7E label for 45 days after application.
	PREEMERGENCE Broadleaf weeds	acifluorfen, MOA 14 (Ultra Blazer) 2 L	0.5 to 1.5 pt	0.125 to 0.375	**Crop row.** Make 1 banded application before laying plastic mulch and after final land preparation, and prior to transplanting the crop. For best results, avoid soil disturbance during laying of plastic and planting of crop. **Row middles between plastic mulch rows.** Apply as a direct-shielded application to strawberry row middles between mulched beds. DO NOT ALLOW ULTRA BLAZER TO CONTACT STRAWBERRY PLANTS. Limited research has been conducted with Ultra Blazer in North Carolina.
	PREEMERGENCE Annual grasses and broadleaf weeds	napropamide, MOA Unknown (Devrinol, Devrinol 2-XT) 2 EC (Devrinol, Devrinol DF-XT) 50 DF	8 qt 8 lb	4	Devrinol applied to bed before laying the plastic has potential to injure strawberry plants. For plantbed treatment, preplant incorporate to weed-free soil before laying plastic mulch. Soil should be well worked yet moist enough to permit a thorough incorporation to a depth of 2 inches incorporated within 24 hours of application before laying of plastic mulch. If weed pressure is from small-seeded annuals, apply Devrinol to the surface of the bed immediately in front of the laying of the plastic mulch. If soil is dry, water or sprinkler irrigate with sufficient water to wet to a depth of 2 to 4 inches before covering with plastic mulch. Lay the plastic mulch over the treated soil on the same day as the Devrinol application.
	PREEMERGENCE Broadleaf weeds including Carolina geranium and cutleaf eveningprimrose, and a few annual grasses	oxyfluorfen, MOA 14 (Goal) 2 XL	up to 2 pt	up to 0.5	Apply to the soil surface of pre-formed beds at least 30 days prior to transplanting crop for control of many broadleaf weeds that will emerge from hole near crop. While incorporation is not necessary, it may result in less crop injury. Soil disturbance after application will reduce weed control. Plastic mulch can be applied any time after applying Goal, but best results are likely if it is applied soon after Goal.
	PREEMERGENCE Annual broadleaf weeds including cutleaf evening primrose, henbit, chickweed, horseweed, wild radish and some annual grasses	flumioxazin, MOA 14 (Chateau SW) 51 WDG	3 oz	0.096	**Crop row.** Apply a minimum of 30 days prior to transplanting and prior to plastic mulch being laid. **Row middles between plastic mulch rows.** Apply only to row middles. DO NOT APPLY over top of strawberries. Apply prior to weed emergence and prior to fruit set. Crop spotting may occur if an adjuvant is added. Application after fruit set may result in spotting of fruit and should be avoided. Do not allow spray drift to come in contact with fruit or foliage.

Table 7-12A. Chemical Weed Control in Small Fruit Crops

Crop	Timing/Targeted Weeds	Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Strawberries (plasticulture) Preplant (continued)	PREEMERGENCE Yellow nutsedge, purple nutsedge, corn spurry, yellow woodsorrel, henbit, chickweed	sulfentrazone, MOA 14 (Spartan) 4F	4 to 8 oz	0.125 to 0.25	Please refer to label for soil type restrictions.
	POSTEMERGENCE Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 2.5 pt	0.2 to 0.5	Apply as a postemergence application to kill emerged grasses. Most effective on actively growing grasses. See label for specific rates and best times to treat. Add 1 quart per acre of crop oil concentrate to spray solution. Very effective control of ryegrass but will not control sedges. Also, effective on volunteer small grains (wheat). Do not tank mix with other pesticides. PHI = 7 days.
		clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply as a postemergence application to kill emerged grasses. Use high rate and sequential applications for perennial grasses (bermudagrass or johnsongrass). With Arrow, Clethodim, Intensity, and Select, add 1 gallon crop oil concentrate per 100 gallons spray mix. With Intensity One and Select Max, add 0.25% nonionic surfactant, 1 quart per 100 gallons spray mix. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. PHI = 4 days.
	POSTEMERGENCE Broadleaf weeds including vetch, clover, dock, sowthistle, and thistle	clopyralid, MOA 4 (Stinger) 3 EC	0.33 to 0.5 pt	0.125 to 0.187	**Crop row.** Apply postemergence over crop for postemergence control. Do not use with other pesticides or surfactants. Do not apply within 30 days of harvest.DO NOT compost treated vegetation if compost will be used on sensitive plants
Strawberries (plasticulture) Row Middles	PREEMERGENCE Annual grasses and small-seeded broadleaf weeds	napropamide, MOA Unknown (Devrinol, Devrinol DF-XT) 50 DF (Devrinol, Devrinol 2-XT) 2EC	8 lb 8 qt	4	Apply as a banded preemergence treatment to the middles between plastic before weed emergence. Tank mixture with paraquat will provide pre- and postemergence weed control. Rainfall or irrigation within 24 hours after Devrinol application is needed for optimum control. Effective on volunteer small grains (wheat) if applied before emergence.
	PREEMERGENCE Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 EC	1.5 pt	0.72	Avoid contact with strawberry plant. See label for more information. PHI = 35 days.
	POSTEMERGENCE Annual broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 inches tall or rosettes less than 3 inches across. Use a crop oil concentrate at up to 1 gallon per 100 gallons solution or a nonionic surfactant at 2 pints per 100 gallons of spray solution. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides. PHI = 0 days.
	POSTEMERGENCE Broadleaf weeds including vetch, clover, dock, sowthistle, thistle	clopyralid, MOA 4 (Stinger) 3 EC	0.33 to 0.67 pt	0.125 to 0.25	Do not tank mix with other pesticides. Do not include an adjuvant. PHI = 30 days.
	POSTEMERGENCE NON-SELECTIVE Contact kill of green foliage	paraquat, MOA 22 (Gramoxone, Parazone or other brands) 3 SL	1.3 pt	0.5	Apply as a banded treatment using shields to the middles between plastic to kill emerged weeds. To avoid injury, do not allow spray to contact strawberry plants. Add a nonionic surfactant at a rate of 32 ounces per 100 gallons or 1 gallon approved crop oil concentrate per 100 gallons spray solution. Do not apply more than 3 times per season. PHI = 21 days.
	POSTEMERGENCE NON-SELECTIVE Most emerged weeds	glyphosate, MOA 9 (Roundup WeatherMax) 5.5L	11 to 22 oz	0.5 to 0.94	Apply as a hooded spray in row middles or shielded spray in row middles or wiper applications in row middles or postharvest. To prevent severe injury to crop, do not let herbicide contact foliage, green shoots or stems, exposed roots, or fruit of crop. PHI = 14 days.
	POSTEMERGENCE	pelargonic acid, MOA 27 (Scythe) 4.2 SL	3 to 10% soln.		Apply with hooded or shielded sprayer for weed control in row middles. See label for directions.
	POSTEMERGENCE Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 2.5 pt	0.2 to 0.5	Apply as a postemergence application to kill emerged grasses. Most effective on actively growing grasses. See label for specific rates and best times to treat. Add 1 quart per acre of crop oil concentrate to spray solution. Very effective control of ryegrass but will not control sedges. Also, effective on volunteer small grains (wheat). PHI = 7 days.
		clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply as a postemergence application to kill emerged grasses. With Arrow, Clethodim, Intensity, and Select, add 1 gallon crop oil concentrate per 100 gallons spray mix. With Intensity One and Select Max, add 0.25% nonionic surfactant, 1 quart per 100 gallons spray mix. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. PHI = 4 days.

[1] Mode of action (MOA) code developed by the Weed Science Society of America. See TABLE 7-10A, Herbicide Modes of Action, for details.

Chemical Weed Control in Tree Fruit Crops

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10, Herbicide Resistance Management, for details.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Apples, Preemergence Directed Underneath Tree	Annual and perennial grass and broadleaf weeds	dichlobenil, MOA 20 (Casoron) 4 G	100 to 150 lb	4 to 6 2 to 3.92	For best results apply Casoron 4G in January or February. Casoron 4G can be used in newly planted orchards once trees have been planted for 4 weeks.
	Annual grasses and broadleaf weeds	diuron, MOA 7 (Diuron, Karmex DF) 80 WDG (Direx, Diuron) 4L	2 to 4 lb 1.6 to 3.2 qt	1.6 to 3.2	Apply in spring (March thru May) to trees established in the orchard for at least 1 year. Best results occur if rainfall occurs within 2 weeks of application. DO NOT treat varieties grafted on full-dwarf rootstocks. When using sequential applications allow at least 90 days between applications and total use rate cannot exceed 4 pounds/acre per year. Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control.
		flumioxazin, MOA 14 (Tuscany, Flumi) 51 WG (Zaltus SX) 51 WG (Tuscany) 4 SC (Chateau EZ) 4 SC	6 to 12 oz 6 to 12 fl oz	0.19 to 0.38	Flumioxazin is for newly planted and established orchards. Shield the trunks of trees established less than 1 year from contact with spray solution. Tank mix with glyphosate, glufosinate, or paraquat for POST weed control. After budbreak, only tank mix with glufosinate or paraquat to minimize the risk of crop injury associated with drift or inversion. Do not apply more than 6 ounces per acre to trees planted less than 3 years in soil having a sand plus gravel content more than 80%. Sequential applications are very effective. Do not apply within 60 days of harvest. Flumioxazin may only be applied after final harvest and no later than pink flower bud in bearing orchards. Do not use more than 24 ounces of flumioxazin in a 12-month period. When applying after bud break in non-bearing orchards use hooded application equipment.
		indaziflam, MOA 29 (Alion) 1.67 SC	3.5 to 6.5 oz	0.046 to 0.085	Use in orchards established 3 years or more. See label for details pertaining to replants in established orchards. Allow at least 90 days between applications. Use rate cannot exceed 3.5 fluid ounces per acre per application on soils having less than 1% organic matter and total use rate for the year cannot exceed 7 fl oz/acre. On soils with an organic matter content from 1 to 3%, no more than 5 fluid ounces/acre can be applied in a single application and the total use rate for the year cannot exceed 8.5 fluid ounces/acre. In order to apply more than 5 fluid ounces/acre in a single application, soil organic matter must be >3%. Do not use on soils that have a 20% or greater gravel content. Do not use in orchards with open channels or cracks in soil— Alion has a 14-day PHI. Tank mix with glyphosate, glufosinate, or paraquat for nonselective POST weed control.
		fluridone, MOA 12 (Brake On!) 1.2L	21 to 43 fl oz	0.2 to 0.4	Brake On! provides PRE control of broadleaf and annual grass weeds. Sequential applications may be used so long as the total use rate cannot exceed 43 fl oz per acre per year. Do not use this product more than **two consecutive years** in a row. Brake On! has a 30-day PHI. Use in orchards that have been established 1 year or more. Tank mix with non-selective POST herbicides like glyphosate, glufosinate, or paraquat to control emerged weeds.
	Annual broadleaf weeds (PRE and POST Control)	mesotrione, MOA 27 (Motif) 4 L	3 to 6 fl oz	0.094 to .188	Motif will provide PRE and POST control of certain annual broadleaf weeds. It may be applied as directed spray in orchards established 12 months or longer. DO NOT allow spray solution to contact with crop foliage, stems, or fruit to prevent bleach injury that is typically temporary. Do not harvest fruit within 30 days of application. Up to 4 applications may be used so long as the total annual use rate does not exceed 12 fl oz per acre per year. Using crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution) or a non-ionic surfactant at 0.25 % v/v (1 qt per 100 gal of spray solution) is necessary for effective POST control. The addition of ammonium sulfate will increase efficacy when used in combination with a crop oil concentrate or a non-ionic surfactant. Motif can be tank mixed with diuron, glufosinate, glyphosate, Alion, paraquat, pendimethalin, rimsulfuron, or simazine.
		indaziflam + rimsulfuron, MOA 29 and 2 (Centrus) WDG	3 to 5.6 oz	0.076 to 0.143	Centrus will provide PRE and POST control of certain annual broadleaf weeds. Do not use on soils with 20% or more gravel content. Use on trees established 3 years or more. Do not apply within 14 days of harvest. Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control.
	Annual grasses and small seeded broadleaf weeds	norflurazon, MOA 12 (Solicam) 80 WDG	2.5 to 5 lb	2 to 4	Can be tank mixed with diuron, Goal, paraquat, Prowl, glyphosate, simazine, rimsulfuron, or oryzalin. Do not apply to newly transplanted trees until ground has settled. Rate is soil texture dependent. See label for details. PHI is 60 days. Multiple applications per season are allowed as long as cumulative rate does not exceed maximum use rate for soil texture and crop.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Apples, Preemergence Directed Underneath Tree (continued)	Annual grasses and small seeded broadleaf weeds (continued)	pendimethalin, MOA 3 (Prowl H_2O) 4 AS (Satellite HydroCap)	2 to 4.2 qt	2 to 4	Most effective when adequate rainfall or overhead irrigation occurs within 7 days of application. Do not apply to newly transplanted trees until ground has settled. Rainfall within 7 to 10 days of application is necessary for herbicide activation. Tank mix with paraquat for POST weed control. 60-day preharvest interval (PHI). May be applied as a sequential application as long as rate does not exceed 4.2 quarts/acre per year. Allow 30 days between applications.
	Broadleaf weeds and some annual grasses	rimsulfuron, MOA 2 (Grapple, Matrix, Solida, Pruvin) 25 WG	4 oz	0.063	For broad spectrum residual control, tank mix with diuron, Sinbar, or pendimethalin. For nonselective POST control, apply in combination with glyphosate or paraquat. Rimsulfuron does have POST activity on certain broadleaf weeds (see label for list). Rimsulfuron will control emerged horseweed less than 3 inches tall when applied in combination with a non-ionic surfactant and a spray grade ammonium sulfate (2 pound/acre). **DO NOT** treat orchards established less than 1 year. Rainfall within 2 to 3 weeks of application is necessary for herbicide activation. Spray solutions having a pH of less than 4.0 or greater than 8.0 will result in herbicide degradation. Rimsulfuron has a 7-day PHI for apples. Rimsulfuron may be applied as a sequential application so long as total use rate does not exceed 4 ounces/acre per year and application is made in a band on less than 50% of orchard floor. Allow at least 30 days between applications.
		Penoxsulam + oxyfluorfen, MOA 2 and 14 (Pindar GT) 4	1.5 to 3 pt	0.75 to 1.5	Pindar GT can be applied after harvest up until bud swell in the fall to late winter/early spring time frame. **DO NOT** use after bud break until completion of final harvest or in orchards established less than 4 years, however the label does allow for use on trees established 18 months or longer in NC, SC, or VA. **DO NOT** use in soils that contain less than 20% clay or greater than 70% sand. For non-selective POST control tank mix with glufosinate, glyphosate, or paraquat. For expanded residual control of annual grass weeds tank mix with pendimethalin or Solicam.
	Annual broadleaf and grass weeds	simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt 2.2 to 4.4 lb	2 to 4	Apply preemergence to trees that have been established 1 year or more. Apply with glyphosate, paraquat, or glufosinate for postemergence weed control. PHI for simazine is 150 days. Tank mixing simazine with pendimethalin or, Solicam, will expand residual control of annual grasses and certain broadleaf weeds.
	Annual broadleaf weeds and **yellow nutsedge**	sulfentrazone + carfentrazone-ethyl, MOA 14 (Zeus Prime XC) 3.5 XC	8 to 15 oz	0.21 to 0.41	Use only in orchards established 2 years or longer. Avoid contact with green tissue or bark. Sequential applications of Zeus Prime can be applied when directed as a banded application (50% band or less of orchard floor) so long as total use rate does not exceed 15.1 fl oz/acre on a broadcast basis within a year and the second application is not applied within 60 days of the initial application. Zeus Prime has a 14-day PHI. For optimum residual control of annual grass weeds tank mix with pendimethalin or norflurazon. Tank mix glyphosate, glufosinate, or paraquat for non-selective POST weed control. **DO NOT** tank mix with products containing flumioxazin (Chateau, Tuscany, for example) or other herbicides containing sulfrentrazone.
	Broadleaf and grass weeds	terbacil, MOA 5 (Sinbar) 80 WDG	2 to 4 lb	1.6 to 3.2	Use only on trees that have been established 3 years or more. Tank mixing Sinbar with diuron allows Sinbar to be used in orchards established 1 year or longer. Rate varies with soil organic matter. See label for details. Apply no more than 3 lb unless soil organic matter is greater than 2%. Do not use on sand or loamy sand soils. Do not use on soils having less than 1% organic matter. Sinbar has a 60-day PHI. Tank mix with glyphosate, paraquat or glufosinate for non-selective postemergence weed control.
	Most annual broadleaf weeds and grass weeds in **NEWLY PLANTED NON-BEARING ORCHARDS**	terbacil, MOA 5 (Sinbar) 80 WDG	0.5 to 1.0 lb	0.4 to 0.8	Apply once adequate rainfall has occurred allowing the soil to settle after transplanting. Apply no more than 1 pound per acre per year. For best results, apply 0.5 pound in spring followed by another 0.5 pound when control from initial application fails. Do not use on soils coarser than sandy loams or soils with less than 1% organic matter. Tank mix with paraquat for non-selective postemergence weed control.
Apples, Preemergence Tank Mixes	Many annual and perennial grass and broadleaf weeds	diuron, MOA 7 (Diuron or Karmex XP) 80 WDG (Direx) 4 L + terbacil, MOA 5 (Sinbar) 80 WDG	1 to 2 lb 1.6 to 3.2 qt + 1 to 2 lb	0.8 to 1.6 0.5 to 1 + 0.8 to 1.6	DO NOT treat varieties grafted on full-dwarf rootstocks. Use only on trees established in orchard for 2 years. See labels for details. See labels for soil texture and organic matter restrictions.
		norflurazon, MOA 12 (Solicam) 80 WDG + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2.5 to 5 lb + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	See labels for details. Apply in combination with paraquat, glyphosate, or glufosinate for postemergence control.
		pendimethalin, MOA 3 (Prowl H2O or Satellite Hydrocap) 4 AS + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	See labels for details. Apply in combination with paraquat, glyphosate, or glufosinate for postemergence control.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Apples, Preemergence Tank Mixes (continued)	Annual grasses and broadleaf weeds (continued)	rimsulfuron, MOA 2 (Matrix, Solida, Pruvin, Grapple) 25 WG + terbacil, MOA 5 (Sinbar) 80 WDG	2 oz + 1 to 2 lb	0.031 + 0.8 to 1.6	See each product label for use precautions. Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control. See label for soil texture and organic matter restrictions.
		norflurazon, MOA 12 (Solicam) 80 WDG + diuron, MOA 7 (Diuron or Karmex XP) 80 WDG	2.5 to 5 lb + 2 to 4 lb	2 to 4 + 1.6 to 3.2	Use only on trees established 1 year or more. Do not treat varieties grafted on full-dwarf rootstocks. See label for details. Apply in combination with glyphosate, paraquat, or glufosinate for postemergence weed control.
		rimsulfuron, MOA 2 (Matrix, Solida, Pruvin, Grapple) 25 WG + diuron, MOA 7 (Diuron or Karmex XP) 80 WDG	4 oz + 2 to 4 lb	0.0625 + 1.6 to 3.2	See labels for details. Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control.
	Annual grasses and broadleaf weeds as well as yellow nutsedge	sulfentrazone + carfentrazone-ethyl, MOA 14 (Zeus Prime XC) 3.5 XC + pendimethalin, MOA 3 (Prowl H2O or Satellite HydroCap) 4 AS	8 to 15 oz + 2 to 4 qt	0.21 to 0.41 + 2 to 4	See labels for details. Apply in combination with paraquat, glyphosate, or glufosinate for postemergence control.
		rimsulfuron, MOA 2 (Matrix, Solida, Pruvin, Grapple) 25 WG + diuron, MOA 7 (Diuron or Karmex XP) 80 WDG	4 oz + 2 to 4 lb	0.0625 + 1.6 to 3.2	Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control.
Apples, Postemergence, Directed Underneath Tree	Broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Broadloom) 4	1 to 2 pt	0.5 to 1	**For application in nonbearing orchards only!** Apply in a minimum spray volume of 20 gallons per acre. The addition of crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution) is necessary for optimum herbicide performance. Do not apply more than 2 pts per acre per application or more than 4 pts per acre per year. For yellow nutsedge control apply 1.5 to 2 pts per acre when yellow nutsedge has 4 to 6 leaves and is less than 6inches tall. Make second application 10 days after the initial application.
	Broadleaf weeds including morningglory, pigweed, dayflower, lambsquarters, and prickly lettuce	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.5 to 2 oz	0.008 to 0.032	Apply alone or tank mixed with other herbicides. Apply in a minimum spray volume of 20 gpa. Applications can be made with boom equipment, hooded sprayers, or shielded sprayers. Do not allow Aim to contact green bark, desirable foliage, flowers, or fruit. Contact with fruit or foliage will result in spotting and leaf necrosis. The trunks of trees less than 2 years old must be protected from Aim. Do not apply within 3 days of harvest. Sequential applications may be used so long as there are 14 days between applications and total use rate for year does not exceed 7.9 ounces/acre. Best results are obtained when applied to weeds in the 2- to 3-leaf stage. Apply in combination with a nonionic surfactant (1 quart/100 gallons of spray solution) or crop oil concentrate (1 gallon/100 gallons of spray solution).
	Broadleaf weeds including perennials like blackberry, horsenettle, poison ivy, Virginia creeper, and white clover.	fluroxypyr, MOA 4 (Starane Ultra) 2.8	0.7 to 1.4 pt	0.35 to 0.70	DO NOT apply during bloom or to trees less than 4 years old. Make only 1 application per year. Starane may be tank mixed with other herbicides registered for use on apples. Starane has a 14-day PHI. **This use is not listed on the Starane Ultra label because it is on a supplemental label.**
	Broadleaf weeds including horseweed, morningglory, pigweed, ragweed, smartweed and purslane	saflufenacil, MOA 14 (Treevix) 70 WG	1 oz	0.044	Do not apply more than 3 ounces/acre per year. Allow at least 21 days between applications. Treevix has a 0-day PHI. Treevix may be tank mixed with glyphosate, glufosinate, Poast, and oxyfluorfen. Treevix provides excellent control of horseweed, purslane, morningglory species, ragweed, and smartweed. The addition of methylated seed oil at 1% v/v (1 gallon per 100 gallons of spray solution) plus ammonium sulfate at 8.5 to 17 lb/100 gallons of spray solution is required for optimum herbicide performance.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Apples, Postemergence, Directed Underneath Tree (continued)	Most annual broadleaf and grass weeds plus many perennials	glufosinate, MOA 10 (Cheetah, Innerline, Reckon, Rely, Surmise, and other brands) 2.34 L	48 to 82 oz	0.88 to 1.5	DO NOT SPRAY GREEN BARK OR FOLIAGE. Glufosinate should not be used on trees within 1 year of transplanting. Apply in a minimum of 20 gallons of water per acre as a directed spray under trees. Repeat applications may be necessary for control of perennial weeds. Glufosinate can be tank mixed with diuron, Sinbar, Solicam, oryzalin, Devrinol, Goal, rimsulfuron, and simazine. Glufosinate has a 14-day PHI. DO NOT allow spot spray applications to directly contact tree or suckers. The addition of ammonium sulfate will enhance glufosinate activity on difficult to control species; however, the addition of surfactants and crop oil will increase risk of crop injury.
		glufosinate+ quizalofop, MOA 1 and 10 (Zalo) 2.51 SL	32 to 46 fl oz	0.769 +0.077 to 0.823 to 0.083	DO NOT SPRAY GREEN BARK, UNCALLOUSED BARK, OR DESIRABLE FOLIAGE UNLESS TREE ARE PROTECTED. Apply no more than two applications per year. DO NOT apply within 14 days either side of apple tree bloom. Zalo has a 14 day PHI. Allow at least 14 days between sequential applications. Always use a crop oil concentrate or methylated seed oil at 1% v/v (1gal per 100 gal of spray solution) and a dry spray grade ammonium sulfate applied at 3 lb per acre with Zalo.This herbicide is a non-selective POST herbicide and provides no residual weed control.
		glyphosate, MOA 9 (various brands and formulations)	See label	1 to 2	DO NOT SPRAY GREEN BARK OR FOLIAGE. Trees are more susceptible to injury from midsummer until dormant. Repeat applications may be necessary for control of perennial weeds. Can be tank mixed with preemergence herbicides for residual control of annual weeds. Check label for specifics. Generic glyphosate formulations may require the addition of a surfactant at 0.5% by volume (2 quart per 100 gallons of spray solution). See label for spray additive information and for detailed restriction information.
	Yellow and purple nutsedge, horsenettle, and pokeweed	halosulfuron, MOA 2 (Sandea, Herbivore, Halomax) 75 WDG	0.5 to 1 oz	0.023 to 0.047	Apply halosulfuron to actively growing weeds. Do not apply to apple trees established less than 1 year. **Do not** apply more than 2 ounces/acre per 12-month period or make more than 2 applications per year. Avoid herbicide contact with tree foliage. Addition of a nonionic surfactant is necessary for optimum herbicide performance. Sequential applications may be more effective on yellow nutsedge than 1 application. When using sequential applications use at least 0.75 ounces/acre per application and allow at least 45 days between applications. Halosulfuron may be tank mixed with glyphosate for broad spectrum POST weed control.
	Broadleaf and some small annual grass weeds	paraquat, MOA 22 (Gramoxone,Helmquat, Paraquat Concentrate, Parazone) 3 SL	1.7 to 2.7 pt	0.6 to 1	Apply when grass and weeds are 1 to 6 inches high and succulent for best results. Direct spray with low pressure to avoid contact with tree foliage or bark less than 1 year old. Young trees must be shielded to prevent spray contact with bark. Add surfactant at 0.25% by volume (2 pints per 100 gallons). Paraquat may be tank mixed with preemergence herbicides for residual control of annual weeds. Paraquat is a restricted-use pesticide.
	Broadleaf weeds	2,4-D amine, MOA 4 (various manufacturers and brands) 3.8 SL	1 to 3 pt	0.95 to 1.4	Apply any time during the growing season to actively growing broadleaf weeds except during apple bloom. Trees must be at least 1 year old. Do not apply more than 2 applications per crop cycle (75-day interval between applications) or within 14 days of harvest. Some formulations limit rate to 2 pints per acre. See label for details.
		2,4-D choline, MOA 4 (Embed Extra) 3.8 SL	1 to 4 pt	0.48 to 1.9	Embed offers the stability and reduced drift technology associated with 2,4-D choline. It may be used in orchards established 1 year or longer. DO NOT apply during bloom or use in orchards having sand soils. Embed has a 14-day PHI for pome fruit. No more than 8 pts of Embed can be applied within a 12-month period. If making more than 1 application allow 75 days between applications. Do not apply more than 2 applications per year. Embed may be tank mixed with glyphosate, glufosinate, as well as various PRE herbicides.
	Broadleaf weeds including clover, curly dock, horseweed, prickly lettuce, thistle, dandelion and mugwort	clopyralid, MOA 4 (Stinger) 3EC	0.33 to 0.66 pt	0.125 to 0.25	Use on trees that have been established in the orchard at least 1 year or longer. No more than 2 applications of Stinger can be applied per crop year and total use rate within that time frame cannot exceed 2/3 pt per acre. DO NOT apply within 30 days of harvest. DO NOT apply during bloom and avoid contact with foliage, fruit, and tree trunk.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Apples, Postemergence, Directed Underneath Tree (continued)	Grasses	clethodim, MOA 1 (Clethodim, Intensity, or Select) 2 EC (Select Max or Intensity One) 1 EC	6 to 8 fl oz 12 to 16 fl oz	0.094 to 0.125	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. When using the 2 EC formulations, add crop oil concentrate at 1% by volume (1 gallon per 100 gallons of spray solution). When using the 1 EC formulations, add nonionic surfactant at 0.25% by volume (1 qt per 100 gallons). **Select Max has a 14-day PHI for use in apples. All other clethodim formulations can be used in NON-BEARING apples ONLY!**
		fluazifop, MOA 1 (Fusilade DX) 2 EC	12 to 24 fl oz	0.125 to 0.38	**NONBEARING TREES ONLY.** Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. Add crop oil at 1% by volume (1 gallon per 100 gallons).
		quizalofop, MOA 1 (Assure II) 0.88 EC	8 to 12 fl oz	0.028 to 0.082	Apply as a directed spray in a spray volume of 10 to 25 GPA. Application intervals must be at least 14 days apart. DO NOT apply with 14 days of anticipated crop bloom. Assure II has a 14 day PHI. Total use within a year cannot exceed 24 fl. oz/ A. Always use a crop oil concentrate or methylated seed oil at 1% v/v (1gal per 100 gal of spray solution) and a dry spray grade ammonium sulfate applied at 2 lb per acre. Assure II with provide POST control of perennial grass weeds like Johnsongrass and bermudagrass (See label for instructions).
		sethoxydim, MOA 1 (Poast) 1.5 EC	1.0 to 2.5 pt	0.19 to 0.47	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. Add Dash adjuvant at 1 pint per acre or crop oil concentrate at 1 quart per acre. Do not apply within 14 days of harvest. Do not apply more than 7.5 pints per acre per year.
Apples, Ground Cover Suppression	Suppression of fescue, orchardgrass, and bluegrass	glyphosate, MOA 9 (various brands and formulations)	Rates and application time vary for each grass species. See label for details.		Mow 1 time in spring. Apply 3 to 4 days after mowing. **Caution**: This treatment will normally discolor the grass. **DO NOT** apply after seedhead emergence. See label for details.
Peaches, Preemergence Directed Underneath Tree	Annual grasses and some broadleaf weeds	diuron, MOA 7 (Direx, Diuron) 4 L (Diuron, Karmex) 80 DF	1.6 to 2.2 qt 2 to 2.75 lb	1.6 to 2.2	Apply in spring to trees at least 3 years old. Rate is soil texture dependent. May be tank mixed with Sinbar, Solicam, glyphosate, or paraquat. Karmex DF, and Direx 4L have a 20-day PHI. Other formulations of diuron have a 90-day PHI.
		flumioxazin, MOA 14 (Zaltus SX) 51 WG (Tuscany, Flumi) 51 WG (Tuscany) 4 SC (Chateau EZ) 4 SC	6 to 12 oz 6 to 12 fl oz	0.19 to 0.38	Fulimoxazin is for newly planted and established orchards. Shield or protect trees established less than 1 year from contact with spray solution. Tank mix with paraquat for non-selective POST weed control. Do not apply more than 6 ounces per acre to trees planted less than 3 years in soil having a sand plus gravel content more than 80%. Sequential applications are very effective. Due to the potential for crop injury, Flumioxazin should not be applied in bearing orchards after bud break until after final harvest. Do not apply within 60 days of harvest. Do not use more than 24 ounces per acre per year. In non-bearing orchards flumioxazin may be applied after bud break however application equipment should be hooded.
		indaziflam, MOA 29 (Alion) 1.67 SC	3.5 to 6.5 oz	0.046 to 0.085	Use in orchards established 3 years or longer. See label for details regarding the management of replants in established orchards. **Use rate cannot exceed 3.5 fluid ounces/acre per application on soils having less than 1% organic matter.** On soils with an organic matter content from 1 to 3%, no more than 5 fluid ounces/acre can be applied in a single application and the total use rate for the year cannot exceed 8.5 fluid ounces/ acre. In order to apply more than 5 fluid ounces/acre in a single application soil organic matter must be >3%. Do not use on soils with 20% or more gravel content. Allow at least 90 days between applications. Research has shown Alion applied in the fall followed by a late spring application will provide summer long control of annual broadleaf and grass weeds. Do not treat soil around trees with cracks or channels, or with depressions. Tank mix Alion with glyphosate or paraquat for nonselective POST weed control. Alion has a 14-day PHI.
		Fluridone, MOA 12 (Brake On!) 1.2L	21 to 43 fl oz	0.2 to 0.4	Brake On! provides PRE control of broadleaf and annual grass weeds. Sequential applications may be used so long as the total use rate does not exceed 43 fl oz per acre per year. Do not use this product more than two consecutive years in a row. Brake On! has a 30-day PHI. Use in orchards that have been established 1 year or more. Tank mix with non-selective POST herbicides like glyphosate, glufosinate, or paraquat to control emerged weeds.
		norflurazon, MOA 12 (Solicam) 80 WDG	2.5 to 5 lb	2 to 4	Can be tank mixed with diuron, Goal, glyphosate, paraquat, Prowl, rimsulfuron, simazine, or SinbarRate is soil texture dependent. See label for details. Do not apply within 6 months of transplanting. PHI is 60 days. Multiple applications per season are allowed as long as total use rate does not exceed maximum use rate for soil texture and crop.
		pendimethalin, MOA 3 (Prowl H_2O or Satellite HydroCap) 4 AS	2 to 4 qt	2 to 4	Most effective when adequate rainfall or irrigation is received within 7 days after application. Do not apply to newly transplanted trees until ground has settled around roots. Apply with paraquat to control emerged weeds. Prowl H_2O has a 60-day preharvest interval (PHI). Pendimethalin may be applied as sequential applications so long as total amount used does not exceed 4.2 qt/acre per year. Allow at least 30 days between applications.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	**Amount of Formulation Per Acre**	**Pounds Active Ingredient Per Acre**	Precautions and Remarks
Peaches, Preemergence Directed Underneath Tree (continued)	Annual broadleaf weeds (PRE and POST Control)	mesotrione, MOA 27 (Motif) 4 L	3 to 6 fl oz	0.094 to .188	Motif will provide PRE and POST control of certain annual broadleaf weeds. It may be applied as directed spray in orchards established 12 months or longer. DO NOT allow spray solution to contact with crop foliage, stems, or fruit to prevent bleach injury that is typically temporary. Do not harvest fruit within 30 days of application. As many as 4 applications can be made so long as the total annual use rate does not exceed 12 fl oz per acre per year. Using crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution) or a non-ionic surfactant at 0.25 % v/v (1 qt per 100 gal of spray solution) is necessary for effective POST control. The addition of ammonium sulfate will increase efficacy when used in combination with a crop oil concentrate or a non-ionic surfactant. Motif can be tank mixed with diuron, glufosinate, glyphosate, Alion, paraquat, pendimethalin, rimsulfuron, or simazine.
	Broadleaf and some grass weeds (PRE and POST Control)	penoxsulam + oxyfluorfen, MOA 2 and 14 (Pindar GT) 4	1.5 to 3 pt	0.75 to 1.5	Pindar GT can be applied after harvest up until bud swell in the fall to late winter/early spring time frame. **DO NOT** use after bud break until completion of final harvest or in orchards established less than 4 years, however, in NC, SC, and VA it may be used on trees established 18 months or longer. **DO NOT** use in soils that contain less than 20% clay or greater than 70% sand. For non-selective POST control tank mix with glufosinate, glyphosate, or paraquat. For expanded residual control of annual grass weeds tank mix with pendimethalin or Solicam. Do not use more than 4.5 pts per acre per year. If using sequential applications allow at least 30 days between applications.
		indaziflam + rimsulfuron, MOA 29 and 2 (Centrus) WDG	3 to 5.6 oz	0.076 to 0.143	Centrus will provide PRE and POST control of certain annual broadleaf weeds. Do not use on soils with 20% or more gravel content. Use on trees established 3 years or more. Do not apply within 14 days of harvest. Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control.
		rimsulfuron, MOA 2 (Grapple, Matrix, Solida, or Pruvin) 25 WG	4 oz	0.063	For broad spectrum PRE control, tank mix with diuron, Sinbar, or pendimethalin. For nonselective POST control, apply with glyphosate or paraquat. Rimsulfuron does have POST activity on certain broadleaf weeds (see label for list). Rimsulfuron will control emerged horseweed less than 3 inches tall when applied in combination with a non-ionic surfactant and a spray grade ammonium sulfate (2 pounds/acre). Do NOT treat orchards established less than 1 year. Rainfall within 2 to 3 weeks of application is necessary for herbicide activation. Spray solutions having a pH lower than 4.0 or higher than 8.0 will result in herbicide degradation. Rimsulfuron has a 14-day PHI for stone fruit, and sequential applications can be made so long as total use rate does not exceed 4 ounces/acre per year and application is made in a band on less than 50% of orchard floor. Allow at least 30 days between applications.
	Broadleaf and grass weed control for NEWLY PLANTED NON-BEARING ORCHARDS	terbacil, MOA 5 (Sinbar) 80 WDG	0.5 to 1.0 lb	0.4 to 0.8	Apply once soil has settled after transplanting. Apply no more than 1 lb per acre per year. For best results, apply 0.5 lb in the spring followed by another 0.5 lb when control from initial application fails. Do not apply on soils coarser than sandy loam. Do not use on soils having less than1% organic matter.
	Annual broadleaf and grass weeds	simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	1.6 to 4 qt 1.8 to 4.4 lb	1.6 to 4	Apply in early spring before weed emergence. Use only on trees established 1 year or more. Do not use on sand or loamy sand soils. Tank mixing simazine with pendimethalin or Solicam will improve residual control of annual grasses and certain broadleaf weeds.
	Annual broadleaf and grass weeds plus many perennial grasses	terbacil, MOA 5 (Sinbar) 80 WDG	2 to 4 lb	1.6 to 3.2	Use on trees established 3 years, however when tank mixed with Karmex XP or another diuron containing herbicide Sinbar may be applied in orchards established 1 year or longer. Sinbar may only be used on soils with at least 1% organic matter. Unless soil organic matter is greater than 2% do not exceed 3 pounds/acre. Do not use on sand or loamy sand soils. Sinbar is an excellent choice for tank mixing with diuron or rimsulfuron for extended broad spectrum residual control of those products. Sinbar has a 60-day PHI.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Peaches, Preemergence Tank Mixes	Many annual and perennial grasses and broadleaf weeds	diuron, MOA 7 (Diuron or Karmex XP) 80 DF + terbacil, MOA 5 (Sinbar) 80 WDG	1 to 2 lb + 1 to 2 lb	0.8 to 1.6 + 0.8 to 1.6	Use only under trees established in the orchard for at least 1 year. Apply to soils having at least 1% organic matter. See label for details.
		norflurazon, MOA 12 (Solicam) 80 WDG + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2.5 to 5 lb + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	See labels for details.
		rimsulfuron, MOA 2 (Grapple, Matrix, Solida or Pruvin) 25 WG + terbacil, MOA 5 (Sinbar) 80 WDG	2 oz + 1 to 2 lb	0.063 + 0.8 to 1.6	See labels for use precautions and details.
		rimsulfuron, MOA 2 (Grapple, Matrix, Solida, or Pruvin) 25 WG + diuron, MOA 7 (Diuron or Karmex XP) 80 WDG	4 oz + 2 to 4 lb	0.0625 + 1.6 to 3.2	Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control.
		norflurazon, MOA 12 (Solicam) 80 WDG + diuron, MOA 7 (Diuron or Karmex XP) 80 DF	2.5 to 5 lb + 2 to 4 lb	2 to 4 + 1.6 to 3.2	See labels for details. Trees must be established at least 3 years.
		rimsulfuron, MOA 2 (Grapple, Matrix, Solida, or Pruvin) 25 WG + pendimethalin, MOA 3 (Prowl H2O or Satellite HydroCap) 4 AS	4 oz + 2 to 4 qt	0.063 + 2 to 4	Tank mix with glyphosate or paraquat for non-selective POST weed control.
Peaches, Postemergence, Directed Underneath Tree	Broadleaf weeds including morningglory, pigweed, lambsquarters, cocklebur, smartweed, and dayflower	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.5 to 1.6 oz	0.008 to 0.025	Apply alone or tank mixed with other herbicides. Apply in a minimum spray volume of 20 gpa. Applications can be made with boom equipment, hooded sprayers, or shielded sprayers. Do not allow Aim to contact green bark, desirable foliage, flowers, or fruit of the crop. Contact with fruit or foliage will result in spotting and leaf necrosis. The trunks of trees established less than 2 years must be protected. Do not apply within 3 days of harvest. Best results are obtained when applied to weeds in the 2 to 3-leaf stage. Sequential applications may be used so long as there are at least 14 days between applications and total use rate for year does not exceed 7.9 ounces/acre per year. Apply in combination with a nonionic surfactant (1 quart per 100 gallons of spray solution) or crop oil concentrate (1 gallon per 100 gallons of spray solution).
	Broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Broadloom) 4	1 to 2 pt	0.5 to 1	**For application in nonbearing orchards only!** Apply in a minimum spray volume of 20 gallons per acre. The addition of crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution) is necessary for optimum herbicide performance. Do not apply more than 2 pts per acre per application or more than 4 pts per acre per year. For yellow nutsedge control apply 1.5 to 2 pts per acre when yellow nutsedge has 4 to 6 leaves and is less than 6inches tall. Make second application 10 days after the initial application.
	Kill all green foliage on contact	paraquat, MOA 22 (Gramoxone, Paraquat Concentrate, Parazone, and various other brands) 3 SL	1.7 to 2.7 pt	0.66 to 1	Apply when grass and weeds are 1 to 6 inches high and succulent for best results. Direct spray with low pressure to avoid contact with tree foliage or bark. Add surfactant at 0.25% by volume (2 pints per 100 gallons) for best results. Paraquat may be tank mixed with Goal, Karmex, simazine, Sinbar, Solicam, and oryzalin. Paraquat is a restricted use pesticide. Newly planted trees can be severely injured by paraquat, so use a shield or wrap to protect the tree from spray. Do not make more than 3 applications per year. Paraquat has a 14-day PHI for peach and 28-day PHI for nectarine.
	Non-selective weed control	glyphosate, MOA 9 (various brands and formulations)	See label	1	Do not apply in orchards established less than 2 years. Applications must be made with shielded sprayer. Low hanging limbs and suckers must be removed at least 10 days prior to application. DO NOT use glyphosate 90 days past bloom. DO NOT allow glyphosate to contact foliage or bark; EXTREME care must be taken to prevent injury. See label for details. Some glyphosate formulations may require the addition of a surfactant.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Peaches, Postemergence, Directed Underneath Tree (continued)	Most annual broadleaf and grass weeds plus many perennials	glufosinate, MOA 10 (Cheetah, Innerline, Reckon, Rely, Surmise, and various other brands) 2.34 L	48 to 82 oz	0.88 to 1.5	**DO NOT SPRAY GREEN BARK, UNCALLOUSED BARK, OR DESIRABLE FOLIAGE UNLESS TREES ARE PROTECTED.** Glufosinate should not be used on trees within 1 year of transplanting. Apply in a minimum of 20 gallons of water per acre as a directed spray under trees. Repeat applications may be necessary for control of perennial weeds. Glufosinate can be tank mixed with diuron, Sinbar, Solicam, oryzalin, Devrinol, Goal, rimsulfuron, and simazine. Glufosinate has a 14-day PHI. DO NOT apply more than 164 fl oz per acre within a 12-month period. There must be at least 28 days between applications. Glufosinate formulations contain surfactant therefore additional nonionic surfactants or crop oils are not necessary and may increase potential for injury.
		glufosinate+ quizalofop, MOA 1 and 10 (Zalo) 2.51 SL	32 to 46 fl oz	0.769 +0.077 to 0.823 to 0.083	DO NOT SPRAY GREEN BARK, UNCALLOUSED BARK, OR DESIRABLE FOLIAGE UNLESS TREE ARE PROTECTED. Apply no more than two applications per year. DO NOT apply within 14 days either side of apple tree bloom. Zalo has a 14 day PHI. Allow at least 28 days between sequential applications. Thorough coverage in necessary for effective control. Always use a crop oil concentrate or methylated seed oil at 1% v/v (1gal per 100 gal of spray solution) and a dry spray grade ammonium sulfate applied at 3 lb per acre. Zalo is a non-selective POST herbicide and provides no residual weed control.
	Grasses	clethodim, MOA 1 (Arrow, Clethodim, Intensity, or Select) 2 EC (Select Max or Intensity One) 1 EC	6 to 8 oz 12 to 16 oz	0.094 to 0.125	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. When using 2 EC formulation chemicals, add crop oil concentrate at 1% by volume (1 gallon per 100 gallons). When using 1 EC formulations, use a nonionic surfactant at 0.25% by volume rather than crop oil. **Select Max has a 14-day PHI for peach. Unless otherwise stated on label, all other clethodim products are for non-bearing orchards ONLY.**
		fluazifop, MOA 1 (Fusilade DX) 2 EC	8 to 24 oz	0.125 to 0.38	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. Add crop oil at 1% by volume (1 gallon per 100 gallons). Do not apply within 14 days of harvest. Do not apply more than 72 fl ounces per acre per year.
		quizalofop, MOA 1 (Assure II) 0.88 EC	8 to 12 fl oz	0.028 to 0.082	Apply as a directed spray in a spray volume of 10 to 25 GPA. Application intervals must be at least 14 days apart. DO NOT apply with 14 days of anticipated crop bloom. Assure II has a 14 day PHI. Total use within a year cannot exceed 24 fl. oz/ A. Always use a crop oil concentrate or methylated seed oil at 1% v/v (1gal per 100 gal of spray solution) and a dry spray grade ammonium sulfate applied at 2 lb per acre. Assure II with provide POST control of perennial grass weeds like Johnsongrass and bermudagrass (See label for instructions).
		sethoxydim, MOA 1 (Poast) 1.5 EC	1.0 to 2.5 pt	0.19 to 0.47	Apply to annual grasses up to 12 inches tall. For perennial grasses apply early in the growth cycle at the high use rate. Multiple applications may be necessary for perennial grass weeds. Add Dash adjuvant at 1 pint per acre or crop oil concentrate at 1 quart per acre. Do not apply within 25 days of harvest for peach or nectarine. Poast may only be used in NON-BEARING plum. Do not apply more than 5 pints per acre per year.
	Broadleaf weeds	2,4-D amine, MOA 4 (Weedar 64) (various brands) 3.8 SL	1 to 3 pt	0.95 to 1.4	Do not apply within 40 days of harvest. Do not apply more than twice a year. Allow 75 days between applications. Trees must be at least 1 year old. Use when trees are dormant. Some formulations limit rate to 2 pints per acre. See label for details.
		2,4-D choline, MOA 4 (Embed Extra) 3.8 SL	1 to 4 pt	0.48 to 1.9	Embed offers the stability and reduced drift technology associated with 2,4-D choline. It may be used in orchards established 1 year or longer. **DO NOT apply during bloom or use in orchards having sand or loamy sand soils.** Embed has a 40 day PHI for peaches. No more than 8 pts of Embed can be applied within a 12-month period. If making more than 1 application allow 75 days between applications. Do not apply more than twice per year. Embed may be tank mixed with glyphosate, glufosinate, as well as various PRE herbicides.
	Broadleaf weeds including clover, curly dock, horseweed prickly lettuce, thistle and mugwort	clopyralid, MOA 4 (Stinger) 3 EC	0.33 to 0.66 pt	0.125 to 0.25	Multiple applications may be used as long as total amount does not exceed maximum rate. Use at least 10 GPA of spray solution. Stinger may be tank mixed with preemergence herbicides. Do not apply within 30 days of harvest. Do not apply more than twice. Total use rate cannot exceed 2/3 pint per acre per crop year.
Pecans, Preemergence, Directed Underneath Tree	Broadleaf weeds and annual grasses	diuron, MOA 7 (Diuron or Karmex DF) 80 WDG (Direx) 4 L	2 to 4 lb 1.6 to 3.2 qt	1.6 to 3.2	Do not apply to trees less than 3 years old. Rate is soil-texture dependent. Do not use on soils with less than 0.5% organic matter.
	Annual grass and some broadleaf weeds	norflurazon, MOA 12 (Solicam) 80 WDG	2.5 to 5 lb	2 to 4	Do not apply when nuts are on the ground. Rate is soil-texture dependent. See label for details. Do not apply within 6 months of planting. PHI is 60 days. Multiple applications per season are allowed as long as total use rate does not exceed maximum use rate for soil texture and crop.
		pendimethalin, MOA 3 (Prowl H_2O or Satellite HydroCap) 4 AS	2 to 6 qt	2 to 6	Most effective when adequate rainfall or irrigation is received within 7 days after application. Do not apply to newly transplanted trees until ground has settled around roots. Apply with paraquat to control emerged weeds. Prowl H2O has a 60-day PHI. Pendimethalin may be applied in sequential applications so long as total use rate does not exceed maximum of application rate on the label and there are at least 30 days between applications.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Pecans, Preemergence, Directed Underneath Tree (continued)	Annual broadleaf weeds and grass weeds	simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt 2.2 to 4.4 lb	2 to 4	Apply preemergence to weeds under trees that have been established 2 years or more. Do not apply when nuts are on the ground. Do not use on sand or loamy sand soils. Tank mixing simazine with oryzalin, Solicam, or Prowl H2O will improve residual control of annual grasses and certain broadleaf weeds.
		flumioxazin, MOA 14 (Zaltus SX,Tuscany, Flumi) 51 WDG (Tuscany) 4 SC (Chateau EZ) 4 SC	6 to 12 oz 6 to 12 fl oz	0.19 to 0.38	Flumioxazin may be applied in newly planted and established orchards. Trees established less than 1 year must be shielded from contact with spray solution to prevent injury. Do not apply more than 6 ounces per acre to trees planted less than 3 years in soil having a sand plus gravel content more than 80%. Sequential applications are very effective; however, allow 60 days between applications. Do not apply after bud break through final harvest unless using shielded application equipment. When applying flumioxazin after bud break DO NOT tank mix with glyphosate or 2,4-D amine. When tank mixed with glyphosate and/or 2,4-D amine the potential for drift increases. Flumioxazin has a 60-day PHI. Use rate cannot exceed 24 ounces per acre in a 12-month period.
		indaziflam, MOA 29 (Alion) 1.67 SC	3.5 to 6.5 oz	0.045 to 0.085	Use in orchards established 3 years or longer. See label for details regarding the management of replants in established orchards. Do not use on soils having a 20% or greater gravel content. Use rate cannot exceed 3.5 fluid ounces per acre per application on soils having less than 1% organic matter. On soils with an organic matter content from 1 to 3%, no more than 5 fluid ounces/acre can be applied in a single application and the total use rate for the year cannot exceed 8.5 fluid ounces/acre. In order to apply more than 5 fluid ounces/acre in a single application soil organic matter must be >3%. Allow at least 90 days between applications. Do not treat soil around trees with cracks or channels, or with depressions. Tank mix Alion with glyphosate, glufosinate, or paraquat for nonselective POST weed control. Alion has a 14-day PHI.
		rimsulfuron, MOA 2 (Matrix, Solida, Pruvin, or Grapple) 25 WG	4 oz	0.063	For broad spectrum PRE control, tank mix with, diuron, oryzalin or Prowl H_2O. For nonselective POST control, apply in combination with glyphosate or paraquat. Rimsulfuron does have POST activity on certain broadleaf weeds (see label for list). Rimsulfuron will control emerged horseweed less than 3 inches tall when applied in combination with a non-ionic surfactant and a spray grade ammonium sulfate (2 pounds per acre). Do NOT treat orchards established less than 1 year. Rainfall within 2 to 3 weeks of application is necessary for herbicide activation. Spray solutions having a pH lower than 4.0 or higher than 8.0 will result in herbicide degradation. Rimsulfuron has a 14-day PHI for Pecan. Rimsulfuron may be applied as a sequential application so long as total use rate does not exceed 4 ounces/acre per year and application is made in a band on less than 50% of orchard floor. Allow at least 30 days between applications.
	Annual broadleaf weeds (PRE and POST Control)	mesotrione, MOA 27 (Motif) 4 L	3 to 6 fl oz	0.094 to .188	Motif will provide PRE and POST control of certain annual broadleaf weeds. It may be applied as directed spray in orchards established 12 months or longer. DO NOT allow spray solution to contact with crop foliage, stems, or fruit to prevent bleach injury that is typically temporary. Do not harvest fruit within 30 days of application. As many as four applications can be made so long as the total annual use rate does not exceed 12 fl oz per acre per year. Using crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution) or a non-ionic surfactant at 0.25 % v/v (1 qt per 100 gal of spray solution) is necessary for effective POST control. The addition of ammonium sulfate will increase efficacy when used in combination with a crop oil concentrate or a non-ionic surfactant. Motif can be tank mixed with diuron, glufosinate, glyphosate, Alion, paraquat, pendimethalin, rimsulfuron, or simazine.
		indaziflam + rimsulfuron, MOA 29 and 2 (Centrus) WDG	3 to 5.6 oz	0.076 to 0.143	Centrus will provide PRE and POST control of certain annual broadleaf weeds. Do not use on soils with 20% or more gravel content. Use on trees established 3 years or more. Do not apply within 14 days of harvest. Tank mix with glyphosate, glufosinate, or paraquat for non-selective POST weed control.
	Annual broadleaf weeds and some annual grasses	penoxsulam + oxyfluorfen, MOA 2 and 14 (Pindar GT) 4	1.5 to 3 pt	0.75 to 1.5	Use on trees established 9 months or longer. Apply after harvest completion up until green leaf tissue emergence. Do not apply more than 4.5 pts per acre per year. Tank mix with pendimethalin or Solicam for expanded control of annual grasses. For non-selective POST weed control tank mix with glyphosate, paraquat, or glufosinate.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Pecans, Preemergence, Tank Mix Options	Annual broadleaf weeds and grass weeds	diuron, MOA 7 (Diuron or Karmex XP) 80 WDG + norflurazon, MOA 12 (Solicam) 80 WDG	2 to 4 lb + 2.5 to 5 lb	1.6 to 3.2 + 2 to 4	Trees must be established in the orchard for 3 years.
		norflurazon, MOA 12 (Solicam) 80 F + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2.5 to 5 lb + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	Trees must be established for at least 2 years. See labels for details.
		pendimethalin, MOA 3 (Prowl H2O) + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	See label for details.
Pecans, Postemergence, Directed Underneath Tree	Broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Broadloom) 4	1 to 2 pt	0.5 to 1	**For application in nonbearing orchards only!** Apply in a minimum spray volume of 20 gallons per acre. The addition of crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution) is necessary for optimum herbicide performance. Do not apply more than 2 pts per acre per application or more than 4 pts per acre per year. For yellow nutsedge control apply 1.5 to 2 pts per acre when yellow nutsedge has 4 to 6 leaves and is less than 6inches tall. Make second application 10 days after the initial application.
	Broadleaf weeds including morningglory, pigweed, lambsquarters, cocklebur, smartweed, and dayflower	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.5 to 2 oz	0.008 to 0.031	Apply alone or tank mixed with other herbicides. Apply in a minimum spray volume of 20 gpa. Applications can be made with boom equipment, hooded sprayers, or shielded sprayers. Do not allow Aim to contact green bark, desirable foliage, flowers, or fruit of the crop. Contact with fruit or foliage will result in spotting and leaf necrosis. The trunks of trees less than 2 years old must be protected from direct contact with Aim. Do not apply within 3 days of harvest. Sequential applications may be used so long as total use rate does not exceed 7.9 ounces/acre per year and there are 14 days between applications. Best results are obtained when applied to weeds in the 2- to 3-leaf stage. Apply in combination with a nonionic surfactant (1 quart per 100 gallons of spray solution) or crop oil concentrate (1 gallon per 100 gallons of spray solution).
	Most annual broadleaf and grass weeds plus many perennials	glufosinate, MOA 10 (Cheetah, Innerline, Reckon, and Rely, Surmise, and various brands) 2.34L	48 to 82 oz	0.88 to 1.5	DO NOT SPRAY GREEN BARK OR FOLIAGE. Glufosinate should not be used on trees within 1 year of transplanting. Do not make more than 3 applications per year. Apply in a minimum of 20 gallons of water per acre as a directed spray under trees. Repeat applications may be necessary for control of perennial weeds. Glufosinate can be tank mixed with diuron, Solicam, Devrinol, Goal, rimsulfuron, and simazine. Do not apply within 14 days of harvest. The addition of ammonium sulfate will enhance glufosinate activity on difficult to control species, however the addition of non-ionic surfactants or crop oil will increase the risk of crop injury.
		glyphosate, MOA 9 (various brands and formulations)	See label	1 to 2	DO NOT SPRAY GREEN BARK OR FOLIAGE. Repeat applications may be necessary for control of perennial weeds. Tank mix with Goal, Karmex, simazine, Solicam, or pendimethalin. Check label for details. Generic glyphosate formulations may require the addition of surfactant at 0.5% by volume (2 qt per 100 gal). See label to determine if surfactant is needed for the formulation you use.
	Yellow and purple nutsedge, horsenettle, pokeweed and other broadleaf weeds.	halosulfuron, MOA 2 (Sandea) 75 WDG	0.66 to 1.33 oz	0.032 to 0.063	Use on trees established in orchard at least 12 months. Avoid contacting bark or foliage or severe injury or death may occur. The addition of 0.25% surfactant (1 quart per 100 gallons of spray solution) will be necessary for adequate control. Do not make more than 2 applications per year. Use no more than 1 ounce per acre on soils classified as sand, loamy sand, or sandy loam or on soils with less than 1% organic matter. Sandea has a 1-day PHI. User assumes risk when treating trees recovering from certain stress conditions. Sandea may be tank mixed with glyphosate to control weeds other than nutsedge.
	Annual broadleaf and grass weeds	paraquat, MOA 22 (Gramoxone, Helmquat, Paraquat Concentrate, or Parazone) 3 SL	1.75 to 2.7 pt 2.5 to 4.0 pt	0.66 to 1	Apply when grass and weeds are 1 to 6 inches high and succulent for best results. Direct spray with low pressure to avoid contact with tree foliage or bark less than 1 year old. Add surfactant at 0.25% by volume (2 pints per 100 gallon) or 1% crop oil concentrate (1 gallon per 100 gallons) for best results. Paraquat may be tank mixed with Goal, Karmex, simazine, Solicam, and oryzalin. Paraquat is a restricted use pesticide.
	Broadleaf weeds	2,4-D amine, MOA 4 (various brands) 3.8 SL	2 to 3 pt	0.95 to 1.4	Apply anytime during the growing season to actively growing broadleaf weeds except during bloom. Do not apply more than 2 applications per year. Allow at least 30 days between sequential applications. Do not use within 60 days of harvest. Do not apply to trees less than 1 year old. Some formulations may limit use rate to 2 pints per acre. Refer to product label for details.
		2,4-D choline, MOA 4 (Embed Extra) 3.8	2 to 4 pt	0.95 to 1.9	Trees must be established at least 1 year in the orchard. 60 day PHI. Allow at least 70 days between sequential applications. Total use per year cannot exceed 4 pts per acre.

Table 7-12B. Chemical Weed Control in Fruit Crops—Tree Fruits

Crop	Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Pecans, Postemergence, Directed Underneath Tree (continued)	Grasses	clethodim, MOA 1 (Arrow, Intensity, or Select) 2 EC (Select Max or Intensity One) 1 EC	6 to 8 oz 12 to 16 oz	0.094 to 0.125	**NONBEARING TREES ONLY**. Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. For 2 EC formulation chemicals, add crop oil concentrate at 1% by volume (1 gallon per 100 gallons). For 1 EC formulation chemicals, a nonionic surfactant at 0.25% by volume may be used rather than crop oil. **The Select Max formulation has a use in bearing pecans with a 14-day PHI.**
		fluazifop, MOA 1 (Fusilade DX) 2 EC	8 to 24 oz	0.125 to 0.38	Postemergence grass control. Annuals up to 12 inches tall and 6 to 10 inches new growth on perennials. Multiple applications may be necessary to control perennial grass weeds. Add crop oil at 1% by volume (1 gallon per 100 gallons). Limited to 72 ounces per year. Do not apply within 30 days of harvest.
		sethoxydim, MOA 1 (Poast) 1.5 EC	1.0 to 2.5 pt	0.19 to 0.47	Apply to annual grasses up to 12 inches tall. For perennial grasses, apply early in the growth cycle at the high use rate. Multiple applications may be necessary to control perennial grass weeds. Add Dash adjuvant at 1 pint per acre or crop oil at 1 quart per acre. Do not apply within 15 days of harvest. Do not apply more than 10 pints per year.
Pecans, Ground Cover Suppression	Groundcover suppression in row middles	glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL	Rate and application times different for grass species. See label.		See label directions specific for each grass species. **DO NOT** apply after seedhead emergence. See label for details.
		(Roundup WeatherMax) 5.5 SL	See label	See label	

* Mode of action (MOA) code developed by the Weed Science Society of America. See Table 7-10, Herbicide Resistance Management, for details.

Chemical Weed Control in Hay Crops and Pastures

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Note: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10B, Herbicide Modes of Action for Hay Crops, Lawns and Turf for details concerning active ingredients, brand names, chemical families, and modes of action.

Table 7-13. Chemical Weed Control in Hay Crops and Pastures

Crop	Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Alfalfa, Birdsfoot Trefoil, Clovers, Lespedeza Preplant	Certain annual grass weeds, broadleaf weeds, and nutsedge species	EPTC, MOA 8 (7 EC)	3.5 pt	3	Use on clay and clay loam soils of piedmont. Incorporate into soil immediately after application. See label for directions. Temporary crop stunting may occur if conditions for germination and growth are not optimum. Do not use if grain or grass crop is to be planted with the legume.
Alfalfa, Preplant or Preemergence	Various grass and broadleaf weeds	paraquat, MOA 22 (2 SL) (3 SL)	2.5 to 4 pt 1.67 to 2.67 pt	0.625 to 1	Apply prior to crop emergence. Add nonionic surfactant at 1 to 2 pints per 100 gallons.
Alfalfa, Established Preemergence	Crabgrass, foxtails, and other annual grasses	trifluralin, MOA 3 (10 G) (4 EC)	20 lb 2 qt	2	A single rainfall of 0.5 inch or more after application is required to activate trifluralin. Apply 2 quarts trifluralin HFP if chemigation or water incorporated.
Alfalfa, Seedling	Seedling broadleaf weeds, such as burcucumber, cocklebur, jimsonweed, lambsquarters, velvetleaf, Virginia pepperweed, shepherdspurse, wild radish, and species of morningglory, mustard, nightshade, pigweed, ragweed, and smartweed	bromoxynil, MOA 6 (2 EC) (4 EC)	1 to 1.5 pt 0.5 to 0.75 pt	0.25 to 0.375	Apply in fall or spring to seedling alfalfa with a minimum of 4 trifoliate leaves and to weeds not greater than 4 leaf stage, 2 inches in height, or 1 inch in diameter, whichever comes first. Unacceptable crop injury can occur 3 days after application if temperatures exceed 70ºF. For chemigation only, apply to alfalfa with 2 trifoliate leaves at 2 pints/A to most susceptible weeds not greater than 8 leaf stage, 4 inches in height, or 2 inches in diameter, whichever comes first. Unacceptable crop injury can occur 3 days after application if temperatures exceed 85ºF. Bromoxynil can be tank mixed with 2,4-DB 200 or imazethapyr 2 AS. Do not apply in warm humid conditions or to alfalfa under any kind of stress. Do not add surfactant unless specified. Do not cut for feed or graze spring-treated alfalfa until 30 days after treatment. Wait until spring, or 60 days after treatment, for winter-treated alfalfa.
Alfalfa, Birdsfoot Trefoil, Clovers, Seedling	Certain broadleaf weeds such as cocklebur, lambsquarters, morningglory, pigweed, ragweed, smartweed, curly dock, shepherdspurse, and wild mustard	2,4-DB, MOA 4 (2 EC)	2 to 6 pt	0.5 to 1.5	Apply postemergence when weeds are less than 3 in. tall and legume has at least 2 to 4 trifoliate leaves. Do not graze or feed seedling legume crops to livestock within 60 days after application.
Alfalfa, Clover, Birdsfoot Trefoil, Crown Vetch, Established and Seedling	Ryegrass species, annual bluegrass, perennial bluegrass, orchardgrass, chickweed, and volunteer grain	pronamide, MOA 3 (3.3 SC)	1.25 to 5 pt	0.516 to 2.06	Use preemergence or postemergence to the weeds only on established legume plantings or on new plantings after the legume has reached the trifoliate leaf stage or beyond. Controls henbit, shepherdspurse, wild radish and wild mustard with preemergence applications. Apply from Oct. 15 to Jan. 15. Optimum herbicidal activity occurs when applications are made under cool temperatures (55ºF or less) and followed by rainfall or irrigation. Do not graze or harvest for forage or dehydration within 120 days of treatment.

Table 7-13. Chemical Weed Control in Hay Crops and Pastures

Crop	Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Alfalfa, Established and Seedling	Lambsquarters, pigweed, ragweed, morningglory, and smartweed	2,4-DB, MOA 4 (2 EC)	2 to 6 pt	0.5 to 1.5	Apply postemergence when weeds are less than 3 inches tall. Do not graze established alfalfa or cut for hay within 30 days after application.
	Crabgrass, foxtails, seedling johnsongrass and certain broadleaf weeds such as chickweed, cocklebur, henbit, jimsonweed, morningglory, wild mustard, nightshade, pepperweed, pigweed, ragweed, smartweed, spurge, and Russian thistle	imazethapyr, MOA 2 (2 AS)	3 to 6 fl oz	0.048 to 0.095	Apply postemergence when seedling alfalfa or clover is in the second trifoliate stage or larger. Can also be applied postemergence to established alfalfa or clover in the fall, in the spring to dormant or semi-dormant alfalfa or clover, or between cuttings. Application should be made before significant alfalfa or clover growth or regrowth to allow herbicide to reach target weeds. Use 80% active nonionic surfactant at 1 quart per 100 gallons of water or a crop oil concentrate at 1 quart per acre. Weeds should be 1 to 3 inches in height. Imazethapyr will reduce growth of perennial grasses (fescue) that are present in the stand. See label for weeds controlled and other precautions.
	Annual bluegrass, barnyardgrass, crabgrass, crowfootgrass, foxtail species, goosegrass, Italian ryegrass, seedling johnsongrass, fall panicum, Texas panicum, sandbur, signalgrass, and certain broadleaf weeds such as Palmer amaranth, common chickweed, henbit, lambsquarters, pigweed species, and smartweed	pendimethalin, MOA 3 (3.8 CS)	1.1 to 4.2 qt	1.045 to 4	Use on alfalfa grown for forage, hay, or seed. Apply 1.1 to 4.2 quarts/acre prior to weed emergence in fall after last cut, during winter dormancy, in the spring, or between cuttings before alfalfa reaches 6 inches when grown for forage or hay. Apply same rates for alfalfa grown for seed production when dormant or before alfalfa exceeds 10 inches after first or second cut. Use drop nozzles to minimize foliar contact. Apply 1.1 to 2.1 pints/acre to seedling alfalfa in second trifoliate stage before 6 inches of growth. Do not harvest alfalfa forage or hay less than 28 days after applying 2.1 quarts/acre or less than 50 days after applying more than 2.1 quarts/acre. Do not harvest alfalfa seed less than 90 days after application. Some stunting and chlorosis of alfalfa may occur after postemergence applications.
	Annual and perennial grasses	clethodim, MOA 1 (2 EC)	6 to 16 fl oz	0.094 to 0.250	Apply postemergence for annual grasses in seedling alfalfa at 6 to 8 fluid ounces per acre or in established alfalfa at 8 ounces per acre. Apply postemergence for bermudagrass and rhizome johnsongrass at 8 to 16 fluid ounces per acre. Add a crop oil concentrate at 1 quart per acre. Can be applied at any stage of alfalfa growth. Apply to actively growing grasses not under drought stress. Be sure grasses have leaves present for contact by the spray solution. Do not apply within 15 days of grazing, feeding, or harvesting (cutting) alfalfa for forage or hay. Select may be tank mixed with 2,4-DB or imazethapyr. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
		sethoxydim, MOA 1 (1.5 EC) (1 EC)	1 to 2.5 pt 1.5 to 3.5 pt	0.19 to 0.47	Apply postemergence for annual grasses at 0.19 pound a.i. (the lower rate) per acre and for bermudagrass and johnsongrass at 0.47 pound a.i. (the higher rate) per acre. Add 2 pints crop oil concentrate per acre. Use 10 to 20 gallons of spray solution per acre. Can be applied at any stage of alfalfa growth. Do not apply to weedy grasses or alfalfa under stress. Be sure grasses have leaves present for contact by the spray solution. Do not apply within 7 days of grazing, feeding, or cutting for (undried) forage, or within 14 days of cutting alfalfa for (dry) hay.
Alfalfa, Established Dormant	Winter annual weeds, such as chickweed, henbit, bittercress, pepperweed, shepherds purse, yellow rocket, and ryegrass	metribuzin, MOA 5 (75 DF) (4 L, 4 F)	0.33 to 1.33 lb 0.5 to 2 pt	0.25 to 1 0.25 to 1	Good results have been obtained in NC when the herbicide was applied from Nov. 20 to Dec. 20. Do not graze or harvest within 28 days after application. In alfalfa-grass mixtures, it will provide partial reduction of forage grass stands.
		paraquat, MOA 22 (2 SL) (3 SL)	0.75 to 2 pt 0.7 to 1.3 pt	0.1875 to 0.5 0.263 to 0.488	Apply up to 1.25 pints per acre on fall-seeded newly established stands less than1 year old. Apply up to 2 pints per acre on established stands. Tank mixing with metribuzin will improve vegetation control. Apply late fall to winter after last fall cutting and before first spring cutting. Alfalfa must be dormant to avoid injury. There is a 60-day grazing or preharvest interval. Add 1 to 2 pints per acre nonionic surfactant per 100 gallons.
		terbacil, MOA 5 (80 WDG)	0.5 to 1.5 lb	0.4 to 1.2	Apply to established alfalfa stands at least 1 year old before or shortly after weed growth begins. Weeds have been controlled with an application from mid-November through February. Do not use terbacil on alfalfa-grass mixtures on sand or loamy sand soils or on soils containing less than 1% organic matter.
Alfalfa, Between Cuttings (even first year alfalfa)	Various grass and broadleaf weeds	paraquat, MOA 22 (2 SL) (3 SL)	1 pt 0.7 pt	0.25 0.263	Apply immediately after hay or silage removal but no more than 5 days after a cutting. Apply up to 2 times for first year alfalfa and 3 times for established alfalfa. There is a 30 day grazing or preharvest interval. Add 1 to 2 pints per acre nonionic surfactant per 100 gallons.
Lespedeza, Preplant	Certain annual grass and broadleaf weeds	EPTC, MOA 8 (7 EC)	3.5 pt	3	See remarks under alfalfa.
No-Till Alfalfa or No-Till Pasture Reseeding	Complete kill of existing sod	glyphosate, MOA 9 (4 SL) (5.5 SL)	1 to 5 qt 2.75 pt	1 to 5 1.89	Broadcast spray 10 to 14 days before planting. Provides better control of perennial weeds. Check label for rate according to weeds present.
		paraquat, MOA 22 (2 SL) (3 SL)	2 to 4 pt 1.67 to 2.67 pt	0.5 to 1 0.625 to 1	Broadcast spray in 20 to 30 gallons of water per acre. Make 2 applications if needed. If spraying following hay harvest, allow enough regrowth to provide leaf area to absorb the herbicide. Add 1 pint of a nonionic surfactant per 100 gallons of water.
No-Till Pasture Reseeding with Grasses or Clover	Suppression of existing sod and undesirable emerged broadleaf and grass weeds to permit pasture reseeding	paraquat, MOA 22 (2 SL) (3 SL)	1 to 2 pt 0.7 to 1.3 pt	0.25 to 0.5 0.263 to 0.488	Rates are per sprayed acre. Usually band sprayed for planting clover into existing grass sod. Apply before or at time of seeding. Pasture should not exceed 3 inches in height at time of treatment. Add 1 to 2 pints of a nonionic surfactant per 100 gallons of water. Spray bermudagrass or bahiagrass sod in late summer to early fall.

Table 7-13. Chemical Weed Control in Hay Crops and Pastures

Crop	Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Pastures, Clover, Velvetbean, Lespedeza, Lupine, Sainfoin, Trefoil, Vetch, Crown Vetch, Milk Vetch	Various grass and broadleaf weeds	paraquat, MOA 22 (2 SL) (3 SL)	0.75 to 2 pt 0.7 to 1.3 pt	0.1875 to 0.5 0.263 to 0.488	Apply up to 1.2 pints per acre to fall-seeded newly established stands less than1 year old. Apply up to 2 pints per acre to established stands. Apply when dormant in late fall or winter after last cutting and before first spring cutting. Do not apply if regrowth is >2 inches. Make only 1 application per season. There is a 60 day grazing or preharvest interval. Add 1 to 2 pints per acre nonionic surfactant per 100 gallons.
Pastures, Ladino Clover, Orchardgrass, Fescue, and other grasses	Curly dock, ragweed, bitterweed, pigweed, dandelion, and other broadleaf weeds	2,4-D amine, MOA 4 (4 SL)	1 to 2 pt	0.5 to 1	Spray when weeds are 4 to 8 inches tall and before heading. Clover may be stunted and growth retarded 3 to 6 weeks. Use lower rate in warm, wet weather. For wild garlic, apply late February or early March. Repeat for 2 years. **Do not graze dairy animals on treated areas within 7 days after application.** Remove meat animals from treated areas for 3 days before slaughter. Withdrawal is not necessary if more than 2 weeks have elapsed since treatment. Do not cut treated grass for hay within 30 days after application.
	Wild garlic	2,4-D amine, MOA 4 (4 SL)	1 qt	1	
Perennial Grasses, Rangeland, Permanent Grass Pastures	Many annual and perennial grass and broadleaf weeds and nutsedge species (goosegrass not controlled)	imazapic, MOA 2 (2 SL)	4 to 12 fl oz	0.0625 to 0.1875	Apply to common and coastal bermudagrass varieties. Jiggs bermudagrass is more sensitive than other types. Expect 30 to 45 days of bermudagrass suppression. Do not apply (1) to drought stressed bermudagrass, (2) during spring transition, (3) to newly aerated fields for 30 days, (4) to newly sprigged or seeded bermudagrass, or (5) to World Feeder bermudagrass varieties. To speed bermudagrass recovery, apply with nitrogen fertilizer and do not add a spray adjuvant. If spray carrier is water, add a nonionic surfactant at 0.25% by volume or a methylated seed oil at 1.5 to 2 pints per acre. Imazapic also controls winter weeds when applied to dormant bermudagrass and can be mixed with glyphosate at this time. There is a 7-day hay restriction.
	Johnsongrass, kyllinga species, purple and yellow nutsedge	sulfosulfuron, MOA 2 (75 WG)	1.33 oz	0.0625	Apply to established bermudagrass and bahiagrass pastures. A second application can be made 40 days after initial application if needed but do not exceed 2.66 ounces per acre per year. Apply a nonionic surfactant at 0.25% v/v. There are no grazing restrictions. Do not harvest for hay within 14 days of application. Johnsongrass is best controlled if sulfosulfuron is applied at 18 to 24 inches and up to heading stage.
	Amaranth and pigweed species, ladysthumb, wild mustard, wild radish, maypop passionflower, pokeweed, ragweed species, hemp sesbania, velvetleaf, purple and yellow nutsedge	halosulfuron, MOA 2 (75 DF)	0.67 to 1.33 oz	0.0314 to 0.0628	Listed weeds are controlled postemergence if small and actively growing at application. Check label for weeds that are controlled preemergence. The following adjuvants can be used with halosulfuron; nonionic surfactant applied at 0.25 to 0.5% v/v, crop oil concentrate or methylated seed oil at 1% v/v, high quality granular spray grade ammonium sulfate at 2 to 4 pounds per acre or liquid ammonium sulfate at equivalent nitrogen rate of 2 to 4 lb per acre. If nutsedge populations resprout or reemerge, a second spot application not to exceed 0.75 ounce per treated acre in these areas can be made. There are no grazing or slaughter restrictions. There is a 37 day pre-harvest interval.
	Emerged annual, biennial, and perennial broadleaf weeds and certain woody species	[picloram + 2,4-D], MOA 4 + 4 (0.54 + 2 lb/gal SL)	1 to 8 pt	0.3175 to 2.54	Due to crop sensitivity, [picloram + 2,4-D] should not be used in cotton- or tobacco-growing regions of the state. Do not graze lactating dairy animals for 7 days after application. Do not harvest grass for hay for 30 days after application. Meat animals must be withdrawn from treated forage at least 3 days before slaughter. There are no other grazing restrictions for non-lactating dairy animals or other livestock. Newly seeded grasses may be injured. Check label for livestock transfer restrictions due to possible urine and manure contamination with picloram. Check label for all other restrictions.
		[picloram + fluroxypyr], MOA 4 + 4 (1.19 + 0.96 lb/gal EC)	1.5 to 6 pt	0.40 to 1.60	Due to crop sensitivity, [picloram + fluroxypyr] should not be used in cotton- or tobacco-growing regions of the state. Do not allow lactating dairy animals to graze or consume harvested forage within 14 days after application. There are no grazing restrictions for nonlactating dairy animals or other livestock. Do not harvest hay within 7 days after application. Withdraw meat animals from treated forage at least 3 days before slaughter. Newly seeded or sprigged grasses may be injured. Check label for livestock transfer restrictions due to possible urine and manure contamination with picloram. Check label for all other restrictions.
	Mustard, radish, cocklebur, vetch, and other susceptible broadleaf weeds	2,4-D amine, MOA 4 (4 SL)	1 to 2 pt	0.5 to 1	Do not spray in seedling stages or just before heading. Apply after the perennial grass seedlings have reached the 2- to 4-leaf stage. For wild garlic apply February or March. Repeat for 2 years. **Do not graze dairy animals on treated areas within 7 days after application.** Remove meat animals from treated areas for 3 days before slaughter. Withdrawal is not necessary if more than 2 weeks have elapsed since treatment. Do not cut treated grass for hay within 30 days after application.
	Wild garlic	2,4-D amine, MOA 4 (4 SL)	3 qt	3	
	Many broadleaf weeds including certain ones resistant to 2,4-D	dicamba, MOA 4 (4 SL)	0.5 to 2 pt	0.25 to 1	Rate dependent on weed species and size. See label for specific rates and precautions concerning grazing.
	Many broadleaf weeds including dogfennel, thistles, and horsenettle	dicamba (4 SL) + 2,4-D amine (4 SL) (a tank mix) MOA 4 + 4	0.5 pt + 1.5 pt	0.25 + 0.75	The tank-mix combination will control a greater number of broadleaf weeds than either herbicide alone. Observe each label for restrictions on grazing and cutting for hay. For 1 pint of dicamba or 2 pints of [2,4-D amine + dicamba], do not graze lactating dairy animals for 7 days or harvest hay for 37 days. No grazing restrictions for other livestock; however, meat animals must be removed 30 days before slaughter.
		[dicamba + 2,4-D amine], MOA 4 + 4 (a premix) (1 + 2.87 lb/gal SL)	1 to 2 pt	0.13 to 0.25 + 0.36 to 0.72	

Table 7-13. Chemical Weed Control in Hay Crops and Pastures

Crop	Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Perennial Grasses, Rangeland, Permanent Grass Pastures (continued)	Many broadleaf weeds including dogfennel, thistles, and horsenettle (continued)	[2,4-D +triclopyr], MOA 4 + 4 (2 + 1 lb/gal EC)	1 to 6 qt	0.5 to 3 + 0.25 to 1.5	Rate depends on weeds to be controlled. Woody plant control requires 6 quarts or more. Consult label for specific rates. Withdraw livestock from treated forage at least 3 days before slaughter during the year of treatment. Do not graze lactating dairy animals on treated areas for 14 days following treatment. Do not harvest grass for hay from treated areas for 1 year following treatment for lactating dairy animals. Wait 7 days for other livestock.
		metsulfuron methyl, MOA 2 (60 WDG)	0.1 to 1 oz	0.0038 to 0.038	Bermudagrass, bluegrass, orchardgrass, bromegrass, and timothy are tolerant. Metsulfuron methyl may cause stunting and seedhead suppression of tall fescue. Therefore, do not exceed 0.4 ounce product per acre. Pensacola bahiagrass controlled at 0.3 ounce product per acre in established bermudagrass. Also controls wild garlic. Alfalfa, clover, and ryegrass are highly sensitive. Use a nonionic surfactant of at least 60% active ingredient with a hydrophilic/lipophilic balance greater than 12 at 1 to 2 pints per 100 gallons of spray solution. Use a COC of 80% quality or MSO with 15% surfactant emulsifiers at 1 gallon per 100 gallons spray solution. Metsulfuron methyl has no grazing restrictions.
		[metsulfuron methyl + chlorsulfuron], MOA 2 + 2 (48% + 15% WDG)	0.125 to 1.25 oz	0.005 to 0.05	Tolerant to native grasses, such as bluestems, blue grama, and buffalograss, as well as bermudagrass, bluegrass, orchardgrass, bromegrass (but not Matua), and fescue. To minimize fescue injury, do not exceed 0.5 ounce per acre and use a nonionic surfactant unless liquid nitrogen is the carrier. Apply to bermudagrass 2 months after establishment and fescue 24 months after establishment. Generally, treat actively growing weeds less than 4 inches tall or 4 inches in diameter. However, this product also provides preemergence control. Unless otherwise recommended, use a nonionic surfactant at 0.25% v/v or crop oil concentrate at 1% v/v. There are no grazing or hay harvest restrictions.
	Many annual and perennial broadleaf weeds and woody brush	[metsulfuron methyl + dicamba + 2,4-D amine], MOA 2 + 4 + 4 (a 2-part product) [60%+(1+2.87) lb/gal]	0.25 to 1 oz + 1 to 4 pt	0.009375 to 0.038 + 0.48 to 1.94	Observe same precautions as metsulfuron methyl except for the following changes or additions: Tall fescue: do not exceed 0.25 ounce per acre Part A + 1 pint per acre Part B. Nonlactating meat animals: remove 30 days prior to slaughter. Lactating dairy animals: 7-day grazing and 37-day hay restriction.
	Henbit, common chickweed, mustards, buttercup, Carolina geranium, pigweed species, common lambsquarters, and other susceptible broadleaf weeds	chlorsulfuron, MOA 2 (75 DF)	0.25 to 1 oz	0.0117 to 0.047	Treat perennial weeds in bud to bloom stage or fall rosette stage. There are no grazing or hay restrictions with rates up to 1.33 ounces per acre. For bermudagrass and orchardgrass, apply a maximum of 1 ounce per acre. Apply up to 0.5 ounce per acre on tall fescue. Spot treat with 1.33 ounces per acre if grass injury can be tolerated. Use a high-quality spray adjuvant for improved postemergence control but do not use LI-700 or other acidifying spray adjuvants.
	Buttercup species, cocklebur, henbit, horsenettle, horseweed, ragweed, thistles, and other susceptible broadleaf weeds	aminopyralid, MOA 4 (2 SL)	3 to 7 fl oz	0.04688 to 0.10938	Due to crop sensitivity, use extreme caution around sensitive crops, including but not limited to alfalfa, cotton, potatoes, soybeans, tobacco, and other broadleaf or vegetable crops, fruit trees, or ornamental plants. Do not use aminopyralid-treated plant residues, including hay or straw from treated areas, or manure from animals that have grazed treated areas in compost or mulch that will be in contact with susceptible broadleaf plants. Hay treated within the preceding 18 months can only be used on the farm or ranch where the product was applied. There are no other restrictions on grazing or hay harvest following aminopyralid applications. Check product label for list of precautions.
		[aminopyralid + florpyrauxifen] (0.28 to 0.46 fl oz)	12 to 20 fl oz	0.07 to 0.11	For control of broadleaf and certain woody plants in rangeland, permanent grass pastures (including grown for hay), CRP areas, and wildlife management areas. Hay from grass treated within the preceding 18 months can only be used on the farm or range where the product is applied. See label for additional precautions and restrictions.
		[aminopyralid + 2,4-D amine], MOA 4 + 4 (0.41 + 3.33 lb/gal L)	1.2 to 2.1 pt	0.56 to 0.975	Do not use on areas where loss of desirable broadleaf forage plants (legumes) cannot be tolerated. Do not use hay, straw, or manure from farm animals that have grazed forage or eaten hay harvested from treated areas within previous 3 days in compost or mulch that will be in contact with susceptible broadleaf plants. Wait 7 days after application to harvest forage for hay. Wait 30 days to make second application. Do not transfer grazing animals from treated areas to sensitive broadleaf crop areas without allowing for 3 days grazing on nontreated areas. Hay treated within the preceding 18 months can only be used on the farm or ranch where the product was applied.
		[aminopyralid + metsulfuron methyl], MOA 4 + 2 (71.58 WG)	1 to 3.3 oz	0.0447 to 0.1476	[Aminopyralid + metsulfuron methyl] is effective on Pensacola bahiagrass. At higher rates, [aminopyralid + metsulfuron methyl] may stunt tall fescue, cause yellowing, or cause seedhead suppression. Follow label precautions to minimize these symptoms. Include 1% crop oil concentrate, 0.25% non-ionic surfactant, 0.5% methylated seed oil, or 2 quarts/acre urea ammonium nitrate. Can spot spray less than 50% of an acre with up to 6.6 ounces/acre. There are no grazing or hay harvest restrictions. Do not use on grasses grown for seed. Do not overseed 4 months after treatment. Aminopyralid precautions: Do not transfer grazing animals from treated areas to sensitive broadleaf crop areas without allowing for 3 days grazing on nontreated areas. Do not use hay, straw, or manure from animals that have grazed forage or eaten hay from treated areas within previous 3 days in compost or mulch that will contact susceptible broadleaf plants. Do not spread manure on land used for growing susceptible broadleaf crops if animals have consumed treated hay within 3 previous days. Conduct a field bioassay before planting a broadleaf crop. Hay treated within the preceding 18 months can only be used on the farm or ranch where the product was applied.

Table 7-13. Chemical Weed Control in Hay Crops and Pastures

Crop	Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Perennial Grasses, Rangeland, Permanent Grass Pastures (continued)	Catchweed bedstraw, common lambsquarters, mustard spp., nightshade spp., amaranthus spp., velvetleaf, bittercress, shepherdspurse, annual sowthistle, corn spurry, Russian thistle, redstem filaree	carfentrazone ethyl, MOA 14 (2 EC)	0.5 to 2 fl oz	0.0078125 to 0.03125	Use in grasses grown for forage, fodder, hay, seed, and sod. There are no grazing or hay restrictions. Add a nonionic surfactant at 0.25% v/v or crop oil concentrate or methylated seed oil at 1% v/v with or without a high quality sprayable liquid N fertilizer at 2 to 4% v/v or ammonium sulfate at 2 to 4 pounds per acre. Apply to weeds up to 4 inches tall. In overseeded pastures, Aim can be applied to barley, millet, oats, rye, teosinte, triticale, and wheat from prior to planting up to joint stage. Tank mix 2,4-d amine or ester for extended broadleaf weed control but don't harvest for forage within 7 days of application.
	Catchweed bedstraw, common lambsquarters, mustard spp., nightshade spp., amaranthus spp., velvetleaf, bittercress, shepherdspurse, annual sowthistle, corn spurry, Russian thistle, redstem filaree, and many other weeds susceptible to 2,4-D	[carfentrazone ethyl + 2,4-D ester], MOA 14 + 4 (0.13 + 5.92 lb/gal EC)	0.5 to 2 pt	0.378125 to 1.5125	Use in grasses grown for forage, fodder, hay, seed, and sod. Restrictions after application include: 3-day slaughter; 7-day dairy grazing; and 30-day hay harvest. Add a nonionic surfactant at 0.25% v/v or crop oil concentrate or methylated seed oil at 1.5 to 2% v/v with or without a high quality sprayable liquid N fertilizer at 2 to 4% v/v or ammonium sulfate at 2 to 4 pounds per acre. Apply to weeds up to 6 inches tall. In overseeded pastures, 8 to 16 ounces of [carfentrazone ethyl + 2,4-D ester] can be applied to barley, oats, rye, and wheat from 3 tiller stage up to joint stage. Use only a nonionic surfactant with or without a fertilizer solution as described above in small grains. Do not graze dairy or meat animals being finished for slaughter for 14 days following application. Do not feed treated straw to livestock.
	Grassy weeds including barnyardgrass, crabgrass spp., foxtail spp., and broadleaf signalgrass and broadleaf weeds including clover spp., eclipta, jointvetch spp., select morningglory spp., and hemp sesbania.	quinclorac, MOA 27 + 4 (1.5 lb/gal)	12 to 64 fl oz plus 2 pt crop oil concentrate or 1.5 pt methylated seed oil	1.5 lb per gallon	May be used for postemergence weed control in cool- and warm-season pastures including pastures grown for hay. Facet L also provides short residual weed control (length of control depends on species and environmental conditions). Facet L is rainfast 6 hours after application. Do not cut treated area for hay within 7 days after application. There is no waiting period for grazing following application.
	Buttercup species, cocklebur, dogfennel, henbit, horsenettle, horseweed, select amaranth and pigweed species, other susceptible broadleaf weeds.	[diflufenzopyr sodium + dicamba], MOA 19 + 4 (21.3% + 55% DF)	4 to 8 oz	0.05 + 0.125 to 0.1 + 0.25	Use caution around sensitive broadleaf crops, including but not limited to alfalfa, clover, and lespedeza. There are no hay harvesting or grazing restrictions for pasture and rangelands treated with [diflufenzopyr sodium + dicamba]; however, there is a 30-day crop rotation or planting restriction. [Diflufenzopyr + dicamba] is for use on established grasses; do not apply to newly seeded grasses or to small grains grown for pasture.
		saflufenacil, MOA 14 (2.85 lb/gal)	1.0 to 2.0 fl oz	2.85 lb per gallon	Provides preemergence and early postemergence broadleaf weed control in perennial cool-season and warm-season forage grasses grown for forage, silage, or hay production. Do not apply to annual forage stands (including forage sorghum, sudangrass) Sharpen does not control grass weeds. Sharpen is labeled at 1.0 to 2.0 fl oz/a during dormant and periods of active growth. Do not apply more than 1.0 oz/a to forage bermudagrass after greenup. Add a methylated seed oil (1% vol/vol or 1.5 pt/a) for optimum control. Do not use a nonionic surfactant.
	Many broadleaf weeds including most legumes, cocklebur, curly dock, horseweed, jimsonweed, lambsquarters, prickly lettuce, mustards, nightshades, redroot pigweed, plantains, wild radish, sicklepod, sowthistles, and thistles	[2,4-D amine + cloypyralid], MOA 4 + 4 (2 +0.38 lb/gal)	2 to 4 qt	1.19 to 2.38	Apply to established grass pastures. Allow 7 days grazing on nontreated pasture before livestock transfer to sensitive broadleaf crop areas. Do not use plant residues or manure from treated areas for composting or mulching near sensitive plants. Avoid movement of treated soil and minimize spray drift when possible. There is a 14-day grazing restriction for lactating cattle, a 30-day restriction for haying, and a 7-day restriction for slaughter. Addition of surfactant is usually not necessary.
	Many woody plants, such as poplar, sumac, sassafras, wax myrtle, oaks, red maple, locust, eastern persimmon, and broadleaf weeds such as poison oak, poison ivy, blackberry, clover, curly dock, multiflora rose, lespedeza, mustard, plantain, and vetch	triclopyr, MOA 4 (4 EC)	1 to 3 pt	0.5 to 1.5	Apply to established grass pastures. Rate depends on weed species to be controlled. See label for rates for specific weeds and dilution rates for woody plant control. For lactating dairy animals do not graze until next growing season. There are no grazing restrictions for other livestock. Portions of grazed area may be treated if comprised of no more than 10% of the total grazable area. There is a 3-day slaughter and 14-day hay harvest restriction. Addition of 2,4-D at 1 pint per acre enhances weed spectrum. A surfactant or oil-based carrier is recommended, but liquid nitrogen carrier may be used as well.
		[triclopyr + fluroxypyr], MOA 4 + 4 (3 + 1 lb/gal EC)	0.75 to 1.5 pt	0.38 to 0.75	Apply to established grass pastures. In general, apply 0.75 to 1 pint per acre for annual broadleaf weeds, 1 to 1.5 pints per acre for biennial and perennial broadleaf weeds, and 1 to 4 pints per acre for woody plants. Do not graze or harvest green forage for lactating dairy animals during the same growing season. There are 14-day haying and 3-day slaughter restrictions. A nonionic surfactant at 1 to 2 quarts per 100 gallons of spray solution may improve control of drought-stressed weeds.
	Multiflora rose	dicamba, MOA 4 (4 SL)	1 to 2 gal	4 to 8	Mix 1 gallon of dicamba herbicide with 99 gallons of water. Add a nonionic surfactant at the rate of 2 quarts per 100 gallons of spray solution to improve wetting. Apply 100 to 200 gallons of spray solution per acre. Completely wet foliage and stems, allowing spray solution to run down the stem. Apply at full vegetative stage before bloom. For spot treatment, mix 3 tbsp of dicamba per 1 gallon of water, or directly apply concentrate to root area with a spotgun applicator. Use 1 fluid ounce of dicamba per 10 feet of canopy diameter and apply before bud-break in spring. Do not graze dairy animals for 60 days after treatment. There is no waiting period between treatment and grazing for animals other than dairy animals.

Table 7-13. Chemical Weed Control in Hay Crops and Pastures

Crop	Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Perennial Grasses, Rangeland, Permanent Grass Pastures (continued)	Multiflora rose (continued)	glyphosate, MOA 9 (4 SL, 5.5 SL)	1% solution		Apply 1% solution of glyphosate in water with a handgun. Spray foliage completely. Apply after full bloom until August 1. Do not graze livestock for 10 days following treatment.
		metsulfuron methyl, MOA 2 (60 WDG)	0.5 oz	0.019	Broadcast application: treat in spring when multiflora rose is fully leafed but less than 3 ft tall. Spot application: treat spring through summer at 1 ounce per 100 gallons of spray solution. Add surfactant. Metsulfuron methyl has no grazing restrictions.
		tebuthiuron, MOA 7 (20 P) (80 DF)	20 lb 2.5	4 2	Apply in the spring just before growth begins or during periods of vigorous growth, late spring or early summer (March 15 to June 1). Best to apply to individual clumps on basis of area (sq ft) covered. Spread uniformly over the plant roots. Check label carefully for restrictions and precautions on use. Do not contaminate water used for irrigation.
		[2,4-D + triclopyr], MOA 4+4 (2 + 1 lb/gal EC)	1.5 gal	4.5	Mix 1 to 1.5 gallons of [2,4-D + triclopyr] with water to make 100 gallons of total spray solution. Spray to give thorough coverage of foliage, wetting leaves and stems to the drip point. The best time for treatment is during early to mid-flowering stage. See restrictions for [2,4-D + triclopyr] on grazing and hay harvest listed previously.
Bermudagrass, Newly Sprigged	Annual and perennial grass and broadleaf weeds	diuron, MOA 7 (4 L)	0.8 to 2.4 qt	0.8 to 2.4	Apply after planting, before bermudagrass or weed emergence. Apply 0.4 to 0.8 quart per acre if annual weeds are up to 4 inches tall with an NIS at 2 quarts per 100 gallons of water. If bermudagrass has emerged at treatment, expect temporary burn. Plant sprigs 2 inches deep to reduce crop injury potential. Do not graze or feed livestock within 70 days of application.
Bermudagrass, Dormant	Emerged winter annual broadleaf and grass weeds	metsulfuron methyl, MOA 2 (60 WDG)	0.1 to 0.3 oz	0.0038 to 0.011	Controls many winter annual broadleaf weeds.
		paraquat, MOA 22 (2 SL) (3 SL)	1 to 2 pt 0.7 to 1.3 pt	0.25 to 0.5 0.263 to 0.488	Apply in February or March in dormant bermudagrass and Coastal bermudagrass pastures. Add 1 pint of a nonionic surfactant per 100 gallons of water. Do not mow for hay until 40 days after treatment.
	Annual bluegrass, bromegrass, Barnyardgrass, cheatgrass, crabgrass, crowfootgrass, downy brome, foxtail brome, foxtails, Japanese stiltgrass, goosegrass,little barley,medusahead, rattail fescue, ryegrass,sandbur, annual sedge, sprangletop, tufted lovegrass. Black nightshade, bittercress, Canada thistle, carpetweed, chickweed, white clover, corn seedwell, cudweed, toadflax, dandelion, dogfennel, doveweed, common groundsel, hairy fleabane, hairy nightshade, horseweed, knapweed, lawn burweed, little mallow, long-stalk phyllanthus, common mullein, willowweed, buckhorne plantain, pigweeds, prostrate spurge, common purslane, redstem filaree, Russian thistle, sheperd's-purse, annual sowthistle, catseaer, swincress.	Indaziflam, MOA 29 (1.67 lb/gal SC)	3-5 fl oz	0.04 - 0.065	Only use on fully established bermudagrass and bahiagrass. Apply in the late winter/early spring (dormant season) for control of early germinating summer annual weeds. This herbicide can also be used immediately after a harvest and prior to foliage regrowth for mid- or late-season summer annual weeds that have not germinated, and in late summer to fall, before winter weeds germinate and after a harvest, for control of winter annual weeds. Do not harvest for hay until 40 days after application.
	Barnyardgrass, crabgrass, crowfootgrass, foxtail species, goosegrass, seedling johnsongrass, fall panicum, Texas panicum, sandbur, signalgrass, and certain broadleaf weeds such as palmer amaranth, lambsquarters, pigweed species, and smartweed, wild mustard.	pendimethalin, MOA 3 (3.8 CS)	1.1 to 4.2 qt	1.045 to 4	Apply to established bermudagrass pasture and hay fields in winter dormancy. Apply as a single full rate or in two split applications with a half rate at the onset of winter dormancy and another half rate prior to spring greenup. Do not harvest for forage or graze until 45 days after treatment. Do not harvest for hay until 60 days after treatment. Observe a plant back interval of 270 days after treatment. Use of pendimethalin on rangeland is prohibited.

Table 7-13. Chemical Weed Control in Hay Crops and Pastures

Crop	Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Bermudagrass, Coastal	Various annual grass and broadleaf weeds	glyphosate MOA 9 (4 SL) (5.5 SL)	1 pt 0.727 pt	0.5	May be applied to coastal bermudagrass prior to spring growth or immediately after first cutting. Cannot be applied prior to spring growth and immediately after first cutting in the same year. Remove domestic livestock from area before making applications. When applying prior to spring growth, apply in late winter or early spring but before new coastal bermudagrass growth begins in spring. Applications to new growth can damage bermudagrass. Wait 60 days after making this application before grazing or harvesting the treated area. When applied after first cutting, apply after the first bermudagrass cutting when the bermudagrass has not yet begun to grow. Applications made after regrowth can damage the bermudagrass. Wait 28 days after making this application before grazing or harvesting the treated area.
	Suppresses large crabgrass, goosegrass. Controls barnyardgrass, broadleaf signalgrass, foxtail species, johnsongrass up to 18 inches, panicum species, Italian ryegrass, sandbur, volunteer cereals, Pensacola bahiagrass, wild garlic, many broadleaf weeds such as bitter sneezeweed, buttercup, geranium, chickweed, curly dock, dandelion, dog fennel, henbit, horseweed, jimsonweed, lambs-quarters, morningglory, pigweed, plantain, smartweed, wild mustard.	[nicosulfuron + metsulfuron methyl], MOA 2 + 2 (56.2% + 15% WG)	1 to 1.5 oz	0.0445 to 0.0668	There are no grazing or hay restrictions. [Nicosulfuron + metsulfuron methyl] provides pre and post broadleaf weed control and only post grass weed control. Apply to established bermudagrass. Temporary crop injury may occur if treated on new growth more than 2 inches or after 7 days following harvest. Do not exceed 2.5 ounce/acre per year if sequential applications are needed; 0.25% non-ionic surfactant is preferred but can apply with 1% crop oil concentrate or 2 quarts/acre urea ammonium nitrate. Check label for acceptable tank mix partners. [Nicosulfuron + metsulfuron methyl] will control crabgrass and sandbur up to 2 inches and goosegrass up to 2 tillers. FIFRA Section 2 (ee) allows glyphosate to be tank mixed with [Nicosulfuron + metsulfuron methyl] for improved control or suppression of crabgrass, sandbur, foxtail, rescuegrass, Japanese brome, little barley, and ryegrass. Apply 2.5 to 4.1 ounce a.i. per acre glyphosate. Expect temporary yellowing or stunting of bermudagrass. Add nonionic surfactant at 0.25% v/v.
Hybrid Bermudagrass, (Coastal, Tifton 44)	Young annual broadleaf weeds	2,4-D amine, MOA 4 (4 SL)	1 qt	1	Apply after sprigging. Gives little preemergence weed control. Later applications may be needed to control broadleaf weeds.
Sorghum-Sudan Hybrids, Preemergence	Annual broadleaf and grass weeds	atrazine, MOA 5 (4 L) (90 DF, 90 WDG)	3.2 to 4 pt 1.8 to 2.2 lb	1.6 to 2	Use only on silt-loam, clay loam, and clay soils with more than 1% organic matter. Use lower rates on soils 1% to 1.5% organic matter and higher rates on soils having more than 1.5% organic matter. On highly erodible soils (as defined by SCS), if conservation tillage is practiced, leaving at least 30% of soil covered with plant residues at planting, apply a maximum of 2 pounds active per acre as broadcast spray. If soil coverage with plant residue is less than 30% at planting, a maximum of 1.6 pounds active per acre may be applied. On soils not highly erodible, apply 2 pounds active per acre as a broadcast spray.

Chemical Weed Control in Lawns and Turf

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Note: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-10B, Herbicide Modes of Action for Hay Crops, Lawns and Turf for details concerning active ingredients, brand names, chemical families, and modes of action.

Several of the preemergence herbicides are available on fertilizer carriers for homeowner application.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Preemergence Control, Smooth and Large Crabgrass, Goosegrass, Foxtails, other annual grasses				
benefin, MOA 3 (2.5 G)	2.75 lb	120 lb	3	Safe to apply to all established turfgrass except bentgrass. Do not apply in the spring to lawns seeded the previous fall or to golf course greens. Do not use on newly sprigged turfgrasses.
[benefin + trifluralin], MOA 3 + 3 (0.86 G)	8 lb	349 lb	3	Use on lawns and golf course fairways of bahiagrass, bentgrass, bermudagrass, centipedegrass, fescue, perennial ryegrass, St. Augustinegrass, and zoysiagrass.
bensulide, MOA 8 (4 EC) (8.5 G, 12.5 G)		Varies, several concentrations available	10	May be applied to all established turfgrass and dichondra, residential lawns, and golf course greens and tees. Limit 2 applications per year to greens and tees. Do not use on newly sprigged turfgrasses. Not effective for goosegrass control.
[bensulide + oxadiazon], MOA 8 + 14 (6.56 G)	2.6 lb	116 lb	6 + 1.5	Controls crabgrass and goosegrass. Use on established bermudagrass, zoysiagrass, tall fescue, bentgrass, perennial bluegrass, or perennial ryegrass fairways and tees. Use also on bermudagrass and bentgrass greens.
dithiopyr, MOA 4 (2 EW, 2 L) (40 WP)	0.75 fl oz 0.46 oz	1 qt 20 oz	0.5	May be applied to most all cool-season and warm-season turfgrasses except colonial bentgrass. See label for injury precautions regarding certain varieties. Also controls pre-tillered crabgrass. Split applications recommended in southern and coastal regions of the state (0.25 pound a.i. at 8-week intervals). Timely irrigation or rainfall is critical for activation.
indaziflam, MOA 21 (20 WSP)	0.057 to 0.115 oz	2.5 to 5 oz	0.03125 to 0.0625	Use only on established turf (1 year after seeding) such as bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, seashore paspalum, and bahiagrass. Labeled for commercial and residential lawns, golf courses (roughs, tees, fairways), sod farms, athletic fields, parks and cemeteries. Use a minimum of 2.5 ounces per acre for crabgrass, annual bluegrass and broadleaf weed control and a minimum of 3.75 ounces per acre for goosegrass, annual sedge and kyllinga species control. Apply up to 2.5 ounces per acre on centipedegrass and St. Augustinegrass due to tolerance concerns. For all other tolerant turfgrasses, do not exceed 5 ounces per acre in a single application or 7.1 ounces per acre within a calendar year. There is an 8-month overseeding restriction following a 2.5 ounces per acre application. Can sprig 2 months following application, or if sprigged first, wait 4 months before spraying. Can sod 4 months following application, or if sodded first wait 2 months after rooting before spraying.
(0.622F)	0.69 to 0.23 fl oz	3 to 10 fl oz	0.01458 to 0.0486	Use up to 6 fluid ounces per acre on common bermudagrass, centipedegrass and St. Augustinegrass and 10 fluid ounces per acre on hybrid bermudagrass, zoysiagrass and bahiagrass established 16 months in areas such as golf course roughs and fairways, residential and commercial turf, sod farms, athletic fields, parks and cemeteries. 10 fluid ounces per acre needed for annual sedge and kyllinga species control. Don't exceed 18.5 fluid ounces per acre per year. Do not vertical mow 1 month before or after application. Irrigate within 2 days of treatment for maximum benefit. Check label for split or multiple application rates and timings. Delay overseeding 10 months if 4.5 to 6 fluid ounces used and 12 months if 6 to 9 fluid ounces used. For sod production, only apply to bermudagrass, zoysiagrass or bahiagrass. Apply if 80% ribbon coverage and before 4 months prior to harvest. Wait 6 month after treatment if sodding bare ground. Apply to actively growing sod established for 3 months.
(0.0224 G)	2.9 to 4.6 lb	125 to 200 lb	0.028 to 0.045	Use on same warm season turf species established at least 16 months and sites as above. Do not exceed 400 pounds product per year. Allow a 15 feet buffer from cool season turf areas. Do not apply upslope from cool season turf.
metolachlor, MOA 15 (7.62 EC)	0.96 fl oz	2.6 pt	2.48	Apply to established bermudagrass, centipedegrass, St. Augustinegrass, bahiagrass, and zoysiagrass. Can apply up to 4.2 pints per acre per year to same area used for commercial sod production.
napropamide, MOA 15 (50 DF)	1.5 to 2.2 oz	4 to 6 lb	2 to 3	Use in established bahiagrass, bermudagrass, centipedegrass, St. Augustinegrass, and tall fescue.
oryzalin, MOA 3 (4 AS, 4 L)	1.5 fl oz	2 qt	2	Use on established bahiagrass, centipedegrass, tall fescue, St. Augustinegrass, zoysiagrass, and bermudagrass except greens and tees. A total of 3 quart per acre may be used if application is split by applying 1.5 quarts per acre followed by 1.5 quarts per acre 8 to 10 weeks later. Follow label directions. Do not apply in the spring or summer to tall fescue reseeded the previous fall.
oryzalin, MOA 3 (85 WDG)	0.64 to 0.88 oz	1.75 to 2.4 lb	1.4875 to 2.04	Observe same turf tolerances and tall fescue precautions as above. Successful preemergence activity should occur if activated by 0.5 inch of water within 21 days of application. Apply 2.4 pounds per acre as a single application or 1.75 pounds per acre in sequential applications spaced 12 weeks apart.
oxadiazon, MOA 14 (2 G)	2.3 to 4.6 lb	100 to 200 lb	2 to 4	Use in established perennial bluegrass, perennial ryegrass, bentgrass, bermudagrass, tall fescue, zoysiagrass, and St. Augustinegrass. Red fescue is not tolerant. Do not apply to dichondra, centipedegrass, putting greens or tees, or to newly seeded areas. Do not apply to bentgrass mowed at less than 3/8 inch. Do not apply to wet turf. Rainfall or irrigation after application will improve weed control activity. May be applied when sprigging bermudagrass and zoysiagrass. Do not apply to home lawns.
oxadiazon, MOA 14 (50 WP)	1.5 to 2.2 oz	4 to 6 lb	2 to 3	Use in dormant, established bermudagrass, St. Augustinegrass, and zoysiagrass in fairways and parks. Should be applied at least 2 to 3 weeks before greenup of turf. May be applied when sprigging bermudagrass and zoysiagrass. Do not use on home lawns.
oxadiazon, MOA 14 (3.17 SC)	1.85 to 2.8 fl oz	2.52 to 3.81 qt	2 to 3	Use in dormant, established bermudagrass, St. Augustinegrass, and zoysiagrass in fairways and parks. May apply 2 lb a.i. per acre when sprigging bermudagrass. Apply at least 2 to 3 weeks before greenup of turf. Do not use on home lawns.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Preemergence Control, Smooth and Large Crabgrass, Goosegrass, Foxtails, other annual grasses (continued)				
[oxadiazon + prodiamine], MOA 14 + 3 (1.2 G)	4.5 lb	200 lb	2 + 0.4	Use on turf, golf courses (excluding putting greens) of established bermudagrass, zoysiagrass, St. Augustinegrass, ryegrass, centipedegrass, bentgrass, bluegrass, and tall fescue. Contains 38% N. Apply to dry foliage.
pendimethalin, MOA 3 (2 G) (0.86 G) (1.29 G)	 1.72 to 3.44 lb 2.67 to 5.34 lb 2.67 lb	 75 to 150 lb 116 to 232 lb 116 lb	 1,5 to 3 1 to 2 1.5	Use on established bahiagrass, bermudagrass, centipedegrass, fine fescue, Kentucky bluegrass, perennial ryegrass, St. Augustinegrass, tall fescue, and zoysiagrass. Do not use on winter-overseeded grasses. Wait 4 months after treatment to seed or sod. Do not apply to newly seeded turf until after the 4th mowing. Do not apply to newly sprigged turf until 5 months establishment.
pendimethalin, MOA 3 (3.8 CS)	1.15 to 2.3 fl oz	3.1 to 6.3 pt	1.5 to 3	Use on noncropland as well as established nonresidential and residential turf areas mowed at least 4 times consisting of bahiagrass, bermudagrass, buffalograss, centipedegrass, St. Augustinegrass, zoysiagrass, Kentucky bluegrass, perennial ryegrass, bentgrass, established *Poa annua* (0.5 inch height or taller), fine fescue, and tall fescue. Do not use on bentgrass or *Poa annua* greens and tees. If lower rate is applied initially, repeat in 6-8 weeks for extended control. Do not reseed or overseed into treated turfgrass for 3 months, or sprig turfgrass for 5 months following application. Do not exceed 4.2 pints per acre on residential and sod farm turfgrass.
[pendimethalin + dimethemamid], MOA 3 + 15 (1.75 G)	2.3 to 4.6 lb	100 to 200	1.75 to 3.5	Use on residential, commercial, recreational, sod farm and golf course turf, excluding greens. Tolerant turf species include bermudagrass, centipedegrass, St. Augustinegrass, seashore paspalum and zoysiagrass. For extended control, make sequential applications within 5 to 8 weeks not to exceed 400 pounds per acre. Irrigate within 24 hours of application for optimum control. Following application, wait 3 months to overseed, reseed or sprig. If sprigged first, wait 2 months for root establishment to treat. On new sod, mow at least twice before application. On new seedlings, mow at least 4 times before application. Wait 2 weeks after aerification or verticutting before applying.
prodiamine, MOA 3 (65 WG) (4 FL)	 0.185 to 0.83 oz 0.23 to 1.1 fl oz	 0.5 to 2.3 lb 0.625 to 3 pt	 0.325 to 1.5 0.3125 to 1.5	May be used on established bahiagrass, bermudagrass, centipedegrass, St. Augustinegrass, zoysia, tall fescue, creeping red fescue, perennial bluegrass and ryegrass, and creeping bentgrass. Do not apply to greens. May apply when sprigging or plugging bermudagrass, up to 0.8 pound product per acre.
prodiamine, MOA 3 (0.5 G)	1.5 to 6.9 lb	64 to 300 lb	0.32 to 1.5	See precautions for prodiamine 65 WG and 4 FL above except may be used on established turf only. Do not apply more than 150 pounds per acre per application. Do not make more than two applications per calendar year. Wait at least 60 days after initial application before making a second application. Prodiamine is coated on a 32-3-12 dry fertilizer carrier.
siduron, MOA 7 (50 WP)	7.3 oz	20 lb	10	Use only on bluegrass, fescue, perennial ryegrass, and certain bentgrasses (check label). Can be used at the rate of 8 pounds of formulation when seeding bentgrass, bluegrass, fescue, and ryegrass. Can be used in newly sprigged or established zoysia. Do not use on bermudagrass, carpetgrass, centipedegrass.
Preemergence Control, Goosegrass				
dimethenamid, MOA 15 (6 L)	0.48 to 0.73 fl oz	21 to 32 fl oz	1 to 1.5	Use on residential, commercial, recreational, sod farm and golf course turf, excluding greens. Apply 21 ounces to established bentgrass, bluegrass species, fescue species and perennial ryegrass maintained at 0.5 inch cut but expect yellowing and stand reduction. Apply 32 ounces to bahiagrass, bermudagrass species, centipedegrass, St. Augustinegrass, seashore paspalum and zoysiagrass. For extended control, make sequential applications within 5 to 8 weeks at 32 fluid ounces per acre rate. Irrigate within 24 hours of application for optimum control. Following application, wait 6 weeks to overseed or reseed, wait 2 months to sprig, wait 2 mowings for new sod, and wait 4 mowings for newly seeded turf.
Preemergence Control, Annual Bluegrass *(Poa annua*)				
[benefin + trifluralin], MOA 3 + 3 (0.86 G)	4 to 8 lb	174 to 349 lb	1.5 to 3	Apply during late summer before *Poa annua* germinates. Do not apply to turf areas that are to be overseeded.
bensulide, MOA 8 (4 EC) (8.5 G, 12.5 G)		several concentrations available	12.5	See section on preemergence control of crabgrass and goosegrass or product labels for turfgrass tolerance, precautions and remarks for the listed preemergence annual bluegrass herbicides.
dithiopyr, MOA 4 (2 EW, 2 L) (40 WP)	 0.75 fl oz 0.46 oz	 1 qt 20 oz	 0.5	Timely irrigation or rainfall is critical for activation.
indaziflam, MOA 21 (20 WSP) (0.622 F) (0.0224 G)	 0.057 to 0.115 oz 0.138 to 0.23 fl oz 2.9 to 4.6 lb	 2.5 to 5 oz 6 to 10 fl oz 125 to 200 lb	 0.031 to 0.063 0.029 to 0.049 0.028 to 0.045	
metolachlor, MOA 15 (7.62 EC)	0.48 to 0.96 fl oz	1.3 to 2.6 pt	1.24 to 2.48	
napropamide, MOA 15 (50 DF)	1.5 to 2.25 oz	4 to 6 lb	2 to 3	
oryzalin, MOA 3 (4 AS) (85 WDG)	1.1 fl oz 0.64 to 0.88 oz	1.5 qt 1.75 to 2.4 lb	1.5 1.4875 to 2.04	 Apply full rate unless potentially thin turfgrass cover is a problem caused by dense poa infestation.
oxadiazon, MOA 14 (2 G)	2.3 to 4.6 lb	100 to 200 lb	2 to 4	
pendimethalin, MOA 3 (2 G) (0.86 G) (1.29 G) (3.8 CS)	 1.72 to 3.44 lb 2.67 to 5.34 lb 2.67 lb 1.15 to 1.55 fl oz	 75 to 150 lb 116 to 232 lb 116 lb 3.1 to 4.2 pt	 1.5 to 3 1 to 2 1.5 1.5 to 2	
(pendimethalin + dimethemamid), MOA 3 + 15 (1.75 G)	2.3 to 4.6 lb	100 to 200	1.75 to 3.5	

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Preemergence Control, Annual Bluegrass *(Poa annua*) (continued)				
prodiamine, MOA 3 (65 WG) (4 FL)	 0.185 to 0.83 oz 0.23 to 1.1 fl oz	 0.5 to 2.3 lb 0.625 to 3 pt	 0.325 to 1.5 0.3125 to 1.5	
pronamide, MOA 3 (3.3 SC)	0.46 to 1.29 fl oz	1.25 to 3.5 pt	0.5 to 1.5	Not for home use. Can be applied from Sept. 15 to Feb. 1 for preemergence or postemergence annual bluegrass control in bermudagrass, zoysiagrass, centipedegrass, and St. Augustinegrass grown for sod, nonresidential or industrial sites, golf course turf, and stadium or professional athletic fields. 1.25 to 2.5 pints per acre provides preemergence to pre tiller stage control. 2 to 2.5 pints per acre provides postemergence control from early tiller to early seedhead stage. 2.5 to 3.5 pints per acre for postemergence control at seedhead stage. Henbit and chickweed species controlled at preemergence timings. Can be used for removal of overseeded grasses; do not overseed if it is desired to maintain a stand. Do not overseed treated area within 90 days of treatment. Injury symptoms from postemergence applications can take up to 5 weeks to develop.
Preemergence Control, Annual Bluegrass in Overseeded Bermudagrass				
benefin, MOA 3 (2.5 G)	2.75 lb	120 lb	3	Apply in late summer before *Poa annua* germinates. Perennial ryegrass can be overseeded 6 weeks after benefin is applied.
dithiopyr, MOA 4 (2 EW, 2 L) (40 WP)	 0.75 fl oz 0.46 oz	 1 qt 20 oz	 0.5	Apply in late summer before *Poa annua* germinates. Perennial ryegrass can be overseeded 6 to 8 weeks after application. Apply only on well-established bermudagrass. Do not reapply in fall or winter after overseeding unless injury can be tolerated.
prodiamine, MOA 3 (65 WG)	0.213 to 0.367 oz	0.58 to 1 lb	0.37 to 0.65	Use on golf courses (excluding putting greens) when overseeding with perennial ryegrass at a minimum seeding rate of 350 pounds per acre. Apply 8 to 10 weeks before overseeding and expect 70% or greater control. For best potential control, use higher rate and shorter time interval before overseeding. However, this could increase ryegrass seedling mortality or temporarily reduce root growth.
Preemergence and Postemergence Control, Annual Bluegrass				
ethofumesate, MOA 8 (1.5 EC)	2 fl oz	2.67 qt	1	For control of annual bluegrass in dormant bermudagrass overseeded with perennial ryegrass or in established perennial ryegrass turf. Rates are per application. The first application should be 30 to 45 days after overseeding with perennial ryegrass. The second application should be 21 to 28 days later. Do not apply ethofumesate to overseeded bermudagrass after Jan. 1 in NC.
ethofumesate, MOA 8 (4 SC)	0.55 to 1.47 fl oz	1.5 to 4 pt	0.75 to 2	Must be professionally applied to residential and nonresidential turf including golf courses and sod farms. May be applied to established perennial ryegrass, Kentucky bluegrass, creeping bentgrass, tall fescue, St. Augustinegrass, and dormant bermudagrass. Do not apply to putting greens. Delay application at least 8 weeks after a pgr application. Fall annual bluegrass control best during period of maximum germination. Spring applications most effective following fall applications. For overseeded bermudagrass, apply 1 to 2 weeks after perennial ryegrass emergence and repeat at 21- to 28-day intervals. Do not apply to bermudagrass 4 weeks prior to breaking winter dormancy.
Preemergence and Postemergence Control, Various Weeds				
imazaquin + prodiamine + simazine (5 L)	1.1 to 1.47 oz	48 to 64 oz	1.88 to 2.5	For use on established bermudagrass, centipedegrass, St Augustinegrass, and Zoysiagrass. Approved application sites are golf courses (excluding putting greens), athletic fields, commercial and residential turf, and sod farms. Should be applied from 15 September to 31 May for preemergent and early postemergent control of annual bluegrass when applied in fall. Will also provide preemergent control of summer annual grasses such as crabgrass if applied prior to grass germination in late winter/early spring. Also provides control of various broadleaf weeds. See label for additional precautions and weeds controlled.
Postemergence Control and Seedhead Suppression, Annual Bluegrass in Overseeded Bermudagrass Fairways, Tees				
bispyribac-sodium, MOA 2 (17.6 SG)	0.046 to 0.138 oz	2 to 6 oz	0.021875 to 0.065625	Do not apply to putting greens, ryegrass mowed to less than 0.375 inch, or non-overseeded bermudagrass. Apply between Feb. 1 and March 15. Make first application when annual bluegrass begins flowering. If actively flowering, use the low rate and re-treat in 28 to 35 days. If not actively flowering, use the low rate and retreat in 14 to 21 days with the low rate. Do not apply if air temperature is less than 50ºF within 3 days after application. Check label for further special instructions.
amicarbazone, MOA 5 (70 WG)	0.023 to 0.23 oz	1 to 10 oz	0.044 to 0.44	Also tolerant to 6-month established turfgrasses such as bahiagrass, centipedegrass, seashore paspalum, St. Augustinegrass, zoysiagrass, bentgrass, Kentucky bluegrass, perennial ryegrass, fine and tall fescue. Labeled for use on golf course, sod farm, residential, commercial, athletic field and roadside turf. Bentgrass tees: 1 ounce/acre at 7 day intervals for 4 applications. Bentgrass roughs and fairways: 2 to 3 ounces/acre for 14 to 21 day intervals for 2 applications. Cool season turf: 2 to 4 ounces/acre for 14 to 21 day intervals for 2 applications. Warm season turf: 3 to 10 ounces/acre for 14 to 21 day intervals for 2 applications not to exceed 10 ounces/acre per year. Allow 4 weeks before cutting or lifting sod. Allow 1 week before overseeding winter grasses.
Postemergence Control, Annual Bluegrass, Overseeded Perennial Ryegrass, Tall Fescue, *Poa trivialis*				
flazasulfuron, MOA 2 (25 DG)	0.011 to 0.069 oz	0.5 to 3 oz	0.0078 to 0.0469	For use on well-established bermudagrass, zoysiagrass, centipedegrass, and seashore paspalum grown turf including golf courses (including fairways, roughs, greens (bermudagrass and seashore paspalum only), tees, collars and approaches), industrial parks, tank-sod- and seed farms, cemeteries, athletic field and commercial lawns. Residential turf applications are limited to spot applications. Apply a maximum of 1.5 ounces per acre on fully green centipedegrass and seashore paspalum. 3 ounces per acre needed for annual bluegrass control and best if applied in spring. 0.5 to 1.5 ounces per acre will control perennial and Italian ryegrass. For clumpy ryegrass, use 1.5 to 3 ounces per acre. 1.5 ounces per acre needed for tall fescue control. 2.25 to 3 ounces per acre needed for *poa trivialis* control. Include a nonionic surfactant at 0.25% by volume.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, Annual Bluegrass, Overseeded Perennial Ryegrass, Tall Fescue, *Poa trivialis* (continued)				
foramsulfuron, MOA 2 (0.19 SC)	0.2 to 0.6 fl oz	8.8 to 26.2 fl oz	0.013 to 0.039	For use on bermudagrass and zoysiagrass grown on home lawns, golf courses and sod farms. Do not use on warm season turfgrass collars surrounding bentgrass greens. May be applied up to 1 week prior to overseeding. Do not apply within 2 weeks of bermudagrass sprigging. Apply in 25 to 60 gallons water per acre. Rainfast after 2 hours. Surfactant not required.
rimsulfuron, MOA 2 (25 DF)	0.011 to 0.092 oz	0.5 to 4 oz	0.0078 to 0.0625	May be applied to bermudagrass, zoysiagrass and centipedegrass on professionally managed sports facilities at professional and collegiate levels, golf courses, sod farms, roadsides, industrial and commercial lawns. For annual bluegrass control, apply November through December and again February through March if needed at 2 ounces per acre. May be applied 10 to 14 days prior to overseeding. For overseeded removal, apply 2 ounces per acre 3 to 4 weeks before desired removal date, and repeat 3 weeks later if needed. For weed control along roadsides, apply 4 ounces per acre if single application only. A nonionic surfactant at 0.25% by volume or an oil adjuvant such as crop oil concentrate and modified seed oil at 1% by volume are required. Do not apply to cool-season turfgrasses, residential lawns or newly sprigged/sodded bermudagrass.
[metsulfuron + rimsulfuron], MOA 2 + 2 (37 WG)	0.0344352 oz	1.5 oz	0.0346875	Use on well-established bermudagrass and zoysiagrass grown on nonresidential turf including golf courses, sod farms, industrial and commercial lawns, and professionally managed college and professional sports fields. Overseeding can occur 2 months after application. Include a nonionic surfactant at 0.25% by volume.
sulfosulfuron, MOA 2 (75 DG)	0.017 to 0.046 oz	0.75 to 2 oz	0.035 to 0.09375	May be applied to certain ornamental native grasses and also bermudagrass species, zoysiagrass, centipedegrass, St. Augustinegrass, and kikuyugrass grown on sod farms, golf courses (excluding greens), commercial and residential turf that is highly managed, and other noncrop areas. Use 1.5 to 2 ounces per acre for fall annual bluegrass control 7 to 10 days before overseeding. Use 0.75 to 1.25 ounces per acre for fall or winter control in nonoverseeded bermudagrass and reapply if needed but not before 21 days after initial application. For tall fescue control, two applications may be required at 4- to 10-week intervals. Perennial ryegrass control not as complete as with foramsulfuron, rimsulfuron, or trifloxysulfuron. Use a nonionic surfactant at 0.25% by volume. Do not exceed 2.66 ounces per acre per year.
trifloxysulfuron, MOA 2 (75 WG)	0.0023 to 0.0129 oz	0.1 to 0.56 oz	0.0047 to 0.0263	May be applied to residential bermudagrass and zoysiagrass and also on golf courses, sod farms, and other nonresidential turf areas. A nonionic surfactant at 0.25 to 0.5% by volume is recommended. Temporary discoloration may occur if used with MSO or COC. May be applied 3 weeks prior to overseeding. Use rates of 0.1 to 0.3 ounces per acre to remove overseeded perennial ryegrass and *Poa trivialis* to aid bermudagrass spring transition. Labeled turf species can be seeded or sprigged into treated areas 4 weeks after application.
Preemergence and Postemergence Control, Annual Bluegrass and certain winter annual broadleaf weeds				
atrazine, MOA 5 (4 L) (90 DF,90 WG)	 0.75 to 1.5 fl oz 0.025 to 0.05 lb	 1 to 2 qt 1.1 to 2.2 lb	 1 to 2	Use on centipedegrass, St. Augustinegrass, and dormant bermudagrass. Apply Nov. 15 to Dec. 31. Follow label directions.
simazine, MOA 5 (90 WDG, 90 DF) (4 L)	 0.4 to 0.8 oz 0.75 to 1.5 fl oz	 1.1 to 2.2 lb 1 to 2 qt	 1 to 2	Use on bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. See label for instructions on newly sprigged turfgrass or on hybrid bermudagrass. Apply Nov. 15 to Dec. 15. Follow label directions.
Preemergence Control, Certain Broadleaf Weeds				
isoxaben, MOA 21 (75 DF, 75 WG)	0.25 to 0.5 oz	0.66 to 1.33 lb	0.5 to 1	All established turfgrasses are tolerant. However, do not apply to putting greens or turfgrass grown for seed. Check label for specific weeds controlled.
pendimethalin, MOA 3 (3.8 CS)	1.15 to 1.55 fl oz	3.1 to 4.2 pt	1.5 to 2	See section on preemergence control of crabgrass or product label for turfgrass tolerance. Provides preemergence control of summer broadleaf weeds, such as prostrate spurge, prostrate knotweed, and purslane species, as well as winter broadleaf weeds, such as yellow woodsorrel, hop clover, cudweed species, common chickweed, lawn burweed, henbit, and corn speedwell when applied before expected germination.
Preemergence Control of Smooth and Large Crabgrass, Goosegrass, Other Broadleaf Weeds				
[isoxaben + dithiopyr]	3.4 to 4.6 lb	140 to 200 lb	1.13 to 1.5	Use on established turfgrasses (creeping bentgrass, Kentucky bluegrass, fine fescue, tall fescue, perennial ryegrass, bahiagrass, bermudagrass, carpetgrass, centipedegrass, seashore paspalum, St Augustinegrass, and zoysiagrass). Do not use on putting greens. Use for preemergent control of annual grasses and broadleaf weeds. See label for a complete list of weeds controlled. Also has postemergent control of small crabgrass (pre-tiller).
Preemergence and Postemergence Control Crabgrass, Goosegrass, Other Annual Grasses, Broadleaf Weeds, Sedges				
mesotrione, MOA 27 (4 SC)	0.092 to 0.183 fl oz	4 to 8 fl oz	0.125 to 0.25	Use on residential turf, golf courses (not greens) and sod farms for pre- and postemergence weed control. Tolerant turfgrasses include St. Augustinegrass, centipedegrass, tall fescue, fine fescue, Kentucky bluegrass, and perennial ryegrass. Add a nonionic surfactant and repeat application after 2 to 3 weeks for improved postemergence control. Tank mix with prodiamine 65 WG for extended preemergence grassy weed control. Can be applied at seeding to all tolerant grasses except fine fescue. After turf germination, wait 4 weeks or until turf has been mowed twice before making a postemergence application. Also controls henbit, chickweed, dandelion, white clover, Florida betony, Florida pusley, ground ivy, oxalis, wild violet, creeping bentgrass, and yellow nutsedge.
[sulfentrazone + prodiamine], MOA 14 + 3 (4 SC)	0.184 to 0.826 fl oz	0.5 to 2.25 pt	0.25 to 1.125	For use in residential and institutional lawns, athletic fields, sod farms, golf course fairways and roughs, roadsides, utility rights-of-way, railways, and industrial areas. Apply to turf following a second mowing if a good root system has been established. Apply up to 12 fluid ounces per acre to bentgrass at 0.5 inch or higher, fine fescue, and perennial ryegrass. Apply 18 to 24 fluid ounces per acre to perennial bluegrass, tall fescue, and all warm season grasses except St. Augustinegrass (do not apply) and bermudagrass (apply 18 to 36 fluid ounces per acre). For sod production, apply 6 months after establishment, and do not harvest within 3 months. Do not apply with adjuvants or surfactants. [Sulfentrazone + prodiamine should not be applied to cool-season turf with N-containing fertilizers unless some short-term discoloration is tolerable.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, Crabgrass, Goosegrass				
fenoxaprop, MOA 1 (0.57 EC)	0.3 to 0.9 fl oz	0.8 to 2.4 pt	0.057 to 0.174	Use only on perennial ryegrass, fine fescue, tall fescue, Kentucky bluegrass, and zoysiagrass. Reduced vigor or discoloration can occur. Rate depends upon leaf number or tillers of grass weeds and turf tolerance. Check label. A second application may be applied after 14 days.
	0.08 fl oz	3.5 fl oz	0.016	Apply only to established Penncross bentgrass maintained at a minimum cutting height of at least 0.25 inch. Bentgrass should be established for one growing season. Do not apply to greens. Applications should be made at a minimum of 21-day intervals, beginning in the spring when grassy weeds first emerge and are not larger than two-leaf. Repeat applications throughout the summer as new infestations of one- to two-leaf grassy weeds occur. See label for restrictions.
metribuzin, MOA 5 (75 DF)	0.12 to 0.24 oz	0.33 to 0.67 lb	0.25 to 0.5	Recommended for application by commercial applicators only on established bermudagrass turf (such as parks, athletic fields, golf course fairways, cemeteries, and sod farms) that has a mowing height of 0.5 inch or greater. Apply when turf is vigorously growing and not under stress. Repeat if necessary, in 7 to 10 days. Do not make more than two applications per season. Do not apply to greens, tees, or aprons.
sethoxydim, MOA 1 (1 EC)	0.8 to 1.38 fl oz	2.25 to 3.75 pt	0.28 to 0.47	Use in seedling and established centipedegrass and fine fescues. Apply 2.25 pint to grasses up to 6 inches and 3.75 pints to grasses up to 12 inches if turf is tolerant. Does not control yellow and purple nutsedge, annual bluegrass or broadleaf weeds. Apply no sooner than 3 weeks after spring greenup of centipedegrass. Apply before crabgrass becomes extensively tillered. Delay all treatments until newly planted centipedegrass has 3 inches of new stolon growth. Do not mow within 7 days before or after application. Two applications 3 weeks apart will suppress bahiagrass. Additives or adjuvants not required.
Postemergence Control, Smooth and Large Crabgrass, Barnyardgrass, White and Hop Clover, Common Dandelion, Dollarweed, Foxtails				
quinclorac, MOA (27 + 4) (75 DF) (1.5 SL)	 0.367 oz 1.45 fl oz	 1 lb 2 qt	0.75	For use in residential and nonresidential turf that is established or newly seeded, overseeded, or sprigged. Refer to label for specific varieties. Apply to common and hybrid bermudagrass, Kentucky bluegrass, annual bluegrass, buffalograss, tall fescue, annual and perennial ryegrass, creeping bentgrass, and zoysiagrass. Can also be applied to fine fescue but must be in a blend. Some discoloration of hybrid bermudagrass, creeping bentgrass or fine fescue may occur. Do not apply to bahiagrass, centipedegrass, St. Augustinegrass, or dichondra. Do not use on golf course greens or collars. The addition of methylated seed oil (1.5 pints per acre or 0.55 ounces per 1,000 square feet) or a crop oil concentrate (2 pint per acre or 0.73 ounces per 1,000 square feet) is required for control. Application to weeds under stress will result in poor control. Irrigation 24 hours prior to application is recommended if drought conditions exist. Some ornamental plants are sensitive to quinclorac. See label for further precautions.
Postemergence Control, Smooth and Large Crabgrass, Barnyardgrass, Foxtails, and many broadleaf weeds				
[quinclorac + sulfentrazone + 2,4-D amine + dicamba], MOA (27 + 4) + 14 + 4 + 4 (1.79 L)	1.8 to 3 fl oz	5 to 8 pt	1.12 to 1.79	For use in fully dormant bermudagrass as well as actively growing bermudagrass after spring greenup but use only 5 to 7 pints per acre. Also labeled in fully dormant zoysiagrass s well as cool-season turf including annual bluegrass and ryegrass, perennial bluegrass and ryegrass, and fescue species. Do not apply to bahiagrass, bentgrass (creeping, Seaside, Colonial), centipedegrass, St. Augustinegrass, carpetgrass, and golf course greens, tees, and collars. May be applied to home lawns. Apply to seedling grasses after second or third mowing, or 28 days after emergence. Wait 3 to 4 weeks after sodding, sprigging, or plugging operations to apply. Wait 4 weeks after application to seed.
[quinclorac + mecoprop + dicamba], MOA (27 + 4) + 4 + 4 (2.45 SL)	0.5 to 1.45 fl oz	0.68 to 2 qt	0.4165 to 1.225	For use in warm- and cool-season residential and non-residential turf, including but not limited to commercial property, parks, roadsides, schools, athletic fields, cemeteries, and golf courses. May be applied to species of bermudagrass, bluegrass, fescue, and ryegrass as well as creeping bentgrass, seashore paspalum, and zoysiagrass. Use with methylated seed oil at 1.5 pints per acre. Allow 28 days of seedling or sprig growth before application. If treating first, allow 28 days before seeding or sprigging. Do not apply to golf course collars or greens or to turf grown for sod. Use low rate in 2 split applications when treating creeping bentgrass.
[carfentrazone + quinclorac], MOA 14 + (27 + 4) (75 WG)	0.184 to 0.413 oz	8 to 18 oz	0.35 to 0.79	Can use up to 12 ounces per acre 7 days after emergence from seed or sod installment on bluegrass and fescue species and perennial ryegrass; 18 ounces per acre can be used 7 days after seed, sod or sprig operations on bermudagrass species, centipedegrass and seashore paspalum. Wait 14 days after emergence for zoysiagrass. May apply to residential, commercial, and institutional lawns, athletic fields, sod farms, and golf course fairways and roughs. Adjuvants not required but may help on mature weeds.
[sulfentrazone + quinclorac], MOA 14 + (27 + 4) (75 WG)	0.367 to 0.735 oz	1 to 2 lb	0.75 to 1.5	Use up to 21 ounces per acre on well-established tall fescue, Kentucky bluegrass and perennial ryegrass; up to 32 ounces per acre on well-established bermudagrass, centipedegrass, zoysiagrass and seashore paspalum. May be applied to residential, commercial, and institutional lawns, athletic fields, sod farms, and golf course fairways and roughs. After treatment, wait at least 1 month before reseeding, overseeding (use slit seeder for best results), or sprigging. Wait at least 3 months for sod establishment and do not spray within 3 months of harvest. Controls goosegrass in the 1 to 4 leaf stage. Yellow nutsedge and kyllinga species are also controlled. Do not apply with a spray adjuvant.
[fenoxaprop + fluroxypyr + dicamba], MOA 1 + 4 + 4 (0.75 EC)	1.3 to 1.5 fl oz	3.5 to 4 pt	0.33 to 0.375	Tolerant turfgrass species include zoysiagrass, Kentucky bluegrass, perennial ryegrass, fine and tall fescue. May be applied to golf courses excluding greens and tees, athletic fields, commercial and residential turf. Sod farm use is not permitted. Best grass weed control will be achieved when treated from 1 leaf to 4 tiller stage. Do not apply more than 15 pints per acre per year. Do not reapply within 14 days of an application. Surfactant not required. Spot treat using 0.6 to 1 fluid ounces per 1 gallon water.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, Large Crabgrass, Carpetgrass, Bull Paspalum, Bahiagrass, Foxtails, and many broadleaf weeds, including Chamberbitter, Corn Speedwell, Dichondra, Dollarweed, Doveweed, Florida Betony, Florida Pusley, Lespedeza, Oxalis, Spurge, Virginia Buttonweed, Kyllinga				
[thiencarbazone-methyl + iodosulfuron-methyl + dicamba], MOA 14 + 2 + 4 (68 WG)	0.057 to 0.113 oz	2.5 to 4.9 oz	0.106 to 0.208	For use by licensed applicators in residential and commercial lawns, golf courses (excluding greens), sports fields, parks, recreational areas, roadsides, school grounds, and sod farms. Provides up to 60 days residual control. Use on bermudagrass, zoysiagrass, centipedegrass, and St Augustinegrass. Apply maximum 7.4 ounces per acre per season. Safe to use at high temperatures. Ryegrass can be overseeded 2 weeks after application. Apply 30 days prior to seeding bermudagrass or zoysiagrass. Wait 2 weeks after bermudagrass seedling emergence or sprigging operation before applying. For zoysiagrass, wait 3 weeks after seedling emergence before applying. A nonionic surfactant or methylated seed oil at 0.25% v/v is required for optimum control.
Postemergence Control or Suppression of Summer Weeds Such as Crabgrass Species, Goosegrass, Dallisgrass, Virginia Buttonweed, Doveweed, Florida Pusley, Nutsedge and Kyllinga Species; Winter Weeds Such as *poa annua, poa trivialis*, Tall Fescue, Henbit, Corn Speedwell, and Species of Ryegrass, Chickweed, and Clover				
[thiencarbazone-methyl + foramsulfuron + halosulfuron], MOA 14 + 2 + 2 (60.5 WG)	0.0735 oz	3.2 oz	0.121	Apply to well-established residential and commercial bermudagrass and zoysiagrass (Emerald, Meyer, Zeon) lawns, golf courses (excluding greens), athletic fields, sod farms, roadsides, parks, cemeteries and recreational areas. Do not exceed 3.2 ounces per acre per application or 6.4 ounces per acre yearly. Use 0.25 to 0.5% by volume nonionic surfactant or 0.5 to 1% by volume methylated seed oil. After application, wait 12 weeks to overseed ryegrass or bermudagrass. Wait 1 month after bermudagrass seedling emergence and 2 weeks after sprigging or sodding bermudagrass before treating. Temporary stunting and yellowing may last up to 2 weeks, but turf will recover. Crabgrass and goosegrass are controlled up to 2 tiller stage.
Postemergence Control, Goosegrass				
[(2,4-D + MCPP + dicamba + carfentrazone) + topramezone]	1.5 + 0.006 oz	4 pts + 0.25 oz	1.1 + 0.0005	Apply to established bermudagrass and emerged goosegrass. Will control mature goosegrass but better control obtained when applied to smaller goosegrass. Bermudagrass discoloration will occur and typically lasts less than 2 weeks. Mixing the products vastly reduces whitening on bermudagrass from topramezone. More discoloration will occur when temperatures are in excess of 85 degrees. Do not apply to putting greens.
foramsulfuron, MOA 2 (0.19 SC)	0.39 fl oz	17 fl oz	0.025	For use on bermudagrass and zoysiagrass grown on home lawns, golf courses and sod farms. See precautions listed under annual bluegrass section. For goosegrass control, apply 17 fl ounces per acre on plants up to 2 tillers followed by 17 fluid ounces per acre 2 weeks later.
metribuzin, MOA 5 (75 DF)	0.18 oz	8 oz	0.38	Apply to established bermudagrass and emerged goosegrass. Will control mature goosegrass but better control obtained when applied to smaller goosegrass. Irrigate in immediately with 0.25 inches of water. Do not apply to saturated soils or if significant rainfall is expected. Immediate irrigation increases efficacy and reduces bermudagrass discoloration. If watered in immediately, limited discoloration will occur. Do not apply to putting greens.
[metribuzin + topramezone]	.09 oz + 0.006 oz	4 oz + 0.25 oz	0.19 + 0.005	Apply to established bermudagrass and emerged goosegrass. Will control mature goosegrass but better control obtained when applied to smaller goosegrass. Do not irrigate in. Some slight bermudagrass discoloration will occur but disappears in approximately 10 to 14 days. Mixing the products vastly reduces whitening on bermudagrass from topramezone. Do not apply to putting greens.
sulfentrazone, MOA 14 (4 SC)	0.275 fl oz	0.75 pt	0.375	May be applied to home lawns. For use on creeping bentgrass, tall and fine fescue, perennial ryegrass, Kentucky bluegrass, and all warm-season turf species except St. Augustinegrass. See precautions listed under purple and yellow nutsedge section. For goosegrass control, apply 0.75 pint per acre on plants up to 2 tillers.
Postemergence Control, Sedge and Various Broadleaf Weeds				
[sulfentrazone + imazaquin]	0.5 to 1 oz	22 to 44 oz	0.38 to 0.75	Use on established bermudagrass (common and hybrid), centipedegrass, St. Augustinegrass, and zoysiagrass. Do not use on putting greens. See label for further restrictions. Controls kyllinga, yellow and purple nutsedge, dandelion, henbit, lawn burweed, spurge, wild garlic, yellow woodsorrel. See label for additional weeds controlled. Addition of a nonionic surfactant at 0.25% volume/volume is required.
Postemergence Control, Bahiagrass, Crabgrass, Dallisgrass, Goosegrass, Nutsedge, Annual Sedges, Sandbur				
MSMA, MOA 17 (6 SL, 6.6 SL)		several concentrations	1.82 to 4.5	MSMA is only registered for golf course, sod farm, and highway right-of-way use. Bermudagrass, bluegrass and zoysiagrass are tolerant. Injury may result on bentgrass, fescue and also St. Augustinegrass grown for commercial sod production only. Do not use on carpetgrass or centipedegrass. MSMA restrictions: For existing golf courses, spot treat (100 square feet per spot) not to exceed 25% of total acreage. For new courses, make 1 broadcast application per year. For sod farms, make 1 to 2 broadcast applications per year and maintain 25 feet buffer around permanent water bodies. For highway rights of way, make 2 broadcast applications and maintain 100 feet buffer around permanent water bodies.
Postemergence Control, Crabgrass, Goosegrass, Sandbur, Dallisgrass				
MSMA, MOA 17 (6 SL, 6.6 SL) + metribuzin, MOA 5 (75 DF)		several concentrations + 0.17 to 0.33 lb	1.5 to 2 + 0.125 to 0.25	See remarks for MSMA and metribuzin. The combination improves goosegrass control. Should be applied to bermudagrass only.
Postemergence Control, Crabgrass, Goosegrass, Sandbur				
asulam, MOA 18 (3.34 SL)	1.8 fl oz	5 pt	2	Use only on St. Augustinegrass and Tifway 419 turf. On golf courses, use only on fairways and roughs.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, Crabgrass and Foxtail Species, Goosegrass, Broadleaf Signalgrass, Japanese Stiltgrass Postemergence Suppression, Creeping Bentgrass, Common Bermudagrass, Dallisgrass, Nimblewill				
topramezone, MOA 27 (2.8 L)	0.023 to 0.034 fl oz	1 to 1.5 fl oz	0.021875 to 0.0328125	Labeled for broadcast treatment use in residential and athletic field turf, as well as in nonresidential turf sites including sod farms, golf courses (excluding greens and collars), parks, roadsides, cemeteries, and commercial properties. Tolerant turf species include Kentucky bluegrass, tall and fine fescue, perennial ryegrass, and centipedegrass at seeding and then anytime beyond 28 days after seeding. Add crop oil concentrate or methylated seed oil for enhanced control at 0.5 to 1% by volume. Don't apply greater than 2 fluid ounces per acre per application or 4 fluid ounces per acre per year. Bleaching intensity of susceptible weeds reduced, and broadleaf weed spectrum increased if tank mixed with quinclorac, [quinclorac + mecoprop + dicamba] or triclopyr. For suppression of above-listed weeds, add triclopyr at 1 pound ae per acre and make either 2 or 3 applications at 3 to 4 week intervals depending on topramezone rate. Creeping bentgrass is marginally tolerant to topramezone at 0.25 fluid ounces per acre. Test on a small area before large-scale use. Sequential applications may be required to achieve desired level of weed control.
Postemergence Control, Yellow Nutsedge, Annual Sedge				
bentazon, MOA 6 (4 SL)	0.75 to 1.5 fl oz	1 to 2 qt	1 to 2	For control of yellow nutsedge in established bluegrass, fescues, bentgrass, ryegrass, bermudagrass, bahiagrass, St. Augustinegrass, centipedegrass, and zoysiagrass. Apply to yellow nutsedge when actively growing under good soil moisture conditions. Additional applications may be made at intervals of 10 to 14 days until nutsedge is controlled.
Postemergence Control, Purple and Yellow Nutsedge, Kyllinga Species				
flazasulfuron, MOA 2 (25 DG)	0.034 to 0.069 oz	1.5 to 3 oz	0.023 to 0.0469	For use on well-established bermudagrass, zoysiagrass, centipedegrass and seashore paspalum grown on nonresidential turf including golf course fairways, roughs and tees, and industrial parks, tank-sod- and seed farms, cemeteries, athletic field and commercial lawns. Apply a maximum of 1.5 ounces per acre on fully green centipedegrass and seashore paspalum. 3 ounces per acre needed for perennial nutsedge and some annual sedge species control. Repeat applications in 2 to 6 weeks when nutsedge or sedge growth is evident. 1.5 to 2.25 ounces per acre will control kyllinga species. Maintain a 25 feet nontreated border beside susceptible turf species. Can overseed in 2 weeks if applied up to 1.5 ounces per acre. Wait 4 weeks if applied more than 1.5 ounces per acre. Include a nonionic surfactant at 0.25% by volume.
imazaquin, MOA 2 (70 DG)	0.128 to 0.256 oz	0.357 to 0.714 lb	0.25 to 0.5	Use on bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. Do not apply during spring greenup. Temporary yellowing may occur. Add a nonionic surfactant at 2 pt per 100 gal of spray solution. Addition of MSMA at 1.5 lb active per acre will improve sedge control in MSMA tolerant turfgrasses.
imazosulfuron, MOA 2 (75 WG)	0.184 to 0.322 oz	8 to 14 oz	0.38 to 0.66	May be applied to established (two mowings) residential and commercial bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, creeping bentgrass, Kentucky bluegrass, perennial ryegrass, tall fescue, and fine fescue. Do not apply to putting greens. Reapply 3 weeks after initial application when using the 8 ounces per acre rate. Reapply as needed 3 weeks after initial application when using rates above 8 ounces per acre. Wait 4 weeks to seed or sod after application. Use an 80% active nonionic surfactant at 0.25% by volume. For spot treatment, add 0.25 to 0.33 oz in 1 to 2 gallons of water per 1000 square feet. Add 2 teaspoons nonionic surfactant per gallon.
halosulfuron, MOA 2 (75 WDG)	0.9 g	0.67 to 1.33 oz	0.031 to 0.062	May be applied to established residential and commercial bermudagrass, bahiagrass, zoysiagrass, centipedegrass, St. Augustinegrass, creeping bentgrass, Kentucky bluegrass, perennial ryegrass, tall fescue, and fine fescue. Apply broadcast when sedges have reached the 3- to 8-leaf stage. Use lower rate for light infestations and higher rate for heavy infestations. A second treatment will usually be required 6 to 10 weeks after the initial treatment. Use an 80% active nonionic surfactant at 2 quarts per 100 gallons of spray solution (0.5% by volume). Do not exceed 1 to 2 pints of surfactant per acre. Do not apply to putting greens. Halosulfuron only suppresses green kyllinga.
MSMA, MOA 17 (6 SL, 6.6 SL)		several concentrations	2 to 3	See remarks for MSMA above. Will require at least 2 applications 7 to 10 days apart.
sulfosulfuron, MOA 2 (75 DG)	0.017 to 0.029 oz	0.75 to 1.25 oz	0.035 to 0.059	May be applied to certain ornamental native grasses and also bermudagrass species, zoysiagrass, centipedegrass, St. Augustinegrass, and kikuyugrass grown on sod farms, golf courses (excluding greens), commercial and residential turf that is highly managed, and other noncrop areas. Use 0.75 to 1.25 ounces per acre and repeat in 4 to 10 weeks if needed. Use a nonionic surfactant at 0.25% by volume.
trifloxysulfuron, MOA 2 (75 WG)	0.0023 to 0.0129 oz	0.1 to 0.56 oz	0.0047 to 0.0263	May be applied to residential bermudagrass and zoysiagrass and on golf courses, sod farms, and other nonresidential turf areas. A nonionic surfactant at 0.25 to 0.5% by volume is recommended. Temporary discoloration may occur if used with MSO or COC. Use rates of 0.33 to 0.56 ounces per acre for sedge and kyllinga species control. Labeled turf species can be seeded or sprigged into treated areas 4 weeks after application. Repeat application may be needed in 4 to 6 weeks.
Postemergence Control, Purple and Yellow Nutsedge, Kyllinga Species, and various broadleaf weeds				
sulfentrazone, MOA 14 (4 SC)	0.092 to 0.275 fl oz	0.25 to 0.75 pt	0.125 to 0.375	May be applied to home lawns. For use on creeping bentgrass, tall and fine fescue, perennial ryegrass, Kentucky bluegrass, and all warm-season turf species except St. Augustinegrass. Wait 3 months to seed, overseed, or sprig unless overseeding bermudagrass with perennial ryegrass, which only requires a 4- to 6-week waiting period after application. Apply to seedling grasses after second mowing and to new sod 6 months after establishment.
[sulfentrazone + imazethapyr], MOA 14 + 2 (4 SC)	0.22 to 0.33 fl oz	9.5 to 14.4 fl oz	0.29 to 0.45	May be applied to home lawns, athletic fields, sod farms, golf course fairways and roughs, and various non-crop sites. For use on bahiagrass, bermudagrass, centipedegrass, and zoysiagrass. Do not apply to soils classified as sand with less than 1% organic matter. Do not reseed, overseed, or sprig within 1 month of application. Expect slight perennial ryegrass injury if overseeded 2 to 4 weeks after application. Allow 3 month sod establishment before treatment.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, Purple and Yellow Nutsedge, Kyllinga Species, and various broadleaf weeds (continued)				
[sulfentrazone + metsulfuron], MOA 14 + 2 (66 WG)	0.075 to 0.23 oz	3.25 to 10 oz	0.134 to 0.413	May be applied to established residential, commercial and institutional lawns, athletic fields, sod farms, and golf course fairways and roughs. Use up to 6.5 ounces per acre on Kentucky bluegrass and tall fescue and 10 ounces per acre on bermudagrass, centipedegrass, St. Augustinegrass and zoysiagrass. Do not reseed, overseed, or sprig within 1 month of application. Expect slight perennial ryegrass injury if overseeded 6 to 8 weeks after application. Allow 3 months sod establishment before treatment. No adjuvant needed.
Postemergence Control, Bahiagrass, Crabgrass, Yellow and Purple Nutsedge, Annual Sedge, Kyllinga Species				
imazapic, MOA 2 (2 AS)	0.092 to 0.184 fl oz	4 to 8 fl oz	0.063 to 0.125	For use on unimproved centipedegrass after complete greenup only. Not for use in home lawns. Do not use on other turfgrass species. A repeat application may be needed on tough to control perennial weeds such as bahiagrass. The highest labeled rate may discolor centipedegrass by causing a red color.
Postemergence Control, Dandelion, Carpetweed, Carolina Cranesbill, Curly Dock, Plantain, Dichondra, Shepherds-Purse, Yellow Rocket				
2,4-D amine, MOA 4 (4 SL)	3 to 4 tsp	1.5 to 2 pt	0.75 to 1	Cut rate one-half for bentgrass, carpetgrass, centipedegrass, and St. Augustinegrass. Spray when weeds are young and actively growing. To reduce danger of injury to flowers and ornamentals by spray drift, use low pressure and do not spray on windy days.
Postemergence Control, Common Chickweed, Mouseear Chickweed, Creeping Charlie or Ground Ivy, Dandelion, Lespedeza, Black Medic, Spotted Spurge, Hop or White Clover				
mecoprop, MOA 4 (1.9 L) (1.16 L) (1.74 L)	 1 to 1.5 fl oz 1.5 to 2.25 fl oz 0.75 to 1.5 fl oz	 2.7 to 4 pt 4 to 6 pt 2 to 4 pt	 0.64 to 0.95 0.58 to 0.87 0.43 to 0.87	Observe same precaution as for 2,4-D. May be used on bentgrass, carpetgrass, centipedegrass, St. Augustinegrass, and other turf grasses.
Postemergence Control, Chickweed, White Clover, Dandelion, Curly Dock, Hawkweed, Henbit, Knotweed, Red Sorrel, Knawel, Spurweed, Spotted Spurge, Wild Strawberry, Yarrow				
dicamba, MOA 4 (4 SL)	1 to 2 tsp	0.5 to 1 pt	0.25 to 0.5	Apply as foliar spray to growing weeds. Prevent injury to ornamentals. Avoid rooting zone of shallow-rooted trees and shrubs.
diglycolamine, MOA 4 (4 SL)	1 to 4.5 tsp	0.5 to 2 pt	0.25 to 1	Do not exceed 1 pint per acre on bentgrass, carpetgrass, buffalograss, and St. Augustinegrass. Apply to newly seeded grasses after the second mowing. Do not exceed 0.25 pint per acre on extended sensitive plant roots on sandy soils and 0.5 pint per acre on clay soils.
Postemergence Control, All Weeds Listed Under 2,4-D Amine, MCPP, Dicamba, and Diglycolamine Sections				
[2,4-D amine + MCPP + dicamba], MOA 4 + 4 + 4 (various formulations)	See individual label	See individual label	See individual label	Check individual labels for specific rates, instructions and precautions. Generally, (1) apply to grass seedlings after second mowing; (2) apply to sodded, sprigged, or plugged turf 3 to 4 weeks after operations; and (3) wait 3 to 4 weeks after application to seed. Many products labeled for tall fescue, perennial ryegrass, perennial bluegrass, bermudagrass, and St. Augustinegrass. Some products labeled for bentgrass putting greens, bahiagrass, zoysiagrass, and centipedegrass. Some products labeled for home use when applied by a commercial applicator.
[2,4-D amine + MCPP + dichlorprop], MOA 4+ 4 + 4 (4.11 L) (2.48 L)	 0.62 to 1.47 fl oz 0.64 to 1.47 fl oz	\ 1.7 to 4 pt 1.75 to 4 pt	 0.873 to 2.06 0.543 to 1.24	
[MCPA + MCPP + dicamba], MOA 4+4+4 (4 L)	0.7 to 1.5 fl oz	2.5 to 4.1 pt	1.25 to 2.05	
Postemergence Control, Curly Dock, Broadleaf Dock, Galinsoga, Nightshade, Clover (Red, Hop, White, Sweet), Goldenrod, Musk Thistle, Speedwells, Common Vetch, Hairy Buttercup, Broadleaf Plantain				
clopyralid, MOA 4 (3 EC)	0.1 to 0.5 fl oz	0.25 to 1.33 pt	0.09 to 0.5	Do not apply to home lawns. May be used on bentgrass, Kentucky bluegrass, creeping, red, chewings, sheep and tall fescue, perennial ryegrass, bermudagrass, bahiagrass, buffalograss, centipedegrass, zoysiagrass, and St. Augustinegrass. Do not apply to putting greens and tees. Should be applied in a minimum of 20 gallons of water per acre. Surfactants are not necessary. Do not apply to exposed roots of certain trees and shrubs (legumes such as acacia, locust, mimosa, redbud, or mesquite) or *Tilia* spp. Do not use treated clippings for mulching and compost during the growing season of application.
All Weeds Listed Under 2,4-D Amine, Clopyralid, Dicamba, and Diglycolamine Sections				
[2,4-D amine + clopyralid + dicamba], MOA 4 + 4 + 4 (3.56 L)	0.55 to 1.1 fl oz	1.5 to 3 pt	0.67 to 1.34	Do not apply to home lawns. Use on perennial bluegrass, ryegrass, and fescue species, bentgrass (excluding greens and tees), bermudagrass, zoysiagrass, and bahiagrass. Do not apply to seedling grasses until well established. Wait 3 to 4 weeks after application to seed.
Postemergence Control, Virginia Buttonweed, Chickweed Species, White Clover, Dandelion, Henbit, Ground Ivy, Prostrate Knotweed, Matchweed, Black Medic, Plantain Species, Common Woodsorrel				
[2,4-D amine + fluroxypyr + dicamba], MOA 4 + 4 + 4 (4 SL)	0.36 to 1.1 fl oz	1 to 3 pt	0.5 to 1.5	Use on perennial bluegrass and ryegrass, tall fescue, creeping bentgrass (excluding greens and tees), bermudagrass species, bahiagrass, zoysiagrass, and St. Augustinegrass in residential, industrial, and institutional lawns, parks, cemeteries, athletic fields, golf courses, and sod farms. Use on St. Augustinegrass sod farms only. Apply 1 to 2 pints per acre on creeping bentgrass and 1.5 to 1.8 pints per acre on warm season turf grown for sod. Apply 2 to 3 pints per acre to all other turf areas. For non-turf areas, rate can be increased to 2 to 5 pints per acre. Application can be made to grass seedlings after second mowing and to newly sodded, sprigged, or plugged grasses 3 to 4 weeks after operations.
[MCPA amine + fluroxypyr ester + dicamba], MOA 4 + 4 + 4 (4.8 SL)	0.73 to 1.1 fl oz	2 to 3 pt	1.2 to 1.8	Same turf tolerances and uses as [2,4-D amine + fluroxypyr + dicamba] in addition to centipedegrass. Only spot treat St. Augustinegrass when temperature exceeds 80ºF. Do not apply more than two applications per year totaling 3 pints per acre. For non-turf areas, rate can be increased to 2 to 5 pints per acre. Application can be made to grass seedlings after second mowing and to newly sodded, sprigged, or plugged grasses 3 to 4 weeks after operations. Sod farm rates include 1.25 pints per acre for creeping bentgrass, 2 to 3 pints per acre for all other cool season grasses listed on label and 1.5 to 1.8 pints per acre for all warm season grasses listed on label.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, Winter and Summer Annual Broadleaf Weeds				
bentazon + atrazine, MOA 6 + 5 Create by tank mixing			0.5 to 0.75 + 0.5 to 0.75	Apply to bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. Check individual labels for weeds controlled and weed size for proper application.
2,4-D (choline salt) + Fluroxypyr + halauxifen methyl (3.28 L)	1.1 to 1.47 oz	48 to 64 oz	1.23 to 1.64	For postemergence control of annual and perennial broadleaf weeds in established turfgrass and ornamental grasses in golf courses, industrial sites, cemeteries, commercial sod farms, and unimproved turfgrass areas. Not for use in residential turfgrasses. Can be used on bentgrass, Kentucky bluegrass, fescues (chewing, creeping red, sheeps, tall, and hard) perennial ryegrass, bermudagrass, and zoysiagrass. Do not use on turf mowed at less than 0.5 inches. Repeat applications can be made at 4-week intervals. For a complete list of weeds controlled and additional precautions, consult GameOn herbicide label.
Postemergence Control, Black Medic, White, Hop Clover, Buckhorn Plantain, Common Chickweed, Mouseear Chickweed, Henbit, Spurweed (Lawn Burweed), Broadleaf Plantain, Dandelion, False Dandelion, Lespedeza, Prostrate Spurge, Wild Violet				
[triclopyr + cloypyralid], MOA 4 + 4 (3 SL)	0.37 to 0.74 fl oz	1 to 2 pt	0.28 to 0.56 + 0.09 to 0.19	Do not apply to home lawns. May be used on centipedegrass, bermudagrass, zoysiagrass, tall fescue, creeping red fescue, chewing fescue, Kentucky bluegrass, perennial ryegrass. Repeat treatment may be necessary for prostrate spurge and wild violet. Quali-Pro formulation: maintain 0.5 inch height for warm season turf. Do not apply to bermudagrass sod farms. Wait 3 weeks to reseed. Do not use grass clippings for compost or mulch.
[MCPA ester + triclopyr ester + dicamba], MOA 4 + 4 + 4 (3.6 EC)	0.91 to 1.29 fl oz	2.5 to 3.5 pt	1.125 to 1.575	May be applied to home lawns by a commercial applicator. Not for use on turf grown for resale or other commercial use as sod or seed production. Use on perennial bluegrass, ryegrass, fescue species, bentgrass (excluding greens and tees), bermudagrass, zoysiagrass, and bahiagrass. Do not apply to seedling grasses until well established. Wait 3 to 4 weeks after application to seed.
[MCPA amine + triclopyr amine + dicamba], MOA 4 + 4 + 4 (4.56 L)	0.73 to 1.1 fl oz	2 to 3 pt	1.14 to 1.71	
[MCPA amine + fluroxypyr ester + triclopyr amine], MOA 4+4+4 (3.41 L)	0.37 to 1.47 fl oz	1 to 4 pt	0.42625 to 1.705	Apply by a commercial applicator to residential, industrial, and institutional lawns, sod farms, parks, cemeteries, athletic fields, roadsides, and golf courses excluding greens and tees. May apply to bentgrass, Kentucky bluegrass, perennial ryegrass, fescue species, bahiagrass, bermudagrass, centipedegrass, and zoysiagrass. Do not spray on warm season turf less than 0.5 inch and do not exceed 3 pints per acre. Generally, apply 3 to 4 pints per acre except on fairway bentgrass, which can only tolerate 2 pints per acre. Wait 3 to 4 weeks after application to reseed. Check label for spray adjuvant recommendation.
Postemergence Control, Plantain, Chickweed, Dandelion, Purslane, and Thistle Species, Ground Ivy, Lawn Burweed, Henbit, Corn Speedwell, Spotted Spurge				
carfentrazone-ethyl, MOA 14 (1.9 EW)	0.0126 to 0.048 fl oz	0.55 to 2.1 fl oz	0.008 to 0.031	May be applied to bahiagrass, bermudagrass, buffalograss, centipedegrass, St. Augustinegrass, zoysiagrass, Kentucky bluegrass, tall fescue, fine fescue, perennial ryegrass, and bentgrass. To expand the weed spectrum and extend control of the weeds listed here and, on the label, carfentrazone-ethyl can be tank mixed with the entire range of phenoxy products—amines, esters, and other salts—and is also compatible with dicamba, atrazine, glyphosate, glufosinate, clopyralid, triclopyr, and MSMA. When applied alone, add 0.12 to 0.25% nonionic surfactant.
Postemergence Control, White Clover, Dandelion, Ground Ivy, Spurges, Plantains, Chickweeds, Henbit, Lawn Burweed, Woodsorrels, Dollarweed, Poison Ivy, Poison Oak, Corn Speedwell, Wild Strawberry, Wild Violet, Virginia Pepperweed, Shepherd's Purse				
[carfentrazone + 2,4-D ester + MCPP + dicamba], MOA 14 + 4 + 4 + 4 (2.2 EC)	0.75 to 1.8 fl oz	2 to 5 pt	0.55 to 1.375	May be used on annual and perennial bluegrass, annual and perennial ryegrass, tall and fine fescue, creeping and colonial bentgrass, common and hybrid bermudagrass, and zoysiagrass. For use in ornamental turf, golf courses, lawns, sod farms, cemeteries, and parks. Optimum results when applied when temperatures are between 45ºF and 75ºF but may be applied up to 90ºF. Lower rates may be used in cooler weather. Rainfast within 3 hr and may reseed after 2 weeks. May apply 3 to 4 wks after sodding, sprigging, or plugging. Also, may be used on bahiagrass, buffalograss, St. Augustinegrass, centipedegrass, seashore paspalum, and kikuyugrass. May reseed after 1 week.
[carfentrazone + 2,4-D ester + MCPP + dicamba], MOA 14 + 4 + 4 + 4 (0.81 EC)	0.55 to 2.2 fl oz	1.5 to 6 pt	0.1519 to 0.6075	
[carfentrazone + MCPA ester + MCPP + dicamba], MOA 14 + 4 + 4 + 4 (2.91 EC)	0.75 to 2.2 fl oz	2 to 6 pt	0.7275 to 2.1825	Same precautions and turf uses as [carfentrazone + 2,4-D ester + MCPP + dicamba] 2.2 EC except cannot be applied to creeping and colonial bentgrass.
penoxsulam + sulfentrazone + 2,4-D + dicamba	1.0 to 2.2 fl oz	2.7 to 6 pt	0.271 to 0.602	May be used on established Kentucky bluegrass, annual bluegrass, perennial ryegrass, annual ryegrass, tall fescue, common and hybrid bermudagrass, zoysiagrass, centipedegrass, and seashore paspalum. Do not apply more than 2.7 pints per acre on fescue or perennial ryegrass unless turf injury can be tolerated. Do not apply more than 3.5 pints per acre on St. Augustinegrass unless injury, discoloration, stunting, and thinning can be tolerated.
[sulfentrazone + 2,4-D amine + MCPP + dicamba], MOA 14 + 4 + 4 + 4 (2.18 SL)	0.92 to 1.84 fl oz	2.5 to 5 pt	0.68 to 1.36	Apply 2.5 to 3.25 pints per acre on warm season turf including bermudagrass species, zoysiagrass, bahiagrass, and buffalograss. Apply 3.25 to 4 pints per acre on cool season turf including species of bluegrass, ryegrass, fescue, and bentgrass (excluding greens and tees). 4 to 5 pints per acre needed to control corn speedwell and wild violet. Turf areas include residential, ornamental, institutional, and sod farms. Apply to grass seedlings after second mowing. Apply to sodded, sprigged, or plugged areas 3 to 4 weeks after operations. Treated areas may be reseeded 3 weeks after application.
[triclopyr ester + sulfentrazone + 2,4-D ester + dicamba], MOA 4 + 14 + 4 + 4 (2.51 EC)	0.75 to 1.5 fl oz	2 to 4 pt	0.628 to 1.26	Apply 2 to 2.25 pints per acre on fully dormant bermudagrass, zoysiagrass, and bahiagrass. Apply 3.25 to 4 pints per acre on annual and perennial bluegrass and ryegrass, and tall, red, and fine fescue. Rainfast within 3 hours. Approved turf areas include residential, ornamental, institutional, noncropland, and sod farms. Apply to grass seedlings after the second or third mowing. Apply to sodded, sprigged, or plugged areas 3 to 4 weeks after operations. Treated areas may be reseeded 3 weeks after application.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, Chickweed, Clover, Plantain and Dandelion Species, Florida Betony, Dollarweed, Ground Ivy, Lespedeza, and Yellow Woodsorrel				
florasulam, MOA 2 (0.42 SC)	0.09 fl oz	4 fl oz	0.013125	Can be used on all established major warm and cool season turfgrass species in residential lawns, golf courses (excluding putting greens), sports fields, sod farms and commercial turf areas. Controls Carolina geranium, species of chickweed, clover and dandelion, vetch, dollarweed and common groundsel. Do not exceed 3 applications or 12 fluid ounces per acre per year. Apply to newly seeded or sprigged turf after third mowing or when tillering and secondary root development has occurred. Wait 4 weeks to reseed. When used alone, add a nonionic surfactant at 0.2% by volume.
penoxsulam, MOA 2 (0.014 G) (0.03 G)	 3.4 to 10.3 lb 1.7 to 4.6 lb	 150 to 450 lb 75 to 200 lb	 0.02 to 0.06	May be applied to residential and commercial lawns, golf courses (excluding greens and tees), parks, athletic fields, and sod farms. Use on turf that has been mowed at least 3 times or sprigs that have developed secondary root systems. Apply up to 75 pounds per acre of 0.03 G or 150 pounds per acre of 0.014 G to perennial ryegrass and tall fescue. Apply up to 150 pounds per acre of 0.03 G or 300 pounds per acre of 0.014 G to bentgrass, Kentucky bluegrass, and fine fescue. Apply up to 200 pounds per acre of 0.03 G or 450 pounds per acre of 0.014 G to bermudagrass, centipedegrass, zoysiagrass, and St. Augustinegrass. Do not apply to dormant centipedegrass. Reapply at 4 weeks if needed but do not exceed 300 pounds per acre of 0.03 G or 650 pounds per acre of 0.014 G per season. After treatment, wait 3 to 4 weeks to reseed.
(0.31 L)	0.092 to 0.55 fl oz	0.25 to 1.5 pt	0.01 to 0.058	Same statement as above concerning turf uses and reseeding intervals. Bermudagrass and kikuyugrass are the only warm season grasses labeled for use. Apply up to 1 pint per acre on bentgrass, 1.5 pint per acre on bermudagrass and kikuyugrass and 2 pints per acre on tall fescue and perennial ryegrass. Do not apply greater than 2.3 pints per acre per year. Surfactant not required.
Carpetweed, Chickweed, Dandelion, Curly Dock, Cutleaf Eveningprimrose, Henbit, Knotweed, Common Mallow, Poison Ivy, and Annual Sowthistle				
pyraflufen ethyl, MOA 14 (0.177 SC)	0.016 to 0.092 fl oz	0.7 to 4 fl oz	0.000938 to 0.0055	Used in established sod farm and ornamental turf by commercial applicators and professional landscapers only. Turf can be newly seeded, sodded, or sprigged as long as it is established and not under stress. Tolerant turfgrasses include bermudagrass, centipedegrass, St. Augustinegrass, zoysiagrass, tall fescue, perennial ryegrass, perennial bluegrass, and creeping bentgrass (not greens or tees). Apply 1 to 4 fluid ounces alone to 3- to 6-inch tall weeds. For larger weeds and broader spectrum control, apply 0.75 to 1.5 fluid ounces and tank mix with 2,4-D, mecoprop, dicamba, chloroprop, MCPA, triclopyr, or fluroxypyr.
Postemergence Control, Bahiagrass, Perennial Ryegrass, Wild Garlic, Spurweed, Henbit, Miscellaneous Other Broadleaf Weeds				
metsulfuron, MOA 2 (60 WDG)	0.003 to 0.02 oz	0.125 to 1 oz	0.005 to 0.038	May be applied to established bermudagrass, zoysiagrass (Meyer or Emerald), St. Augustinegrass, Kentucky bluegrass or fine fescue. Do not apply to turf less than 1 year old. Do not exceed 0.5 ounces per acre on centipedegrass, fine fescue, or Kentucky bluegrass. See label for a complete list of weeds controlled. The addition of 0.25% nonionic surfactant will enhance control. May be used for removal of perennial ryegrass from overseeded warm-season turf species. For bahiagrass control, use 0.25 to 0.75 ounces per acre after spring greenup but before seedhead development. A repeat treatment may be necessary in 4 to 6 weeks.
metsulfuron (Patriot) 60 WDG	0.007 to 0.046 oz	0.33 to 2 oz	0.012 to 0.075	Apply to unimproved industrial turf only. Use maximum of 0.5 ounce per acre for fescue and bluegrass and 2 ounces per acre for bermudagrass.
[metsulfuron + rimsulfuron], MOA 2 + 2 (37 WG)	0.0344352 oz	1.5 oz	0.0346875	See comments under postemergence annual bluegrass control. For bahiagrass control, a repeat treatment may be necessary 4 to 6 weeks after initial application.
Postemergence Control, Wild Garlic, Wild Onion				
imazaquin, MOA 2 (70 DG)	0.128 to 0.256 oz	0.357 to 0.714 lb	0.25 to 0.5	Use on bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. Do not apply during spring greenup. Temporary yellowing may occur. Add a nonionic surfactant at 2 pints per 100 gallons of spray solution.
2,4-D amine, MOA 4 (4 SL)	2.2 fl oz	3 qt	3	Apply in fall when garlic is young and actively growing. Add a wetting agent to keep spray from bouncing off garlic leaves. Repeat treatment for 2 years. Avoid spray drift which can injure susceptible plants. Use on bluegrass, fescue, bermudagrass, or zoysia. For more susceptible grasses, uses spot treatment below.
	Spot treatment			One tbsp of 1% 2,4-D solution per garlic clump or use pressurized applicator. Apply December to April. Use as spot treatment for widely scattered clumps in small areas. Avoid excessive spraying as turfgrass injury may result.
Postemergence Control of Various Grass and Broadleaf Weeds in Unimproved Turf and Other Noncrop Areas				
glyphosate, MOA 9 (5.5 SL) (5 SL) (4 SL)	 0.14 to 1.01 0.12 to 0.87 fl oz 0.75 to 2.94 fl oz	 0.375 to 2.75 pt 0.3125 to 2.375 pt 1 to 4 qt	 0.26 to 1.89 0.2 to 1.48 0.5 to 4	Check specific labels for correct rates. Apply to dormant or actively growing well established bermudagrass and bahiagrass. Bahiagrass growth will be suppressed if treated after spring greenup and before seedhead formation. Treat winter annual weeds when less than 6 inches tall. Higher rates are needed for more mature plants. Apply in 10 to 40 gallons of water per acre and use an NIS at 2 quarts per 100 gallons of spray solution.
[glyphosate + 2,4-D amine], MOA 9 + 4 (1.2 + 1.9 lb/gal SL)	0.55 to 1.47 fl oz	1.5 to 4 pt	0.58 to 1.55	Apply in 15 to 30 gallons of water per acre. May be applied to highly maintained dormant bermudagrass at 2 to 4 pt per acre. In low maintenance bermudagrass, sulfometuron can be added at 0.25 to 1 ounce per acre when dormant or actively growing. Apply 2 to 4 pints per acre on dormant bahiagrass and 1.5 to 2 pints per acre on actively growing bahiagrass. Tank mix with sulfometuron if needed. Check label for sulfometuron rates. Tall fescue applications can be made in the spring or summer at 2 to 3 pints per acre with or without sulfometuron. Spray tall fescue at 4 to 6 inches tall and before seedhead emergence to minimize injury.
sulfosulfuron, MOA 2 (75 WG)	0.017 to 0.046 oz	0.75 to 2 oz	0.035 to 0.094	May be used in well-established dormant and actively growing bermudagrass and bahiagrass. Wait 30 days to re-treat if needed; do not exceed 2.66 ounces per acre per year. If treating weeds postemergence, use an NIS at 2 quarts per 100 gallons spray solution unless tank mixed with glyphosate. Sulfosulfuron can be tank mixed with [glyphosate + 2,4-D amine], metsulfuron, sulfometuron, and chlorsulfuron, but check label for proper turf species and timing. Expect temporary injury or discoloration with tank mix partners. For well-established tall fescue, do not exceed 1 ounce per acre per year, and do not tank mix. Effective on johnsongrass.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control of Various Grass and Broadleaf Weeds in Unimproved Turf and Other Noncrop Areas (continued)				
[thiencarbazone-methyl + iodosulfuron-methyl + foramsulfuron], MOA 14 + 2 + 2 (36.4 WDG)	0.069 to 0.138 oz	3 to 6 oz	0.068 to 0.137	May be applied to unimproved bermudagrass, zoysiagrass, centipedegrass and bare ground sites on private, public and military land for control of many annual and perennial broadleaf and grass weeds. Check label for complete weed listing, rate needed and recommended adjuvant. Repeat application in 4 to 6 weeks if weed regrowth occurs not to exceed 6 ounces product per year. Spot treatment (spray-to-wet) rate is 3 to 6 ounces product per 25- to 100-gallon solution. Nonionic surfactant is generally recommended at 0.25 to 0.5%. Use 0.5 to 1% methylated seed oil for difficult to control broadleaf weeds and perennial grasses. Increased control may be achieved with 1.5 to 3 pounds per acre ammonium sulfate in high humidity climates or 1.5 to 2 quarts per acre urea ammonium nitrate in low humidity climates. Do not use an organosilicone surfactant.
Postemergence Control in Dormant Warm Season Turf Annual Bluegrass, Various Other Winter Annual Weeds				
diquat, MOA 22 (2 SL)	0.4 to 0.75 fl oz	1 to 2 pt	0.25 to 0.5	Apply in 20 to 100 gallons spray mix as a broadcast application. Add 1 to 2 pints of a nonionic surfactant per 100 gallons of solution. Bermudagrass must be dormant. More than one application may be needed.
flumioxazin, MOA 14 (51 WG)	0.1837 to 0.2755 oz	8 to 12 oz	0.255 to 0.3825	Use on completely dormant bermudagrass turf including residential and commercial lawns, golf courses (excluding greens), sod farms, roadsides, athletic fields, parks and schools. Add 0.25% by volume nonionic surfactant for postemergence applications. Provides preemergence control of annual grasses such as crabgrass, goosegrass, foxtail species, barnyardgrass and annual bluegrass. Does control annual bluegrass postemergence along with many common winter annual broadleaf weeds such as chickweed species, henbit, Carolina geranium and hairy bittercress. Allow a 15 feet buffer zone when applying upslope from bentgrass greens or bermudagrass greens overseeded with *Poa trivialis*. To limit potential lateral movement, do not apply to saturated soil.
glyphosate - Roundup, MOA 9 (4 SL) (5 SL) (5.5 SL)	 0.37 fl oz 0.29 fl oz 0.27 fl oz	 1 pt 0.8 pt 0.73 pt	 0.5	Check specific labels for correct rates. Apply in 5 to 40 gallons water per acre with 0.5% by volume of a nonionic surfactant. Application to actively growing annual bluegrass must be made before initiation of bermudagrass greenup in the spring.
glyphosate - Touchdown, MOA 9 (3 LC) (4.17 LC) (5 LC)	 0.18 to 1.47 fl oz 0.13 to 1.06 fl oz 0.11 to 0.88 fl oz	 0.5 to 4 pt 0.36 to 2.88 pt 0.3 to 2.4 pt	 0.1875 to 1.5	Apply to dormant bermudagrass and bahiagrass before spring greenup. Apply in 10 to 40 gallons water per acre. Will control winter annual weeds up to 6 inches tall and 4- to 6-leaf tall fescue. Use a 75% active ingredient nonionic surfactant at 0.25% by volume or dry ammonium sulfate at 0.5% by weight.
[glyphosate + diquat], MOA 9 + 22 (76 WG) (4.21 SL)	 0.11 to 0.37 oz 0.18 to 0.62 fl oz	 5 to 16 oz 8 to 27 fl oz	 0.24 to 0.76 0.26 to 0.89	Apply to dormant bermudagrass and bahiagrass not grown for research, sale, or other commercial uses, such as sod, seed production. Apply in 10 to 80 gallons water per acre. Rates greater than 9 ounces per acre of 76 WG product or 15 fluid ounces per acre of 4.21 SL product may cause injury or delay greenup in highly maintained areas. Controls tall fescue.
metribuzin, MOA 5 (75 WDF)	0.25 oz	0.67 lb	0.5	For application by commercial applicators to dormant bermudagrass turf. Broadcast spray before greenup of turf. Do not apply to greens, tees, or aprons. Controls common chickweed, corn speedwell, henbit, parsley-piert, and spurweed.
Suppression/Control, Bermudagrass				
fenoxaprop, MOA 1 (0.57 EC)	0.46 fl oz	1.25 pt	0.089	Use on Kentucky bluegrass, perennial ryegrass, fine and tall fescue, and zoysiagrass. Apply June 1, July 1, Aug. 1, Sept. 1, repeat for 2 years. Can be tank mixed with 1 pt per acre triclopyr following the same schedule as above. Apply June 1 and Aug. 1 for 2 years if tank mixed with 1 quart per acre triclopyr. Zoysia may show discoloration but should recover in 10 to 14 days following tank mix applications.
fluazifop, MOA 1 (2 EC)	0.05 to 0.14 fl oz	2 to 6 fl oz	0.03 to 0.09	Use on tall fescue or zoysia. For fescue, apply 5 to 6 ounces per acre during warm weather in early spring when bermudagrass is breaking dormancy; repeat in fall when bermudagrass is preparing for dormancy. For zoysia, apply 4 ounces per acre on June 1, Aug. 1; repeat for 2 years. Can tank-mix with 1 quart per acre triclopyr following schedule above. Zoysia or tall fescue may show slight discoloration but should recover in 10 to 14 days. Add a nonionic surfactant at 0.25% v/v. Apply in a minimum of 30 gallons of water per acre.
siduron, MOA 7 (50 WP)	0.5 to 1 lb	21.78 to 43.56 lb	10.88 to 21.78	Apply as 8- to 12-inch band treatment with a single nozzle sprayer along putting green perimeter to suppress bermudagrass stolon encroachment. Initiate in March or April and continue subsequent applications at 4- to 5-week intervals.
triclopyr, MOA 4 (4 EC)	0.73 fl oz	1 qt	1.0	Use on perennial bluegrass, perennial ryegrass, tall fescue or ornamental turf including sod farms and golf courses. Do not apply to zoysia unless injury can be tolerated. Apply June 1, July 1, Aug. 1, Sept. 1, repeat for 2 years. Can be tank-mixed with fenoxaprop or fluazifop at rates, timings listed above. New low-odor formulation uses methylated seed oil solvents instead of petroleum distillates.
Postemergence Control Bermudagrass				
clethodim, MOA 1 (0.97 EC)	0.4 to 0.8 fl oz	17 to 34 fl oz	0.125 to 0.25	For use on sod farms only. Do not apply to centipedegrass being grown for seed. Do not apply until 3 weeks after full greenup of centipedegrass in spring. Do not mow for 1 week before and after application. The addition of a nonionic surfactant at 0.25 % solution (1 pint per 50 gallons water) or a crop oil concentrate at 1% solution (2 quarts per 50 gallons water) is necessary for control. A repeat application usually 3 to 4 weeks after the first application will be required for bermudagrass control. Use higher rates for more established bermudagrass. Do not apply more than 68 ounces of clethodim per acre per year. Some discoloration of centipedegrass will occur at higher rates.
Preplant Control or Lawn Renovation — Emerged Annual and Perennial Grass and Broadleaf Weeds				
glyphosate - Roundup, MOA 9 (4 SL) (5 SL) (5.5 SL)	 0.75 to 3 fl oz 0.54 to 2.17 fl oz 0.54 to 2.14 fl oz	 1 to 4 qt 0.8 to 3.2 qt 0.73 to 2.91 qt	 1 to 4	Where existing vegetation is growing in a field or unmowed situation, apply to actively growing weeds at the stages according to label. Where existing vegetation is growing under mowed turfgrass management, apply after omitting at least one regular mowing to allow sufficient growth for good interception of the spray. Tillage or renovation techniques such as vertical mowing, coring, or slicing should be delayed for 7 days after application. Desirable turfgrass may be established following treatment.

Table 7-14. Chemical Weed Control in Lawns and Turf

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Preplant Control or Lawn Renovation — Emerged Annual and Perennial Grass and Broadleaf Weeds (continued)				
glyphosate - Touchdown, MOA 9 (3 LC) (4.17 LC) (5 LC)	 0.18 to 1.47 fl oz 0.13 to 1.06 fl oz 0.11 to 0.88 fl oz	 0.5 to 4 pt 0.36 to 2.88 pt 0.3 to 2.4 pt	0.1875 to 1.5	Same remarks as glyphosate, above. In addition, use a 75% active ingredient nonionic surfactant at 0.25% by volume or dry ammonium sulfate at 0.5% by weight.
[glyphosate + diquat], MOA 9 + 22 (76 WG) (4.21 SL)	 1.65 to 4.5 oz 2.75 to 5.5 fl oz	 4.5 to 12.25 lb 3.75 to 7.5 qt	 3.4 to 9.3 3.95 to 7.89	Generally, use the 75 WG product at 4.5 pounds per acre on annuals, 9 pounds per acre on perennials, and 12.25 pounds per acre on dusty or stressed plants, dense stands, or difficult-to-control perennials. Generally, use the 4.21 SL product at 3.75 quarts per acre on annuals and 7.5 quarts per acre on perennials. Do not use on turf grown for research, for sale, or for commercial uses, such as sod or seed production. Do not use if renovating bermudagrass or kikuyugrass sods. Delay tillage for 7 days after application.
[indaziflam + diquat dibromide + glyphosate], MOA 21 + 22 + 9 (1.958 SL)	 1 pt	 5.44 gal	 10.66	For nonselective preemergence and postemergence control in noncrop areas. Reapply 4 months after initial application if needed not to exceed 1 quart per 1000 square feet per year. Apply 1 pint in 1 gallon of water to cover 1000 square feet. Do not seed for 12 months after application.
Trimming and Edging and Control of Emerged Weeds				
diquat, MOA 22 (2 SL)	0.4 to 0.75 fl oz	1 to 2 pt	0.25 to 0.5	Add nonionic surfactant at 0.25 ounce per gallon of water. Water volumes above 15 gal per acre should be used. For spot sprays, use 0.3 to 0.75 fluid ounce per gallon.
glufosinate, MOA 10 (1 SL)	2.2 to 4.4 fl oz	3 to 6 qt	0.75 to 1.5	Rate depends on weed to be controlled and stage of growth. Consult label. For spot or directed spray use 1.5 to 4 fluid ounces per gallon of water.
glyphosate + diquat, MOA 9 + 22 (76 WG) (4.21 SL)	 1.65 to 4.5 oz 2.75 to 5.5 fl oz	 4.5 to 12.25 lb 3.75 to 7.5 qt	 3.4 to 9.3 3.95 to 7.89	May be used in general noncrop areas. Do not use on plants grown for sale or other commercial uses, such as seed production. See rate comments in lawn renovation section. For spray to wet treatments, apply the 76 WG product at 1.2 ounces per gal of water for annuals and 1.5 ounces per gal of water for perennials. Apply the 4.21 SL product at 2 fluid ounces per gallon of water for annuals and 2.5 fluid ounces per gal water for perennials. For directed spot treatment of perennials using hand-held low volume equipment, apply 4 to 8 ounces per gallon of water.

Chemical Weed Control in Ornamentals

J. C. Neal, Horticultural Science Department

Table 7-15. Chemical Weed Control in Ornamentals

More detailed information about herbicides labeled for use in nursery crops and landscape plantings is available at the NC State Extension portal: "Weed Management in Nurseries, Landscapes, and Christmas Trees" (weeds.ces.ncsu.edu).

Control Type	Weed	Herbicide and Formulation	Mode of Action	Amount Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preplant to all Ornamentals	Most annuals and perennials	diquat dibromide (Reward) 2 L	22	1 to 2 qt	0.5 to 1	Non-selective, contact-type, postemergence control of seedling weeds. A nonionic surfactant should be added to the spray solution. Apply for full coverage and thorough weed contact. Retreatment will be necessary for established weeds. May be used in landscapes, nurseries and greenhouses.
		glufosinate (Finale XL or Cheetah Pro) 2.34 L	10	82 oz	1.5	Non-selective postemergence control of weeds, including many glyphosate-resistant weeds. Thorough coverage is essential. Apply in a minimum of 20 gallons of water per acre. No residual control. Repeat applications may be necessary for control of perennial weeds. See content.ces.ncsu.edu/finale-xl-or-cheetah-pro-glufosinate.
		glyphosate (Roundup Pro and many others)	9	1 to 5 qt	1 to 5	Non-selective, systemic herbicide. Apply to emerged weeds prior to planting ornamentals. See content.ces.ncsu.edu/glyphosate-1.
		paraquat (Gramoxone Extra) 2.5 L	22	2 to 3 pt	0.6 to 0.9	Non-selective, contact herbicide. Apply when grass and weeds are 1 to 6 inches high and succulent for best results. Direct spray with low pressure to avoid contact with foliage or bark of crop less than 1 year old. Add nonionic surfactant, 0.25% by volume (2 pints per 100 gallons of water). Not for use in landscapes or greenhouses. Paraquat is a restricted-use pesticide. Users must successfully complete an EPA-approved training program before mixing or applying paraquat.
Post-plant Preemergence Weed Control	Annual grasses and broadleaf weeds (preemergence) See label for susceptible species	benefin + oryzalin (XL) 1 + 1 G	3	200 to 300 lb	2 to 3 + 2 to 3	Apply preemergence to weeds. May be applied in spring and fall to ornamental plants.
		dichlobenil (Casoron) 4 G	29	100 to 150 lb	4 to 6	Do not use on fir, hemlock, *Ilex crenata, I. rotunda,* or *I. vomitoria*. Do not use more than 6 pounds per acre on azalea, *Rhododendron*, boxwood, holly, *Euonymus*, *Forsythia*, *Leucothoe*, ivy, lilac, heather, or any plantings less than 1 year old. Do not use in seedbeds, cutting, or transplant beds. Do not apply until 4 weeks after transplanting any plants. Apply in winter. See content.ces.ncsu.edu/casoron-dichlobenil.
		dithiopyr (Dimension) 2 EW 40 WP	3	 2 pt 20 oz	0.5	Preemergence control of annual grasses and some small seeded broadleaf weeds in turf, landscape plantings, and nurseries. Use as a directed application around ornamental plants unless specified otherwise on the product label. See label for tolerant species and restrictions. See content.ces.ncsu.edu/dimension-dithiopyr.
		dimethenamid-p (Tower) 6 EC	15	21 to 32 oz	1 to 1.5	Preemergence control of annual sedges, annual grasses and many annual broadleaf weeds in woody landscape plantings, field, and container nurseries. Suppression of yellow nutsedge. Avoid foliar treatments over the top of early spring growth flushes as injury to ornamental plants can occur. See content.ces.ncsu.edu/tower-dimethenamid-p.
		dimethenamid-p + pendimethalin (Freehand) 1.75 (0.75 + 1) G	15 + 3	100 to 200 lb	1.75 to 3.5	Preemergence control of annual grasses and many broadleaf weeds from seed as well as suppression of yellow nutsedge in container and field nurseries, and woody landscape plantings. See content.ces.ncsu.edu/freehand-dimethenamid-p-pendimethalin.
		flumioxazin (Broadstar) G	14	150 lb	0.375	Preemergence control of most annual broadleaf and annual grasses in container and field-grown woody nursery crops. Not for use in landscape plantings. See label for species and precautions. Do not apply to wet foliage or newly potted liners. See content.ces.ncsu.edu/broadstar-flumioxazin.
		flumioxazin (Sureguard) DG (Sureguard) 4SC	14	 8 to 12 oz 8 to 12 fl oz	0.25 to 0.375	Preemergence control of most annual broadleaf and annual grasses, and early postemergence control of seedling broadleaf weeds in field and container-grown woody nursery crops and certain landscape plantings. May be applied for residual weed control in covered structures before crops are placed in the house. See label for species and precautions. See content.ces.ncsu.edu/sureguard-flumioxazin.
		flumioxazin + prodiamine (Fuerte) 0.875 (0.125 + 0.75) G	14 + 3	100 lb	0.875 (0.125 + 0.75)	Preemergence control of most annual broadleaf and annual grass weeds in container and field grown nursery crops, and landscape plantings. Do not apply to wet foliage or newly potted liners. Do not use on herbaceous ornamentals.
		indaziflam (Marengo) 0.0224 G (Marengo) 0.622 SC	29	 100 to 200 lb 7.5 to 15.5 fl oz	0.022 to 0.044 0.036 to 0.075	Preemergence control of many annual weeds in container or field grown nursery crops. Not labeled for use in landscape plantings. See label for specific species. See content.ces.ncsu.edu/marengo-indaziflam. Preemergence weed control in field grown nursery crops. Use as a directed spray. Also for use as a ground treatment in container nurseries and greenhouses (and similar covered structures). When treating inside covered houses, structures should have no crop present at the time of treatment. See label for full details.

Table 7-15. Chemical Weed Control in Ornamentals

More detailed information about herbicides labeled for use in nursery crops and landscape plantings is available at the NC State Extension portal: "Weed Management in Nurseries, Landscapes, and Christmas Trees" (weeds.ces.ncsu.edu).

Control Type	Weed	Herbicide and Formulation	Mode of Action	Amount Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-plant Preemergence Weed Control (continued)	Annual grasses and broadleaf weeds (preemergence) (continued) See label for susceptible species	indaziflam (Specticle) 0.0224% G (Specticle) 0.622 SC	29	100 to 200 lb 6 to 12 fl oz	0.022 to 0.044 0.029 to 0.058	Preemergence control of many annual weeds in established woody landscape plantings. Do not use in areas planted to or to be planted to bedding plants. Labeled for use on a limited number of herbaceous perennials. The GR formulation is less injurious to ornamental plants than the SC formulation. The SC formulation should be applied as a directed spray, avoiding contact with the foliage of ornamental plants. Check labels for details. See content.ces.ncsu.edu/marengo-indaziflam.
		isoxaben (Gallery) 75 DF (Gallery) 4.16 SC	29	0.66 to 1.33 lb 16 to 31 fl oz	0.5 to 1	Use as preemergence control of broadleaf weeds in many field and container grown ornamentals, turf, and landscape plantings. Generally used in combination with another herbicide for broader spectrum weed control. See content.ces.ncsu.edu/gallery-isoxaben.
		isoxaben + dithiopyr (Fortress) 0.75 G (0.5 + 0.25)	29 + 3	150	1.125 (0.75 + 0.375)	Preemergence control of most annual broadleaf weeds and annual grasses in container or field-grown nursery crops, and some field grown cut flower plantings. May be used on many woody and herbaceous ornamental species. Not for use in landscape plantings. See content.ces.ncsu.edu/fortress-isoxaben-dithiopyr.
		isoxaben + prodiamine (Gemini) 3.7 SC (1.5 + 2.2) (Gemini) 0.65 GR (0.25 + 0.5)	29 + 3	43.5 to 87 fl oz 100 to 200 lb	1.25 (0.5 + 0.75) to 2.5 (1 + 1.5)	Preemergence control of weeds in field- and container-grown ornamentals and landscape plantings. See label for specific species. See content.ces.ncsu.edu/gemini-isoxaben-prodiamine.
		isoxaben + trifluralin (Snapshot TG) 2.5 G	29 + 3	100 to 200 lb	2.5 to 5	Preemergence control of weeds in field- and container-grown ornamentals and landscape plantings. See label for specific species. See content.ces.ncsu.edu/snapshot-tg-isoxaben-trifluralin.
		S-metolachlor (Pennant Magnum) 7.62 EC	15	1.3 to 2.6 pt	1.2 to 2.5	Preemergence control of annual grasses, annual sedges, and some annual broadleaf weeds including doveweed, as well as suppression of yellow nutsedge. Apply to soil surface immediately after planting. Avoid foliar treatments over the top of early spring growth flushes as injury to ornamental plants can occur. See content.ces.ncsu.edu/pennant-magnum-s-metolachlor.
		napropamide (Devrinol) 50 DF	15	8 to 12 lb	4 to 6	Apply preemergence to weeds and as a directed spray in ornamentals. Can be used in field or container nurseries or landscape plantings. If broadcast over top of ornamentals, irrigate soon after application to reduce risk of foliar injury. See content.ces.ncsu.edu/devrinol-napropamide.
		oryzalin (Surflan) 4 AS	3	2 to 4 qt	2 to 4	Preemergence to weeds in field or container nurseries or landscape plantings. Apply only to established plantings. Do not use in seedbeds or transplant beds. Not recommended for use on soils containing more than 3% organic matter. Use higher rate for longer term control. Do not apply on hemlock. See content.ces.ncsu.edu/surflan-oryzalin. Note: manufacturing was discontinued but remaining supplies may be used according to the label.
		oxadiazon (Ronstar) 2 G	14	100 to 200 lb	2 to 4	Apply preemergence to weeds. Can be used on container- and field-grown ornamentals. Repeat applications are labeled for some species. Injury has been observed on *Ajuga*, *Liriope*, mondo, and fig. Granules may burn tender foliage of several species if irrigation is not used to wash them off. Caution: Plants that trap granules in leaf axil can be injured.
		oxyfluorfen (Goal) 2 XL (Galigan) 2E	14	5 to 10 pt	1 to 2	Preemergence and postemergence control of many broadleaf and grass weeds in conifers and dormant deciduous trees. Do not apply when conifers have young tender growth. Lower rates are used in conifer seedbeds and for postemergence treatments. See content.ces.ncsu.edu/goal-goaltender-oxyfluorfen.
		oxyfluorfen + oryzalin (Rout or Double O) 3 (2+1) G	14 + 3	100 lb	3 (2 + 1)	Apply preemergence to weeds. Can be used on container and field-grown ornamentals. Repeat applications are labeled. Injury is to be expected to herbaceous plants or to plants with leaf orientation that might trap granules. Check label for genera of plants on which it can be used. Note: manufacturing was discontinued but remaining supplies may be used according to the label.
		oxyfluorfen + oxadiazon (Regal OO) 3 (2 + 1) G	14 + 14	100 lb	3 (2 + 1)	Apply preemergence to weeds. May be used on container- or field-grown woody ornamentals, including liner production. Injury is to be expected to herbaceous plants or to plants with leaf orientation that might trap granules. Check label for genera of plants on which it can be used. See content.ces.ncsu.edu/regal-o-o-oxyfluorfen-oxadiazon.
		oxyfluorfen + pendimethalin (Ornamental Herbicide 2) 3 (2+1) G	14 + 3	100 lb	3 (2 + 1)	Apply preemergence to weeds. Can be used on container- and field-grown ornamentals. Repeat applications are labeled. Injury is to be expected to herbaceous plants or to plants with leaf orientation that might trap granules. Check label for genera of plants on which it can be used. See content.ces.ncsu.edu/ornamental-herbicide-ii-oxyfluorfen-pendimethalin.
		oxyfluorfen + prodiamine (Biathlon) 2.75 G	14 + 3	100 lb	2.75 (2 + 0.75)	Apply preemergence to weeds. Can be used on container- and field-grown ornamentals. Repeat applications are labeled. Injury is to be expected to herbaceous plants or to plants with leaf orientation that might trap granules. Check label for genera of plants on which it can be used. See content.ces.ncsu.edu/biathlon-oxyfluorfen-prodiamine.

Table 7-15. Chemical Weed Control in Ornamentals

More detailed information about herbicides labeled for use in nursery crops and landscape plantings is available at the NC State Extension portal: "Weed Management in Nurseries, Landscapes, and Christmas Trees" (weeds.ces.ncsu.edu).

Control Type	Weed	Herbicide and Formulation	Mode of Action	Amount Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-plant Preemergence Weed Control (continued)	Annual grasses and broadleaf weeds (preemergence) (continued) See label for susceptible species	pendimethalin (Corral, Pendulum) several formulations	3	See label	2 to 4	Preemergence control of annual grasses and some broadleaf weeds in turf, landscape plantings, container- and field-grown nursery crops, and Christmas trees. Pendulum Aqua Cap is labeled only for turf and landscape uses. See labels for details. See content.ces.ncsu.edu/pendulum-aquacap-corral-pendimethalin.
		pethoxamid (StriCore)	15	24 to 48 oz	0.75 to 1.5	Preemergence control of annual grasses, annual sedges and some small-seeded annual broadleaf weeds. For use by professional applicators in field grown nursery crops and around woody landscape plants. See content.ces.ncsu.edu/stricore-pethoxamid?x=11092.
		prodiamine (Barricade) 65 WG, 4 FL (Regalkade) 0.5 G	3	1 to 1.15 lb 21 to 48 oz 150 lb	0.65 to 0.75	Apply preemergence to weeds. Labeled for use in turf, landscape plantings, and nurseries. See label for tolerant species and restrictions. See content.ces.ncsu.edu/barricade-prodiamine-regalkade-g-prodiamine.
		pronamide (Kerb) 50 WP	3	2 to 4 lb	1 to 2	Pre and postemergence control of cool-season grasses and some annual broadleaf weeds from seed. Apply in late winter just before rain or snowfall. Not recommended for soils that are high in muck or peat. Check label for use restrictions.
		simazine (Princep) 4 L	5	2 to 3 qt	2 to 3	Apply preemergence to weeds in field nurseries and Christmas trees. Injury has occurred on azaleas, Japanese holly, *Euonymus*, lilac, privet, *Pittosporum*, mock orange, hemlock, boxwood, and several other broadleaf species. High rates will injure Fraser fir. See content.ces.ncsu.edu/princep-simazine-simazine.
		trifluralin (Preen) 1.47G (Treflan) 5 G	3	136 to 272 lb 80 lb	2 to 4 4	Preemergence to weeds. Irrigate after application. May injure some azalea cultivars. Safe on numerous herbaceous and woody landscape plants. Controls annual bluegrass, henbit and chickweed. Weak on summer annual weeds.
Post-Plant, Postemergence Selective Grass Control	Annual and perennial grasses (postemergence) See label for tolerant species	clethodim (Envoy and others)	1	8 to 34 fl oz	0.06 to 0.25	Postemergence grass control. Annuals 2 to 6 inches tall, perennials at 4 to 12 inches new growth. Add nonionic surfactant at 0.25% v/v (2 pints per 100 gallons) to final spray. See content.ces.ncsu.edu/envoy-plus-clethodim.
		fenoxaprop-P (Acclaim Extra) .57EC	1	13 to 39 oz	0.06 to 0.17	Apply to emerged grass using at least 40 gpa. Can be used overtop of many flowers and woody ornamentals. Check label. Injury has been observed on Bar Harbor juniper, *Philodendron*, *Salvia*, *Podocarpus*, and *Pittosporum* when sprayed with this product. See content.ces.ncsu.edu/acclaim-extra-fenoxaprop-p.
		fluazifop-P (Fusilade II) 2 EC	1	2 to 3 pt	0.25 to 0.4	Postemergence grass control. Annuals not over 2 to 8 inches tall, perennials at 4 to 12 inches new growth. Consult label for tolerant species. Use nonionic surfactant and no oil. See content.ces.ncsu.edu/fusilade-ii-fluazifop-p-butyl.
		sethoxydim (Segment, Sethoxydim) 1 EC	1	36 to 60 oz	0.3 to 0.5	Postemergence grass control. Annuals up to 12 inches tall and 6 to 10 inches new growth on perennials. See content.ces.ncsu.edu/segment-sethoxydim.
Post-Plant, Postemergence Weed Control	Annual grasses and broadleaf weeds (postemergence)	2,4-D amine (Weedar 64)	4	2 to 8 pt	0.95 to 3.8	For postemergence broadleaf weed control in Christmas tree production. Not for use in commercial nurseries or landscape plantings. Use as a directed spray prior to bud break. Avoid contact with the desirable plants. Applications after conifer bud-break carry a much greater risk of crop injury from spray drift or misapplication than do applications made before bud break.
		asulam (Asulox) 3.34 L	18	77 to 128 oz	2 to 7	Apply postemergence to weeds in many conifers. Controls glyphosate-resistant horseweed. Suppression of field horsetail (*Equisetum*) has been reported.
		bentazon (Basagran TO) 4 L	6	1.5 to 2 pt	0.75 to 1	Postemergence directed applications to many established ornamentals for yellow nutsedge and seedling broadleaf weed control. See content.ces.ncsu.edu/basagran-bentazon.
		clopyralid (Lontrel) 3 L	4	4 to 11 oz	0.09 to 0.25	Postemergence control of legume and many aster weeds. Can be used as a directed spray around on several field-grown woody ornamentals. Can be applied overtop of actively growing conifers transplanted 1 year or more. Apply when weeds are young and actively growing. See content.ces.ncsu.edu/lontrel-clopyralid.
		dichlobenil (Casoron) 4 G	29	100 to 150 lb	4 to 6	Pre- and Postemergence control of many annual and perennial weeds. Do not use on fir, hemlock, *Ilex crenata, I. rotunda*, or *I. vomitoria*. Do not use more than 6 pounds per acre on azalea, *Rhododendron*, boxwood, holly, *Euonymus*, *Forsythia*, *Leucothoe*, ivy, lilac, heather, or any plantings less than 1 year old. Do not use in seedbeds, cutting, or transplant beds. Do not apply until 4 weeks after transplanting any plants. Winter applications are best. See content.ces.ncsu.edu/casoron-dichlobenil.
		diquat dibromide (Reward) 2 L	22	1 to 2 qt	0.5 to 1	Non-selective, contact-type, postemergence control of seedling weeds. A nonionic surfactant should be added to the spray solution. Apply for full coverage and thorough weed contact. Retreatment will be necessary for established weeds. May be used in landscapes, nurseries and greenhouses.
		flumioxazin (Sureguard) DG 4SC	14	8 to 12 oz 8 to 12 fl oz	0.375	Early postemergence and residual control of many seedling annual broadleaf weeds in field and container-grown woody nursery crops and certain landscape plantings. See label for species and precautions. See content.ces.ncsu.edu/sureguard-flumioxazin.

Table 7-15. Chemical Weed Control in Ornamentals

More detailed information about herbicides labeled for use in nursery crops and landscape plantings is available at the NC State Extension portal: "Weed Management in Nurseries, Landscapes, and Christmas Trees" (weeds.ces.ncsu.edu).

Control Type	Weed	Herbicide and Formulation	Mode of Action	Amount Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-Plant, Postemergence Weed Control (continued)	Annual grasses and broadleaf weeds (postemergence) (continued)	glufosinate (Finale XL or Cheetah Pro) 2.34 L	10	41 to 82 oz	0.75 to 1.5	Non-selective postemergence control of weeds. Thorough coverage is essential. Apply in a minimum of 20 gallons of water per acre. No residual control. Repeat applications may be necessary for control of larger annual weeds or perennial weeds. Controls several glyphosate-tolerant weed species. See content.ces.ncsu.edu/finale-xl-or-cheetah-pro-glufosinate.
		glyphosate (Many formulations are available including Roundup-Pro Max and others)	9	1 to 5 qt	1 to 5	Non-selective postemergence, systemic control of weeds. DO NOT SPRAY GREEN BARK OR FOLIAGE of crop. Exercise extreme caution in applications near small plants. Use of a shielded sprayer can increase crop safety. Apply in 20 to 30 gallons of water per acre as a directed spray under shrubs or trees. No residual control. Repeat applications may be necessary for control of perennial weeds. See content.ces.ncsu.edu/glyphosate-1.
		oxyfluorfen (Goal) 2 EC	14	1 to 2 pt	0.25 to 0.5	Pre- and postemergence control. Apply 1 to 2 pints of Goal 2 EC per acre as a postemergence application on some conifers. Add 0.25% (v/v) nonionic surfactant. See content.ces.ncsu.edu/goal-goaltender-oxyfluorfen.
		paraquat (Gramoxone Extra) 2.8 L	22	2 to 3 pt	0.6 to 0.9	Non-selective postemergence control of weeds. Apply when grass and weeds are 1 to 6 inches high and succulent for best results. Direct spray with low pressure to avoid contact with foliage or bark of crop less than 1 year old. Add wetting agent to make 0.25% (2 pints per 100 gallons) by volume of spray for best results. Not for use in landscapes. Paraquat is a restricted-use pesticide. Users must successfully complete an EPA-approved training program before mixing or applying paraquat.
		pelargonic acid (Scythe) several similar, long-chain fatty acid products are available. See labels for specific guidelines	0	3 to 10% by volume	na	Non-selective, contact-type control of seedling broadleaf and grass weeds. Use as a directed spray avoiding contact with foliage and stems of desirable plants. Thorough spray coverage is required. Use the lower concentration for small, succulent seedling weeds. Higher concentrations are needed for larger weeds. Repeated applications are generally required. May be used in landscapes, nurseries, and greenhouses.
		topramezone (Frequency)	27	4 oz	0.09	Post and preemergence control of many broadleaf weeds and certain grasses in Christmas tree production and field grown ornamental conifer production. Effective on several glyphosate-resistant species including horseweed, ragweed, and lambsquarters. Add MSO for best POST efficacy.
		triclopyr (Garlon 3A, numerous others)	4	2 to 5 pt	0.75 to 1.75 lb ae	Postemergence control of broadleaf weeds among some conifers grown as Christmas trees. Labeled for directed applications avoiding contact with desirable plants. Also the active ingredient in many consumer products for woody weed control.
	Sedges (postemergence)	bentazon (Basagran T/O) 4 L	6	1.5 to 2 pt	0.75 to 1	Postemergence directed spray. For best results add 1 quart per acre crop oil concentrate. For yellow nutsedge and annual sedges; does not control purple nutsedge. May be used in nurseries or landscape plantings.
		halosulfuron (Sedgehammer and others) 75 DF	2	0.67 to 1.33 oz	0.031 to 0.062	Early postemergence control of yellow and purple nutsedge. Use only as a directed spray around established woody plants. Add 0.25% nonionic surfactant. For use in landscape plantings only. Not labeled for use in nurseries. See content.ces.ncsu.edu/sedgehammer-halosulfuron
		sulfentrazone (Dismiss) 4L	14	6 oz	0.188	Postemergence suppression of yellow and purple nutsedge, as well as several broadleaf weeds. Apply as a directed spray avoiding contact with foliage of desirable plants. Reapply when regrowth of treated weeds is observed. Do not exceed 12 ounces per acre per year. May be used in landscape plantings, as well as field and container nurseries. See content.ces.ncsu.edu/dismiss-sulfentrazone
		sulfosulfuron (Certainty) 0.75 WDG	2	1.25 oz	0.06	Postemergence control of yellow and purple nutsedge, and *Kyllinga* species. Add 0.25% to 0.5% (by volume) nonionic surfactant. May be used around woody landscape plants or in field nurseries. Use as a directed spray unless species is specifically approved for over the top applications. A second application 4 to 6 weeks is often required.

Chemical Weed Control in Vegetable Crops

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NOTE: A mode of action code (MOA) has been added to the Herbicide and Formulation column in this table. Use MOA codes for herbicide resistance.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Asparagus (seeded and new crown plantings), Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.7 to 2.7 pt	0.6 to 1	Apply to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix. No more than 3 applications per year.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Perennial weeds may require higher rates. The need for an adjuvant depends on brand used.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Annual grasses and small-seeded broadleaf weeds	linuron, MOA 5 (Lorox DF) 50 WDG	1 to 2 lb	0.5 to 1	**Preemergence application.** Plant seed 0.5 inch deep in coarse soils. Apply to soil surface. See label for further instructions about the addition of activated charcoal for crop safety. **Postemergence application**. Apply when ferns are 6 to 18 inches tall. Make 1 or 2 applications, but do not exceed 2 pounds active ingredient total per acre. Do not use fertilizer and surfactant or crop oil, as injury will occur. Use the lower rate on coarse soils. Not recommended on sand or loamy sand soils. Do not apply within 1 day of harvest.
Annual grasses and certain broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 AS	Up to 8.2 pt	3.9	Newly planted crown asparagus only. Do not apply to newly seeded asparagus. Apply at least 14 days before first spear harvest or after seasonal harvest is complete. Newly planted crowns must be covered with at least 2 to 4 inches of soil prior to application. **Do not apply Prowl H20 at more than 2.4 pints per acre in sandy soils. See label for more information.**
Asparagus (seeded and new crown plantings), Postemergence				
Annual and perennial grasses	clethodim, MOA 1 (Intensity One, Select Max) 1 EC (Arrow) 2 EC	9 to 16 oz 6 to 8 oz	0.07 to 0.125 0.094 to 0.125	Apply to emerged grasses. Consult the manufacturer's label for best times to treat specific grasses. Refer to label for adjuvant and rate. With sethoxydim, add 1 quart crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. With fluazifop, add 1 quart of nonionic surfactant or 1 gallon crop oil concentrate per 100 gallons of spray mix. PHI is 1 day.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.5 to 2.5 pt	0.3 to 0.5	
Asparagus (established - at least 2 years old) Preemergence				
Annual grasses and small-seeded broadleaf weeds	linuron, MOA 5 (Lorox DF) 50 WDG	1 to 2 lb	0.5 to 1	Apply before spear emergence or immediately after a cutting. Do not use a surfactant or fertilizer solution in spray mixture. Use the lower rates on coarse soils. Not recommended for sand or loamy sand soils. Repeat applications may be made but do not exceed 4 pounds per acre per year.
	napropamide, MOA Unknown (Devrinol DF-XT) 50 DF (Devrinol 2-XT) 2 EC	8 lb 2 gal	4	Apply to the soil surface in spring before weed and spear emergence. Do not exceed 8 pounds per acre per year. See XT labels for information regarding delay in irrigation event.
	trifluralin, MOA 3 (Treflan HFP, Treflan) 4 EC	1 to 4 pt	1 to 2	In winter or early spring, apply to dormant asparagus after ferns are removed but before spear emergence, or apply after harvest in late spring or early summer. In a calendar year, the maximum rate is 2 pints per acre for coarse soils, 3 pints on medium soils and 4 pints on fine soils. See label for further restrictions on rates for soil types and on split application.
Annual grasses and certain broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 AS	Up to 8.2 pt	3.9	Apply at least 14 days prior to the first spear harvest or after seasonal harvest complete. Do not apply over the top of emerged spears as severe injury may occur. **Do not apply Prowl H20 at more than 2.4 pints per acre in sandy soils.** See label for more information.
Annual broadleaf and grass weeds	diuron, MOA 5 (Karmex) 80 DF (Direx) 4 L	1 to 4 lb 0.8 to 3.2 qt	0.8 to 3.2	Apply in spring before spear emergence but no *earlier* than 4 weeks before spear emergence. A second application may be made immediately after last harvest. **For the majority of NC plantings, a 1 to 2 pounds per acre dosage of 80 DF or 0.8 to 1.6 quarts rate of Direx 4L should be used.** Diuron also controls small emerged weeds but less effectively.
	flumioxazin, MOA 14 (Chateau) 51 SW	6 oz	0.188	Apply only to dormant asparagus no sooner than 14 days before spears emerge or after the last harvest. Do not apply more than 6 ounces per acre during a single growing season. Provides residual weed control. Can be tank mixed with paraquat for control of emerged weeds. Apply in a minimum of 15 gallons spray mix per acre. Add a nonionic surfactant at 1 quart per 100 gallons of spray mix. A spray-grade nitrogen source (either ammonium sulfate at 2 to 2.5 pounds per acre or 28% to 32% nitrogen solutions at 1 to 2 quarts per acre) may be added to increase herbicidal activity.
	metribuzin, MOA 5 (Metribuzin TriCor DF, Dimetric DF) 75 WDG(TriCor 4F) 4 F	1.3 to 2.67 lb 2 to 4 pt	1 to 2	Make a single application to small emerged weeds and the soil surface in early spring before spear emergence or a split application consisting of a preemergence application prior to spear emergence followed by a post-harvest application. Do not apply within 14 days of harvest or after spear emergence. For the majority of NC plantings, the low rate should be used. Tricor DF may be used in sprinkler irrigation. A split application can be used. See label for rates.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Asparagus (established - at least 2 years old) Preemergence (continued)				
Annual broadleaf and grass weeds (continued)	terbacil, MOA 5 (Sinbar) 80 WDG	See label	See label	Apply in spring before weed emergence and spear emergence or immediately after last clean-cut harvest. Use the lower rate on sandy soils and the higher rate on silty or clay soils. Do not use on soils containing less than 1% organic matter nor on gravelly soils or eroded areas where subsoil or roots are exposed. Do not harvest within 5 days after application. See label about rotation restrictions.
Grasses and broadleaf weeds	norflurazon, MOA 12 (Solicam) 80 DF	2.5 to 5 lb	2 to 4	Either rainfall or irrigation necessary for herbicide activation within 4 weeks after application. Solicam DF rates depend on type of soil. Solicam may be tank mixed with other herbicide registered for use in asparagus. See label for rates and tank mix information. PHI 14 days
Annual broadleaf weeds	mesotrione, MOA 27 (Callisto) 4 L	3 to 7.7 fl oz	0.093 to 0.25	**Preemergence application: apply as a spring application prior to spear emergence, after final harvest, or both.** For optimum preemergence weed control Callisto must be applied after fern mowing, disking or other tillage operations but before spear emergence. **Directed or semi-directed application**: Apply after final harvest with care to minimize contact with any standing asparagus spears to avoid crop injury. Do not make more than 2 applications per year or apply more than 7.7 ounces per acre per year.
Asparagus (established - at least 2 years old), Postemergence				
Broadleaf weeds including trumpetcreeper	2,4-D, MOA 4 (Amine 4, Embed Extra, and various other brands) 3.8 SL	1.5 to 2 qt	1.5 to 2	Apply in spring before spear emergence or immediately following a clean cutting. Make no more than 2 applications during the harvest season and these should be spaced at least 1 month apart. Postharvest sprays should be directed under ferns, avoiding contact with ferns, stems, or emerging spears. Add a nonionic surfactant at a rate of 1 quart per 100 gallons spray mix. **Do not apply if sensitive crops are planted nearby or if conditions favor drift.** PHI 3 days
Broadleaf weeds including trumpetcreeper, annual sowthistle, black mustard, nettleleaf goosefoot, and wild radish	dicamba, diglycolamine salt, MOA 4 (Clarity) 4 L	8 to 16 oz	0.25 to 0.5	Apply to emerged and actively growing weeds in 40 to 60 gallons of diluted spray per treated acre immediately after cutting in the field but at least 24 hours before the next cutting. If spray contacts emerged spears, twisting of spears may occur. Discard twisted spears. See label for more information. **Follow precautions on label concerning drift to sensitive crops. PHI = 1 day**
Contact kill of emerged annual weeds, suppression of emerged perennial weeds, and contact kill of volunteer ferns	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.7 to 2.7 pt	0.6 to 1	Apply to control emerged weeds (including volunteer ferns). Apply in a minimum of 20 gallons spray mix per acre to control weeds before spears emerge or after last harvest. Do not apply within 6 days of harvest. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Volunteer ferns (seedling) and certain broadleaf weeds	linuron, MOA 5 (Lorox DF) 50 WDG	1 to 2 lb	0.5 to 1	Apply before cutting season or immediately after. Do not apply within 1 day of harvest. Lorox will also control emerged annual broadleaf weeds that are up to 3 inches in height. Lorox can also be applied as a directed spray to the base of the ferns.
Annual and perennial grass and broadleaf weeds Established volunteer ferns	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds up to 1 week before spear emergence or immediately after last cutting has removed all above-ground parts or as a directed spray under mature fern. Avoid contact with the stem to reduce risk of injury. Perennial weeds may require higher rates of glyphosate. For spot treatment, apply immediately after cutting but prior to emergence of new spears. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Yellow and purple nutsedge, non-ALS resistant pigweed, cocklebur, ragweed, wild radish	halosulfuron, MOA 2 (Profine 75) 75 DF (Sandea) 75 DF	0.5 to 1.5 oz	0.024 to 0.072	**Postemergence and post-transplant.** Apply before or during harvesting season. **Do not use nonionic surfactant or crop oil or unacceptable crop injury may occur.** Without the addition of a nonionic surfactant, postemergence weed control may be reduced. Do not harvest within 24 hours of application. **Postharvest.** Apply after final harvest with drop nozzles to limit contact with crop. Contact with the fern may result in temporary yellowing. Add a nonionic surfactant at 1 quart per 100 gallons of spray mixture. Under heavy nutsedge pressure, split applications will be more effective; see label for details.
Annual and perennial grasses	clethodim, MOA 1 (Intensity One, Select Max) 1 EC	9 to 16 oz	0.07 to 0.125	See label for adjuvant and rate. DO NOT USE CLETHODIM WITHIN 1 DAY OF HARVEST.
	(Arrow) 2 EC	6 to 8 oz	0.094 to 0.125	
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	Apply to emerged grasses. Consult the manufacturer's label for best times to treat specific grasses. With sethoxydim, add 1 qt crop oil concentrate per acre. With fluazifop, add 1 quart nonionic surfactant or 1 gallon crop oil concentrate per 100 gallons of spray mix. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperature. DO NOT USE FLUAZIFOP OR SETHOXYDIM WITHIN 1 DAY OF HARVEST.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.5 to 2.5 pt	0.3 to 0.5	
Beans, Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	**Lima or snap beans only.** Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Legume vegetable group (Group 6) such as but not limited to edamame, kidney bean, lima bean, pinto bean, snap bean, soybean, and wax bean. Apply prior to or no later than 1 day after planting. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Various beans are covered.** See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control. See label for details.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Beans, Preplant and Preemergence (continued)				
Annual grasses and small-seeded broadleaf weeds	ethalfluralin, MOA 3 (Sonalan HFP) 3 EC	1.5 to 3 pt	0.6 to 1.1	**Dry beans only.** See label for specific bean. Apply preplant and incorporate into the soil 2 to 3 inches deep using a rototiller or tandem disk. If groundcherry or nightshade is a problem, the rate range can be increased to 3 to 4.5 pints per acre. For broader spectrum control, Sonalan may be tank mixed with Eptam or Dual. Read the combination product labels for directions, cautions, and limitations before use.
	dimethenamid, MOA 15 (Outlook) 6.0 EC	12 to 18 oz	0.55 to 0.85	**Dry beans only.** See label for specific bean. Apply preplant incorporated, preemergence to the soil surface after planting, or early postemergence (first to third trifoliate stage). Dry beans may be harvested 70 or more days after Outlook application. For soils having 3% or greater organic matter, see label for rate. See label for further instructions, including those for tank mixtures.
	trifluralin, MOA 3 (Treflan, Trifluralin, Trifluralin HF, other brands) 4 EC	1 to 1.5 pt	0.5 to 0.75	**Dry, lima, or snap beans only.** See label for specific bean. Apply preplant and incorporate into the soil 2 to 3 inches deep within 8 hr. Incorporate with a power-driven rototiller or by cross disking.
	pendimethalin, MOA 3 (Prowl H_20) 3.8 AS	1.5 to 3 pt	0.75 to 1.5	**Edible beans: dry, lima, or snap beans, and certain others.** See label for specific bean. Apply preplant and incorporate into the soil 2 to 3 inches using a power-driven rototiller or by cross disking. **Do not apply after seeding.**
	S-metolachlor, MOA 15 (Brawl, Dual Magnum, Medal) 7.62 EC (Brawl II, Dual II Magnum, Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	**Dry, lima, or snap beans, and certain others.** See label for specific bean, and specific rate based on soil texture. Apply preplant incorporated or preemergence to the soil surface after planting.
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3ME	0.4 to 0.67 pt	0.15 to 0.25	**Snap beans (succulent) only.** Apply to the soil surface immediately after seeding. Offers weak control of pigweed. See label for further instructions. Do not apply within 45 days of harvest. Limited research has been done on this product in this crop in North Carolina.
Yellow and purple nutsedge, grasses and some small-seeded broadleaf weeds	EPTC, MOA 15 (Eptam) 7 EC	3.5 pt		**Dry or snap beans only.** See label for specific bean. Apply preplant and incorporate immediately to a depth of 3 inches or may be applied at lay-by as a directed application before bean pods start to form to control late season weeds. See label for instructions on incorporation. May be tank mixed with Prowl. Do not use on black-eyed beans, lima beans, or other flat-podded beans except Romano.
Many broadleaf weeds	fomesafen, MOA 14 (Reflex 2 EC)	1 to 1.5 pt	0.25 to 0.375	**Dry bean and snap beans only.** Apply preplant surface or preemergence. Total use per year cannot exceed 1.5 pints per acre. See label for further instructions and precautions.
Yellow and purple nutsedge, common cocklebur, and other broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	**Dry beans and succulent snap beans including lima beans only.** Apply after seeding but prior to cracking. Do not apply more than 0.67 ounce product per acre to dry bean. Data are lacking on runner-type snap beans. See label for other instructions.
Broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	1.5 oz	0.023	**Dry beans and lima beans only.** See label for specific bean. Apply preemergence or preplant incorporated. Pursuit should be applied with a registered preemergence grass herbicide. **Snap beans only.** Apply preemergence or preplant incorporated. For preplant incorporated application, apply within 1 week of planting. May be used with a registered grass herbicide. Reduced crop growth, quality, yield, or delayed crop maturation may result. Do not apply within 30 days of harvest of snapbeans.
Beans, Postemergence				
Annual broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	**Dry, lima, or snap beans only.** Apply overtop of beans and weeds when beans have one expanded trifoliate leaf. Two applications spaced 7 to 10 days apart may be made for nutsedge control. Do not apply more than 2 quarts per season or within 30 days of harvest. Use of crop oil as an adjuvant will improve weed control but will likely increase crop injury. See label regarding crop oil concentrate use. Do not apply within 30 days of harvest.
Many broadleaf weeds	fomesafen, MOA 14 (Reflex 2 EC)	0.75 to 1 pt	0.188 to 0.25	**Dry or snap beans only.** See label for specific bean. Apply postemergence to dry beans or snap beans that have at least 1 expanded trifoliate leaf. Include a nonionic surfactant at 1 quart per 100 gallons spray mixture. Total use per year cannot exceed 1.5 pints per acre. Do not apply within 45 days of dry bean harvest or 30 days of snap bean harvest. **Postemergence application of fomesafen can cause significant injury to the crop.** See label for further information.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter. Does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	**Edible beans: edamame, kidney bean, lima bean, pinto bean, snap bean and wax bean only.** Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Yellow and purple nutsedge	EPTC, MOA 15 (Eptam) 7 EC	3.5 pt	3	**Green or dry beans only.** See label for specific bean. Do not use on lima bean or pea. Apply and incorporate at last cultivation as a directed spray to soil at the base of crop plants before pods start to form.
Yellow and purple nutsedge, common cocklebur, and other broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.67 oz	0.024 to 0.031	**Succulent snap beans, including lima beans.** Apply after crop has reached 2 to 3-trifoliate leaf stage but prior to flowering. Postemergence application may cause significant but temporary stunting and may delay crop maturation. Use directed spray to limit crop injury. Do not apply within 30 days of harvest. See label for further precautions. Data lacking on runner-type snap beans.
Annual broadleaf weeds, including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2.EC	1.5 to 3 oz	0.023 to 0.047	**Dry beans and snap beans only.** See label for specific bean. Use only 1.5 ounces EC formulation on snap bean and up to 3 ounces on dry beans. Apply postemergence to 1- to 3-inch weeds (1 to 4 leaves) when beans have at least 1 fully expanded trifoliate leaf. Add nonionic surfactant at 2 pints per 100 gallons of spray mixture with all postemergence applications. For snap beans, allow at least 30 days between application and harvest. For dry bean, do not apply within 60 days of harvest. See label for instructions on use.
Most emerged weeds	glyphosate, MOA 9 (Roundup PowerMax) 5.5 L (Roundup WeatherMax) 5.5 L	11 to 22 oz	0.5 to 0.94	**Row middles only.** See comments on resistance management in TABLE 7-10. See label for specific bean. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. Spot treatment is allowed in some bean crops. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Beans, Postemergence (continued)				
Annual and perennial grasses	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	**Dry or succulent beans only.** See label for specific bean. For succulent beans, products with quizalofop are limited to snap beans. Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. See label for specific adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply on days that are unusually hot and humid. Do not apply within 15 days and 30 days of harvest for succulent and dry beans, respectively.
	quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC (Targa) 0.88 EC	6 to 12 oz	0.04 to 0.08	
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 16 oz 9 to 16 oz	0.094 to 0.25 0.07 to 0.125	**Dry or succulent beans.** See label for specific bean. Select is registered for dry beans only. Apply postemergence for control of emerged grasses. See label for specific rate for crop. See label for specific adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. See label for minimum time from application to harvest.
Beets (Garden or Table), Preplant				
Most emerged weeds except for resistant pigweed, primrose, or spiderwort	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Garden beets only.** See comments on resistance management in TABLE 7-10. Apply to emerged weeds before seeding or after seeding but before crop emergence. Perennial weeds may require higher rates. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Emerged broadleaf weeds	pyraflufen, MOA 14 (ET Herbicide) 0.208 EC	0.5 to 2 fl oz	0.0008 to 0.003	**Garden beets only.** Apply as a preplant burndown treatment in a minimum of 10 gallons per acre. **Addition of a crop oil concentrate at 1 to 2% is recommended for optimum weed control. See label for additional information.**
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Apply as a preplant burndown treatment or prior to crop emergence from seed.
Beets (Garden or Table), Preemergence				
Annual grasses (crabgrass spp., foxtail spp., barnyardgrass, annual ryegrass, annual bluegrass) and broadleaf weeds (Lamium spp., lambsquarters, common purslane, redroot pigweed, shepherdspurse)	cyclohexylethylthio-carbamate, MOA 3 (Ro-Neet) 6E	0.5 to 0.67 gal	3 to 4	Use on mineral soils only. Use higher dosage rate on heavier soils. Read label for further instructions.
Annual broadleaf and grass weeds including common chickweed, common purslane, nightshade spp.	ethofumesate, MOA 15 (Ethotron) 4 SC	See label	See label	Apply preplant, preemergence, or postemergence to the beets and prior to weed germination. Application rate is soil type dependent. The use of higher than specified rates may cause beet injury or carry over problems. See label for more information about planting restrictions.
Beets (Garden or Table), Postemergence				
Broadleaf weeds including sowthistle clover, cocklebur, jimsonweed, and ragweed	clopyralid, MOA 4 (Stinger) 3EC	0.25 to 0.5 pt	0.093 to 0.187	Apply to beets having 2 to 8 leaves when weeds are small and actively growing. Will control most legumes. Do not apply within 30 days of harvest. Do not apply more than 0.5 pint per acre per year. See label for information regarding rotational restrictions. The PHI is 30 days.
Broadleaf weeds including wild mustard, common lambsquarters, common chickweed, purslane suppression	phenmedipham, MOA 5 (Spin-Aid) 1.3 EC	1.5 to 3 pt	0.25 to 0.5	**Red garden beets only.** Apply to red garden beets in the 2 to 6-leaf stage. Rate is dependent on crop stage. See label for specific rate. Best control occurs when applied to seeds in cotyledon to 2-leaf stage. Minor crop stunting may be observed for approximately 10 days. Do not add spray adjuvant. Do not apply within 60 days of harvest.
Broadleaf weeds including wild mustard, shepherdspurse and velvetleaf	triflusulfuron methyl, MOA 2 (Upbeet) 50 DF	0.5 oz	0.0156	**Garden beets**. Apply when beets are at the 2 to 4-leaf stage. Additional applications may be made at the 4- to 6-, and 6- to 8-leaf stages. See label for information on adjuvants. Total amount of Upbeet must not exceed 1.5 ounces per acre per growing season. Do not apply within 30 days of harvest.
Annual and perennial grasses	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply postemergence for control of emerged grasses. Consult manufacturer's label for specific rates and best times to treat. See label for adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 60 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for annual grasses at 6 to 8 ounces per acre or bermudagrass and johnsongrass at 8 ounces per acre. See label for adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 30 days of harvest.
Beets (Garden or Table), Row Middles Only				
Most emerged weeds except resistant pigweed	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. The need for an adjuvant depends on brand used. Do not apply within 14 days of harvest.
Annual broadleaf weeds including morningglory, spiderwort, and very small pigweed	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Broccoli – See Cole Crops				
Cabbage – See Cole Crops				
Cantaloupes (Muskmelons), Preplant and Preemergence				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Cantaloupes (Muskmelons), Preplant and Preemergence (continued)				
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	**Transplant crop: apply no later than one day before transplanting crop.** **Seeded crop: apply no later than 7 days before seeding crop.** Use a crop oil at up to 1 gallon per 100 gallons of spray solution or a nonionic surfactant at 2 pints per 100 gallons of spray solution. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before crop emerges or before transplanting as a broadcast or band treatment over a preformed row. Seedbeds or plant beds should be formed as far ahead of treatment as possible to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds at least 3 days before seeding or transplanting. Perennial weeds may require higher rates of glyphosate. Consult manufacturer's label for rates for specific weeds. When applying Roundup before transplanting crops into plastic mulch, carefully remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 inch rainfall or by applying water via a sprinkler system. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Morningglory and small pigweed < 1 inch	pyraflufen ethyl, MOA 14 (ET Herbicide) 0.208 L	1 to 2 oz	0.016 to 0.0032	**Bareground.** Wait 1 day following preplant burndown application before planting. Addition of Crop Oil Concentrate (COC) at 1-2% is recommended for optimum weed control. **Plasticulture.** May apply over mulch; however, a single 0.5 inch irrigation/rain event plus a 7 day waiting period is needed before transplanting.
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Apply before crop emergence and control emerged weeds. There is no residual activity. May be tank mixed with soil residual compounds. See label for instruction. May also be used as a banded spray between row middles. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Registered for cucurbit vegetable group (Crop grouping 9). Apply preplant and incorporate into the soil 1 to 2 inches (1 inch incorporation is optimum) with a rototiller or tandem disk or apply preemergence after seeding and follow with irrigation. Check replant restrictions for small grains and other crops on label.
Annual grasses and broadleaf weeds; weak on pigweed and morningglory	clomazone, MOA 13 (Command) 3 ME	0.4 to 0.67 pt	0.15 to 0.25	Apply immediately after seeding or just prior to transplanting with transplanted crop. Roots of transplants must be below the chemical barrier when planting. See label for further instruction.
Annual grasses and some small-seeded broadleaf weeds	ethalfluralin, MOA 3 (Curbit) 3 EC	3 to 4.5 pt	1.1 to 1.7	Apply postplant to seeded crop prior to crop emergence or as a banded spray between rows after crop emergence or transplanting. See label for timing. Shallow cultivation, irrigation, or rainfall within 5 days needed for good weed control. Do not use under mulches, row covers, or hot caps. Under conditions of unusually cold or wet soil and air temperatures, crop stunting and injury may occur. Crop injury can occur if seeding depth is too shallow.
Annual grasses and broadleaf weeds	ethalfluralin, MOA 3 + clomazone, MOA 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after seeding crop, prior to weed emergence for preemergence control of weeds. **Do not apply prior to planting crop. Do not soil incorporate.** May also be used as a **banded** treatment **between** rows after crop emergence or transplanting. Do not apply over or under plastic mulch. See label for application rate according to soil type and crop restriction instructions.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	Apply after seeding or prior to transplanting crop. For seeded crop, apply prior to soil cracking. For transplanted crop, do not transplant until 7 days after application. Rate can be increased to 1 ounce of product per acre to middles between rows. Do not apply within 57 days of harvest.
Cantaloupes (Muskmelons), Postemergence				
Annual grasses and some small-seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	8 to 10 lb 6 to 10 pt	4.5 to 7.5	**Not labeled for transplanted crop.** To improve preemergence control of late emerging weeds. Apply only when crop has 4 to 5 true leaves, is well-established, and growing conditions are favorable. Will not control emerged weeds. Incorporation not recommended.
	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF) 4EC	1 to 2 pt	0.5 to 0.75	**Apply as a directed spray to soil between rows after crop emergence when crop plants have reached** 3 to 4-true leaf stage of growth. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 30 days of harvest. Will not control emerged weeds.
Yellow and purple nutsedge and broadleaf weeds including cocklebur, galinsoga, smartweed, ragweed, wild radish, and pigweed	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	Apply postemergence only after the crop has reached 3 to 5 true leaves but before first female flowers appear. Do not apply sooner than 14 days after transplanting. Use nonionic surfactant at 1 quart per 100 gallons of spray solution with all postemergence applications. Avoid over-the-top applications during late summer when temperature and humidity are high. Do not apply within 57 days of harvest.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides. PHI = 0 days.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Cantaloupes (Muskmelons), Postemergence (continued)				
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. See label for adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 3 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of emerged grass in cantaloupes (muskmelons). Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
Broadleaf, grass and nutsedge	imazosulfuron, MOA 2 (League) 0.5 DF	4 to 6.4 oz	0.19 to 0.3	**ROW MIDDLE APPLICATION ONLY.** Apply anytime during the cropping season (up to 48 days prior to harvest), as long as the melons are well-established and at least 5 inches wide. Avoid contact with the melon crop. In plasticulture, prevent the spray from contacting the plastic. Consult label for further instructions. PHI = 48 days.
Carrots, Preplant				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most emerged weeds except resistant pigweed	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before seeding or crop emergence. Perennial weeds may require higher rates. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Apply as a preplant burndown or prior to emergence of plants from seed. There is no residual activity. May be tank mixed with soil residual compounds. See label for instruction. May also be used as a banded spray between row middles. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Carrots, Preplant incorporated (PPI) or Preemergence (PRE)				
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan, Trifluralin) 4 EC	1 to 2 pt	0.5 to 1	Apply preplant and incorporate into the soil 2 to 3 inches within 8 hr. Use lower rate on coarse soils with less than 2% organic matter.
Broadleaf and grass weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 AS	2 pt	0.95	Apply postplant within 2 days after planting but prior to crop emergence. See label for instruction on layby treatment. PHI interval is 60 days.
	prometryn, MOA 5 (Caparol) 4L	2 to 4 pt	1 to 2	Apply as preemergence and or postemergence over the top to carrot. Make Post application through the 6-leaf stage of carrot. See label for application rate and crop rotation restrictions. PHI is 30 days.
Carrots, Postemergence				
Annual grasses and broadleaf weeds	linuron, MOA 5 (Lorox DF) 50 WDG	1.5 to 3 lb	0.75 to 1.5	Apply as a broadcast spray after carrots are at least 3 inches tall. If applied earlier crop injury may occur. Avoid spraying after 3 or more cloudy days. Repeat applications may be made, but do not exceed 4 pounds of Lorox DF per acre per season. Do not use a surfactant or crop oil. Carrot varieties vary in their resistance, therefore determine tolerance to Lorox DF before adoption as a field practice to prevent potential crop injury. See label for further directions. PHI = 14 days.
Annual broadleaf weeds and some grasses	metribuzin, MOA 5 (Dimetric, Metribuzin, TriCor DF) 75 WDG (TriCor 4F) 4 F	0.33 lb 0.5 pt	0.25 0.25	Apply overtop when weeds are less than 1 inch tall and carrots have 5 to 6 true leaves. A second application may be made after a time interval of at least 3 weeks. Do not apply unless 3 sunny days precede application. Do not apply within 3 days of other pesticide applications. Preharvest interval is 60 days.
Annual and perennial grasses	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply to actively growing grasses not under drought stress. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Do not mix with other pesticides. Very effective in controlling annual bluegrass. Do not apply within 30 days of harvest.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	Apply to actively growing grasses not under drought stress. Up to 48 ounces of Fusilade DX may be applied per year. See label for rates for specific weeds controlled and adjuvant and rate. Do not mix with other pesticides. Do not apply within 45 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to actively growing grasses not under drought stress. Consult manufacturer's label for specific rate and best times to treat. Add 1 quart of crop oil concentrate per acre. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Do not apply on days that are unusually hot and humid. Do not apply with other pesticides. Do not apply within 30 days of harvest.
Carrots, Row Middles				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 ounces	up to 0.031	Apply as a hooded spray in row middles for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds except resistant pigweed	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Cauliflower – See Cole Crops				
Celery, Preplant				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Celery, Preplant (continued)				
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	3 to 9% v/v		May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Cutleaf evening primrose, Carolina geranium, henbit, and a few grasses	oxyfluorfen, MOA 14 (Goaltender) 4 F (Goal 2 XL) 2 EC	up to 1 pt up to 2 pt	up to 0.5	**Transplants only.** Apply to soil surface of pre-formed beds at least 30 days prior to transplanting. No research has been conducted in North Carolina, therefore, try on a limited number of acres first.
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Apply as a preplant burndown. There is no residual activity. May be tank mixed with soil residual compounds. See label for instruction. May also be used as a banded spray between row middles. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Celery, Preplant incorporate (PPI) or Preemergence (PRE)				
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan, Treflan HFP, Trifluralin) 4 EC	1 to 2 pt	0.5 to 1	Apply incorporated to direct seeded or transplant celery before planting, at planting, or immediately after planting. Incorporate within 8 hours of application. Use lower rate on coarse soils with less than 2% organic matter.
	Bensulide (Prefar) 4-E	5 to 6 qt	5 to 6	**Transplants only.** Apply PRE after planting, irrigate immediately. See label for rotation restrictions.
Celery, Postemergence				
Annual broadleaf and grass weeds	linuron, MOA 5 (Lorox DF) 50 WDG	1.5 to 3 lb	0.75 to 1.5	Apply after celery is transplanted and established but before celery is 8 inches tall. Grasses should be less than 2 inches in height, and broadleaf weeds should be less than 6 inches tall. Do not tank mix with other products including surfactant or crop oil. Avoid spraying after 3 or more cloudy days or when temperature exceeds 85 F. Not recommended for sands or loamy sand soil. Preharvest interval is 45 days.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply to actively growing grasses not under drought stress. See label for adjuvant and rate. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Adding crop oil may increase the likelihood of crop injury at high air temperatures and humidity. Do not apply within 30 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to actively growing grasses not under drought stress. Consult label for specific rates and best times to treat and adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 30 days of harvest.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Cole Crops: Broccoli, Cabbage, Cauliflower — Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in minimum of 10 gallons spray mix per acre to emerged weeds before crop emergence or transplanting as a broadcast or band treatment over a preformed row. Use sufficient water for thorough coverage. Row should be formed several days ahead of planting and treated to allow maximum weed emergence. Use nonionic surfactant at rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	up to 2 oz	up to 0.031	Apply no later than 1 day before transplanting or 7 days before seeding. See label for rate for crop oil or nonionic surfactant. Coverage is essential for good weed control. See label for more information.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence or before transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 inch natural rainfall or by applying water via a sprinkler system. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Also labeled for collards, kale, mustard/turnip greens. Apply as a preplant burndown or prior to emergence of plants from seed. There is no residual activity. May be tank mixed with soil residual compounds. May also be used as a banded spray between row middles. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	Do not apply in cabbage except Chinese cabbage. May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Cole Crops: Broccoli, Cabbage, Cauliflower — Preplant and Preemergence (continued)				
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Also labeled for Chinese broccoli, broccoli rabe, Chinese cabbage (bok choy, Napa), Chinese mustard cabbage (gai choy), and kohlrabi. Apply preplant or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF) 4 EC	1 to 1.5 pt	0.5 to 0.75	Also labeled for Brussels sprouts. Apply and incorporate prior to transplanting. **Caution**: If soil conditions are cool and wet, reduced stands and stunting may occur. Direct seeded cole crops exhibit marginal tolerance to higher than recommended rates.
	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	 8 to 10 lb 8 to 10 pt	6 to 7.5	Also labeled for Brussels sprouts and all other Brassica (cole) leafy vegetables in this crop group. Apply immediately after seeding or transplanting. May also be incorporated.
Hairy galinsoga, common lambsquarters, redroot pigweed, and Palmer amaranth	sulfentrazone, MOA 14 (Spartan) 4 F	2.25 to 4.5 oz	0.07 to 0.14	**Cabbage only (Transplanted Processing only).** May be applied 60 days prior to planting up to planting time. Application rate depends on soil type.
Annual grasses and small-seeded broadleaf weeds, including galinsoga, common ragweed, and smartweed	napropamide, MOA Unknown (Devrinol DF) 50 DF (Devrinol DF-XT) 50 DF (Devrinol 2-XT) 2 EC	 4 lb 4 lb 4 qt	 2 2 2	Includes Brussels sprouts. Apply to weed-free soil just after seeding or transplanting as a surface application. Light cultivations, rainfall, or irrigation will be necessary within 24 hours to activate this chemical. PHI 60 days.
Many broadleaf weeds, including galinsoga, common ragweed, and smartweed	oxyfluorfen, MOA 14 (Goal 2 XL, Galigan) 2 EC (GoalTender, Galigan H20) 4 E	 1 to 2 pt 0.5 to 1 pt	0.25 to 0.5	**Transplants only.** Surface apply before transplanting. Do not incorporate or knock the bed off after application. *Do not spray over the top of transplants*. Oxyfluorfen is weak on grasses. Expect to see some temporary crop injury.
Cole Crops: Broccoli, Cabbage, Cauliflower — Postemergence				
Annual grasses, small seeded broadleaf weeds and nutsedge	*S*-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	0.5 to 1 pt	0.5 to 1	A section 24(c) North Carolina Label must be obtained at syngenta-us.com/labels/indemnified-label-login prior to use. Label includes Chinese cabbage. **Transplants.** After transplanting in bareground, irrigate to seal soil around root ball; about 10 days after sealing soil apply Dual Magnum overtop. If applying in mulched systems, apply 10 days after transplanting. **Seeded.** Apply overtop after crop reaches 3 inches. **Row middle.** May be applied at a rate up to 1.25 pt/A.
Grass and broadleaf weeds	pendimethalin, MOA 3 (Prowl H2O) 3.8 AS	2.1 pt	0.97	Apply postemergence-directed-spray on the soil, beneath plants, and between rows. Do not spray foliage or stems because crop injury can occur. PHI for broccoli is 60 days and for other crops 70 days.
Broadleaf weeds including sowthistle, clover, cocklebur, jimsonweed, and ragweed	clopyralid, MOA 4 (Stinger) 3 EC	0.25 to 0.5 pt	0.09 to 0.187	Labeled for broccoli, cabbage, cauliflower, broccoli rabe, brussels sprouts, cavalo broccoli, Chinese cabbage (bok choy), Chinese broccoli, Chinese mustard, and Chinese cabbage (Napa). Apply to crop when weeds are small and actively growing. Will control most legumes. Do not apply within 30 days of harvest.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter, does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use crop oil concentrate at up to 1 gallon per 100 gallons solution or a nonionic surfactant at 2 pints per 100 gallons of spray solution. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max) 1 EC	 6 to 8 oz 9 to 16 oz	 0.094 to 0.125 0.07 to 0.125	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. For sethoxydim, add 1 quart of crop oil concentrate per acre. Adding crop oil to Poast or Select may increase the likelihood of crop injury at high air temperature and high humidity. Do not apply within 30 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	
Corn (sweet), Preplant Burndown				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply prior to planting or within 24 hours after planting. Use a crop oil concentrate or a nonionic surfactant with Aim. For optimum performance, make applications to actively growing weeds up to 4 inches high or rosettes less than 3 inches across. Coverage is essential for good weed control. Optimum broad-spectrum control of annual and perennial weeds requires a tank mix with burndown herbicides such as glyphosate, paraquat or 2,4-D. Must be applied prior to the preharvest interval of 14 leaf collars. See label for directions.
Contact kill of all green foliage, stale bed and minimum tillage application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 20 gallons spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Seedbeds should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix. May be tank mixed with preemergence sweet corn herbicides and herbicide combinations. Check label for directions and specific rates.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult manufacturer's label for rates for specific weeds. Check label for directions. Certain glyphosate formulations require addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control. Glyphosate-resistant horseweed (marestail) is now common in eastern North Carolina counties.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Corn (sweet), Preplant Burndown (continued)				
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Broadleaf weeds	2,4-D amine 4, MOA 4 (various brands)	1 to 2 pt	0.5 to 1	May be tank mixed with glyphosate for broad spectrum weed control including glyphosate-resistant horseweed (marestail). See label for planting restrictions if applied prior to planting.
Corn (sweet), Preemergence				
Most annual grass weeds, including fall panicum, broadleaf signalgrass, and small-seeded broadleaf weeds	dimethenamid, MOA 15 (Outlook) 6.0 EC	12 to 21 oz	0.56 to 1.0	Apply to soil surface immediately after planting. May be tank mixed with atrazine, glyphosate, or paraquat. See label for other herbicides that may be tank mixed to broaden weed control spectrum.
	metolachlor, MOA 15 (Me-Too-Lachlor II) 7.8 EC (Parallel) 7.8 EC	1 to 2 pt	0.98 to 1.98	See comments for *s*-metolachlor products. Products containing s-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. See label for all instructions.
	S-metolachlor, MOA 15 (Brawl II, Dual II Magnum, Medal II) 7.64 EC (Dual Magnum) 7.62 EC	1 to 2 pt	0.95 to 1.91	Apply to soil surface immediately after planting. May be tank mixed with atrazine, glyphosate, or simazine. Check label for directions. Rate is soil-texture and organic-matter dependent. See label for details.
	pyroxasulfone, MOA 15 (Zidua) 85 WG	1.5 to 4 oz	0.0796 to 0.213	Rate ranges based on soil texture. See label for specific rate relating to your fields. Sweet corn seed must be planted a minimum of 1-inch deep. Provides suppression of Texas panicum, seedling johnsongrass, and shattercane. Do not harvest sweet corn ears for human consumption less than 37 days after application of this herbicide. See label regarding tank mixtures for broader spectrum control or control of emerged weeds. Research with Zidua in sweet corn is limited in North Carolina.
Most annual broadleaf and grass weeds	atrazine, MOA 5 (various brands) 4 F (various brands) 90 WDG	1 to 2 qt 1.1 to 2.2 lb	1 to 2	Apply to soil surface immediately after planting. Shallow cultivations will improve control. Check label for restrictions on rotational crops. See label for reduced rate if soil coverage with plant residue is less than 30% at planting. Does not control fall panicum or smooth crabgrass. May be tank mixed with metolachlor, glyphosate, paraquat, bentazon, or simazine. Check label for directions.
	dimethenamid, MOA 15 + atrazine, MOA 5 (Guardsman Max) 5 F	2.4 to 4.6 pt	0.51 to 1 + 1 to 1.9	Apply to soil surface immediately after planting. Does not control Texas panicum, seedling johnsongrass, or shattercane adequately. Adjust rate for soil texture and organic matter according to label. See label for reduced rate if soil coverage with plant residue is less than 30% at planting. See labels for comments on rotational crops. See label for additional instructions.
	S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 F	1.3 to 2.6 qt	0.78 to 1.56 + 1 to 2	Apply to soil surface immediately after planting. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. May not adequately control cocklebur, morningglory, or sicklepod. Cultivation or other herbicides may be needed. See label for rates based on soil texture and organic matter and for information on setback requirements from streams and lakes. See label for reduced rate if soil coverage with plant residue is less than 30% at planting and for comments on rotational crops.
Grass and broadleaf weeds	pendimethalin, MOA 3 (Prowl H2O) 3.8 AS	2 to 4 pt	1 to 2	Apply preemergence before crop germinates, or postemergence until sweet corn is 20 to 24 inches tall or in the V8 growth stage whichever is more restrictive. Do not apply in reduced, minimum or no-till sweet corn. See label for use rates according to organic matter. See label for additional information. See label for tank mix options.
Broadleaf and grass weeds	simazine, MOA 5 (Princep) 4L	1.6 to 2 qt	1.6 to 2	Apply preemergence before weeds and crop emerge. See label for tank mix options. PHI is 45 days.
Corn (sweet), Postemergence				
Most annual broadleaf and grass weeds	atrazine, MOA 5 (various brands) 4 L (various brands) 90 WDG	2 qt 2.2 lb	2	Apply overtop before weeds exceed 1.5 inches in height. See label for additional information in controlling larger weeds. Atrazine cannot exceed 2.5 lb ai per acre per calendar year. See label for amount of oil concentrate to add to spray mix. See label on setback requirements from streams and lakes.
Annual grasses and broadleaf weeds	dimethenamid, MOA 15 (Outlook) 6.0 EC + atrazine, MOA 5 (AAtrex) 4 F or 90 WDG	8 to 21 oz + See label for rate	0.375 to 1 + See label for rate	Apply overtop corn before crop reaches 12 inches tall and before weeds exceed the 2-leaf stage. Larger weeds will not be controlled. Good residual control of annual grass and broadleaf weeds. Do not apply within 50 days of sweet corn ear harvest. Do not apply to corn 12 inches or taller. Also available as the commercial product Guardsman.
	S-metolachlor, MOA 15 (Dual II Magnum) 7.64 EC + atrazine, MOA 5 (AAtrex) 4 F (AAtrex) 90 WDG	1 to 1.67 pt + 1 to 2 qt 1.3 to 2.2 lb	0.95 to 1.58 + 1 to 2	Apply overtop corn (5 inches or less) before weeds exceed the 2-leaf stage. Larger weeds will not be controlled. Do not apply within 30 days of sweet corn ear harvest. Good residual control of annual grass and broadleaf weeds. Also available as Bicep II or Bicep II Magnum.
Cocklebur, common ragweed, jimsonweed, Pennsylvania smartweed, velvetleaf, yellow nutsedge, and morningglory	bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	Apply early postemergence overtop when weeds are small and corn has 1 to 5 leaves. See label for rates according to weed size and special directions for annual morningglory and yellow nutsedge control. Use a crop oil at a rate of 1 quart per acre.
Many broadleaf weeds	mesotrione, MOA 27 (Callisto) 4 EC	3 oz	0.094	Apply overtop corn 30 inches or less or 8 leaves or less to control emerged broadleaf weeds. Use nonionic surfactant at 2 pints per 100 gallons of spray solution. DO NOT add VAN or AMS adjuvants when making post application in sweetcorn or severe injury will occur. Most effective on small weeds, however, if weeds are greater than 5 inches or for improved control of certain weeds, certain atrazine formulations may be mixed with this herbicide. See label for further information. Do not apply within 45 days of harvest.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Corn (sweet), Postemergence (continued)				
Annual broadleaf weeds and some grasses	tembotrione, MOA 27 (Laudis) 3.5 L	3 fl oz	0.082	Can be applied overtop or with drop nozzles to sweet corn from emergence up to V7 stage. Controls most broadleaf weeds. Does not control sicklepod or prickly sida and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. Herbicide sensitivity in all hybrids and inbreds of sweet corn has not been tested. See label for information on adjuvant use. May be tank mixed with atrazine to increase weed spectrum and consistency of control. If tank mixed with atrazine do not apply if corn is 12 inches tall or greater. See label for further restrictions and instructions.
	topramezone, MOA 27 (Impact) 2.8 L	0.75 fl oz	0.016	Can be applied overtop or with drop nozzles to sweet corn from emergence until 45 days prior to harvest. Does not control sicklepod and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. This product has not been tested on all inbred line for tolerance. See label for information on adjuvant use. See label for further restrictions and instructions. Do not apply within 45 days of sweet corn ear harvest.
Velvetleaf, spreading dayflower, morningglory species, and redroot pigweed. Will not control grasses	fluthiacet-methyl, MOA 14 (Cadet) 0.91 L	0.6 to 0.9 oz	0.0042 to 0.06	**Processing sweet corn only.** Apply to small weeds, generally about 2 inches tall. Will control large velvetleaf up to 36 inches. See label for information on adjuvant use. See label for further restrictions and instructions.
Annual broadleaf weeds	fluthiacet-methyl, MOA 14 + mesotrione, MOA 27 (Solstice)	2.5 to 3.15 fl oz	0.004 to 0.0053 0.074 to 0.0931	Apply up to the V8 growth stage (or 30 inches tall). See label for crop rotation restrictions. Do not include nitrogen-based adjuvants (UAN or AMS) when making postemergence application or severe injury will occur. Use nonionic surfactant at 1 qt per 100 gallons of spray. Do not apply within 40 days of sweet corn ear harvest. See label for further instructions.
Velvetleaf, pigweed, nightshade, morningglory, common lambsquarters	carfentrazone-ethyl, MOA 14 (Aim) 2.0 EC	0.5 oz	0.008	Apply postemergence to actively growing weeds less than 4 inches high (rosettes less than 3 inches across) up to the 14-leaf collar stage of corn. Rates above 0.5 oz will aid in controlling larger weeds and certain weeds (see label for specific rate). Directed sprays will lessen the chance of crop injury and allow later application. Coverage of weeds is essential for control. Use nonionic surfactant (2 pints per 100 gallons of spray) with all applications. Under dry conditions, the use of crop oil concentrate may improve weed control. Mix with atrazine to improve control of many broadleaf weeds. Limited information is available concerning the use of this product in sweet corn. Do not apply more than 2 ounces per acre per season. Do not apply within 3 days of sweet corn ear harvest.
Broadleaf weeds including sowthistle, clover, cocklebur, jimsonweed, ragweed, Jerusalem artichoke, and thistle	clopyralid, MOA 4 (Stinger) 3 EC	0.25 to 0.67 pt	0.095 to 0.25	**Processing sweet corn only.** Apply to sweet corn when weeds are small (less than 5-leaf stage) and actively growing. Addition of surfactants, crop oils, or other adjuvants is not usually necessary when using Stinger. Use of adjuvants may reduce selectivity to the crop. Do not apply to sweet corn over 18 inches tall. Will control most legumes. Do not apply within 30 days of harvest.
Cocklebur, passionflower (maypop), pigweed, pokeweed, ragweed, smartweed (Pennsylvania), velvetleaf	halosulfuron-methyl, MOA 2 (Profine 75, Sandea) 75 WDG	0.67 oz	0.032	Apply over the top or with drop nozzles to sweet corn from spike to lay-by for control of emerged weeds. Add nonionic surfactant at 1 to 2 quarts per 100 gallons of spray solution. See label for all instructions and restrictions. Do not apply within 30 days of harvest.
Cocklebur, pigweed, lambsquarters, morningglory, sicklepod, and many other annual broadleaf weeds	2,4-D amine, MOA 4 (various brands) 3.8 SL	0.5 to 1 pt	0.24 to 0.48	Use 0.5 pt of 2,4-D overtop when corn is 4 to 5 inches tall and weeds are small. Increase rate to 1 pt as corn reaches 8 inches. Use drop nozzles and direct spray toward base if corn is over 8 inches tall. Do not cultivate for about 10 days after spraying as corn may be brittle. Reduce rate of 2,4-D if extremely hot and soil is wet. For better sicklepod and horsenettle control, add a nonionic surfactant when using a directed spray at a rate of 1 quart per 100 gallons spray solution. Do not apply within 45 days of sweet corn harvest.
Annual grasses and broadleaf weeds	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	0.7 to 1.3 pt	0.25 to 0.5	DO NOT SPRAY OVERTOP OF CORN OR SEVERE INJURY WILL OCCUR. Make a post directed application in a minimum of 20 gallons spray mix per acre to emerged weeds when the smallest corn is **at least 10 inches tall.** Use nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix. Use of a hooded or shielded sprayer will reduce crop injury.
Certain grasses, including barnyardgrass, foxtails, Texas panicum, and johnsongrass; and broadleaf weeds, including burcucumber, jimsonweed, pigweed, pokeweed, and smartweeds	nicosulfuron, MOA 2 (Accent) 75 WDG	0.67 oz	0.031	Apply to sweet corn up to 12 inches tall or up to and including 5 leaf collars. For corn 12 to 18 inches tall, apply only with drop nozzles. Sweet corn hybrids vary in their sensitivity to Accent. Do not apply to Merit sweet corn variety. Contact company representative for information on other local hybrids that have been evaluated with Accent. Accent may be applied to corn previously treated with Fortress, Aztec, or Force, or non-organophosphate soil insecticides regardless of soil type. See label for more information on use of soil insecticides with Accent. Label prohibits application of Accent to corn previously treated with Counter insecticide, and also indicates that applying Accent to corn previously treated with Counter 20 CR, Lorsban, or Thimet may result in unacceptable crop injury, especially on soils with less than 4% organic matter. See label for information on use of adjuvants.
Cucumbers, Preplant and Preemergence				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Apply before crop emergence and control emerged weeds. There is no residual activity. May be tank mixed with soil residual compounds. See label for further instructions. May also be used as a banded spray between row middles. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Cucumbers, Preplant and Preemergence (continued)				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter, does not control grasses.	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	**Aim 1.9 EW is registered for application in transplant production systems only. Aim 2 EC is registered in seeded and transplant production systems.** Apply no later than 1 day before transplanting or no later than 7 days before seeding crop. See label for information about application timing. Use a crop oil at up to 1 gallon per 100 gallons of spray solution or a nonionic surfactant at 2 pints per 100 gallons of spray solution. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds at least 3 days before seeding or transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 inch natural rainfall or by applying water via a sprinkler system. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Morningglory and small pigweed < 1 inch	pyraflufen ethyl, MOA 14 (ET Herbicide) 0.208 L	1 to 2 oz	0.016 to 0.0032	**Bareground.** Wait 1 day following preplant burndown application before planting. **Plasticulture.** May apply over mulch; however, a single 0.5 inch irrigation/rain event plus a 7-day waiting period is needed before transplanting.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Registered for cucurbit vegetable group (Crop grouping 9). Apply preplant and incorporate into the soil 1 to 2 inches (1 inch incorporation is optimum) with a rototiller or tandem disk or apply to the soil surface after seeding and follow with irrigation within 36 hours of application. Check replant restrictions for small grains on label.
Annual grasses and some small-seeded broadleaf weeds; weak on pigweed	clomazone, MOA 13 (Command) 3 ME	0.4 to 1 pt	0.15 to 0.375	Apply immediately after seeding. See label for further information.
Annual grasses and some small-seeded broadleaf weeds	ethalfluralin, MOA 3 (Curbit) 3 EC	3 to 4.5 pt	1.1 to 1.7	Apply postplant to seeded crop prior to crop emergence or as a banded spray between rows after crop emergence or transplanting. See label for timing. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. Do not use under mulches, row covers, or hot caps. Under conditions of unusually cold or wet soil and air temperatures, crop stunting or injury may occur. Crop injury can occur if seeding depth is too shallow.
Annual grasses and broadleaf weeds	ethalfluralin, MOA 3 + clomazone, MOA 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after crop seeding for preemergence control of weeds. **Do not apply prior to planting crop. Do not soil incorporate.** May also be used as a **banded** treatment **between** rows after crop emergence or transplanting. Do not apply over or under plastic mulch.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	Apply after seeding but before soil cracking or prior to transplanting crop. For transplanting, do not transplant until 7 days after application. For seeded or transplanting cucumbers in plasticulture, do not plant within 7 days of Sandea application. Rate can be increased to 1 ounce of product per acre to middles between rows.
Cucumbers, Postemergence				
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan HFP, Trifluraline, Trifluralin HF) 4EC	1 to 2 pt	0.5 to 0.75	**Will not control emerged weeds. Row middles only.** To improve preemergence control of late emerging weeds. **Apply as a directed spray to soil between rows after crop emergence when crop plants have reached** 3 to 4-true leaf stage of growth. Avoid contacting crop foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 30 days of harvest.
Yellow and purple nutsedge and broadleaf weeds, including cocklebur, galinsoga, smartweed, ragweed, wild radish and pigweed	halosulfuron-methyl, MOA 2 (Profine 75, Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	Apply postemergence only after the crop has reached 3 to 5 true leaves but before first female flowers appear. Do not apply sooner than 14 days after transplanting. Use nonionic surfactant at 1 quart per 100 gallons of spray solution with all postemergence applications. Do not apply within 14 days of harvest.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use crop oil concentrate at up to 1 gallon per 100 gallons solution or a nonionic surfactant at 2 pints per 100 gallons of spray solution. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 14 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Control of emerged grasses. See label for adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Eggplant, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information. Chloropicrin (150 pounds per acre broadcast) will also be needed when laying first crop mulch to control nutsedge.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before transplanting as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	**Aim 1.9 EW is registered for application in transplant production systems only. Aim 2 EC is registered in seeded and transplant production systems.** Apply no later than 1 day before transplanting crop (Aim 1.9 EW or Aim 2 EC) or no later than 7 days before seeding crop (Aim 2 EC only). See label for information about application timing. Use a crop oil at up to 1 gallon per 100 gallons of spray solution or a nonionic surfactant at 2 pints per 100 gallons of spray solution. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds at least 3 days before seeding or transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 inch natural rainfall or by applying water via a sprinkler system. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Eggplant, Preemergence				
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant incorporated (1 inch incorporation is optimum) or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
Annual grasses and some broadleaf weeds	napropamide, MOA Unknown (Devrinol, Devrinol DF-XT) 50 DF (Devrinol 2-XT) 2 EC	2 to 4 lb 2 to 4 qt	1 to 2	**Transplanted eggplant only.** Apply preplant and incorporate into soil 1 to 2 inches using a rototiller or tandem disk. Shallow cultivations or irrigation will improve control. See label for small grains replanting restrictions. May also be applied in the **row middles** between plastic covered beds. See label for more information. See XT labels for information regarding delay in irrigation event.
Grass and broadleaf weeds including black nightshade and hairy nightshade	pendimethalin, MOA 3 (Prowl H2O) 3.8 AS	1.0 to 1.5 pt	0.48 to 0.72	**Transplanted eggplant only.** Apply to row middles or under the plastic. Do not exceed 3 pt/A per year. 70 day PHI.
Eggplant, Postemergence				
Annual grasses and small-seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	6 to 10 lb 6 to 10 pt	4.5 to 7.5	Application confined to a period of 4 to 6 weeks after transplanting. To improve preemergence control of late emerging weeds. Apply to weed-free soil over the top of transplants.
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 20 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of grasses. See label for adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 20 days of harvest.
Eggplant, Row Middles				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use crop oil concentrate at up to 1 gallon per 100 gallons solution or a nonionic surfactant at 2 pints per 100 gallons of spray solution. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides. PHI 0 days.
Most emerged weeds	glyphosate, MOA 9 ((numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048	Apply between rows as a postemergence spray. Do not allow spray to contact crop or plastic mulch. Early season application will give postemergence and preemergence control. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution. Preharvest interval is 30 days.
Contact kill of all green foliage	paraquat, MOA 22 (Parazone) 3SL (Gramoxone SL) 3 SL	1.3 pt	0.5	Apply in 10 gallons spray mix as a shielded spray to emerged weeds between rows of eggplant. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix. Do not allow spray to contact crop or injury will result.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Garlic, Preplant or Preemergence				
Annual and perennial grass and broadleaf weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Stale bed application. Apply to emerged weeds at least 3 days before planting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.7 to 2.7 pt	0.6 to 1	Apply in a minimum of 20 gallons spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix. Do not apply within 60 days of harvest.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 2.0 EC	Up to 2 oz	0.031	Apply no later than 30 days before planting. See label for specific Aim rate relating to weed species and proper adjuvant and rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Emerged broadleaf weeds	pyraflufen, MOA 14 (ET Herbicide) 0.208 EC	0.5 to 2 fl oz	0.0008 to 0.003	Apply as a preplant burndown treatment in a minimum of 10 gallon solution per acre. See label for information on use of adjuvant.
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	3 to 10% v/v		Apply as a preplant burndown treatment or use in row middles using shielded sprayer.
Emerged broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant incorporated (1 inch incorporation is optimum) or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
Annual broadleaf weeds Including henbit, purslane, pigweed, primrose, smartweed, and many others; controls small emerged weeds as well	oxyfluorfen, MOA 14 (Galigan, Goal 2XL) 2 E	1 to 2 pt	0.25 to 0.5	**Transplanted garlic only.** For use on a fallow bed. Garlic may be planted immediately following application of 1 pt of product. For rates above 1 pt do not plant within 30 days. PHI 60 days.
Annual broadleaf and grass weeds	ethofumesate, MOA 15 (Ethotron) 4 SC	16 to 32 oz	0.5 to 1	Can use as preplant, preemergence or postemergence application. The use of higher than specified rates may cause injury or carry over problems. Rainfall of at least 0.5 inch is needed for activation. See label for more information.
Garlic, Preemergence				
Annual grasses and small-seeded broadleaf weeds	dimethenamid-P, MOA 15 (Outlook) 6 EC	12 to 21 oz	0.6 to 1	For preemergence weed control. Apply after crop has reached 2 true leaves until a minimum of 30 days before harvest. If applications are made to transplanted crop, DO NOT apply until transplants are in the ground and soil has settled around transplants with several days to recover.
	flumioxazin, MOA 14 (Chateau) 51 SW	6 oz	0.188	For preemergence weed control. Apply prior to garlic and weed emergence. Application should be made within 3 days after planting garlic.
	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 AS	1.2 to 3.6 pt 1.5 to 3 pt	0.5 to 1.5 0.75 to 1.5	For preemergence weed control. Apply preemergence after planting but prior to weed and crop emergence, or postemergence to garlic in the 1- to 5-true leaf stage. Prowl can be applied sequentially by applying preemergence followed by a postemergence application. Preharvest interval is 45 days.
Garlic, Postemergence				
Annual grasses and small-seeded broadleaf weeds	dimethenamid-P, MOA 15 (Outlook) 6 EC	12 to 21 oz	0.6 to 1	For preemergence weed control applied after crop has reached 2 true leaves until a minimum of 30 days before harvest. If applications are made to transplanted crop, DO NOT apply until transplants are in the ground and soil has settled around transplants with several days to recover.
Most annual broadleaf weeds	oxyfluorfen, MOA 14 (Galigan) 2 E (Goal 2 XL) 2 EC (GoalTender) 4 E	0.5 pt 0.5 pt 0.25 pt	0.12	**Transplanted dry bulb only.** May be used as a postemergence spray to both the weeds and crop after the garlic has at least 2 fully developed true leaves. Some injury to garlic may result. Injury will be more severe if the chemical is applied during cool, wet weather. Weeds should be in the 2 to 4-leaf stage for best results. Preharvest interval is 60 days.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 16 oz 9 to 32 oz	0.09 to 0.25 0.07 to 0.25	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 45 days of harvest. Very effective in controlling annual bluegrass.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	Apply to emerged grasses. Consult label for specific rates and best times to treat and adjuvant and rate. Do not apply on unusually hot and humid days. Do not apply within 45 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 pt	0.2	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 30 days of harvest.
Garlic, Row Middles				
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Greens (Collard, kale, mustard, and turnip greens or roots), Preplant				
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Apply as preplant burndown emerged weeds. See label for instruction. May also be used as a banded spray between row middles. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	**Collard and turnip only.** Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before crop emergence or transplanting as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan) 4 EC	0.75 to 1.5 pt	0.5 to 0.75	**Greens.** Collard, kale, mustard and turnip (fresh or processing). Apply preplant and incorporate into the soil 2 to 3 inches within 8 hr using a rototiller or tandem disk. **Turnip root.** TREFLAN HFP ONLY. A Section 24 (c) North Carolina Local Need Label must be obtained prior to use. Apply Treflan HFP as a preplant soil incorporated treatment.
	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Brassica (cole) leafy vegetable group. Not labeled for turnip. Apply preplant or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
	S-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	0.5 to 1 pt	0.5 to 1	A section 24(c) North Carolina Label must be obtained at syngenta-us.com/labels/indemnified-label-login prior to use. ONLY REGISTERED FOR USE IN COLLARD AND KALE. **Bare Ground Applications for Transplanted Crops:** After transplanting, irrigate to seal the soil around the transplanted root ball. Five to ten days after transplanting and irrigating, apply Dual Magnum. **Mulched Systems Preplant Applications for Transplanted Crops:** After final bed formation but prior to laying the mulch. **Mulch System Postemergence Applications for Transplanted Crops:** Apply broadcast postemergence 10 days after transplanting to ensure that the crop root system is well established. **Seeded.** Apply overtop after crop reaches 3 inches. **Row Middle Applications to Transplanted and Direct Seeded Crops:** May be applied up to 1.25 pt/A.
	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	6 to 10 lb 6 to 10 pt	4.5 to 7.5	Also labeled for broccoli raab (raab, raab salad), and hanover salad. Apply immediately after seeding. May also be incorporated.
Greens, Postemergence				
Broadleaf weeds including sowthistle clover, cocklebur, jimsonweed, and ragweed	clopyralid, MOA 4 (Stinger) 3 EC	0.25 to 0.5 pt	0.11 to 0.187	**Kale, collards, mustard, turnip, mizuna, mustard spinach, and rape.** Apply to crop when weeds are small and actively growing. Will control most legumes. For kale, collards, mustard, and turnip (roots), do not apply within 30 days of harvest. For turnip tops, do not apply within 15 days of harvest. Mustard green injury observed in some research trials.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for grass control. See label for adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest of green crops. Do not apply within 30 days of harvest of turnips grown for roots.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	ALSO LABELED FOR RAPE GREENS. Do not apply within 14 days of harvest of turnip and 30 days of harvest of other greens. Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity.
Greens, Row middles				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Not labeled for turnip greens.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Lettuce, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before crop emerges as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray solution or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Lettuce, Preplant or preemergence				
Annual grasses and small-seeded broadleaf weeds	benefin, MOA 3 (Balan) 60 WDG	2 to 2.5 lb	1.2 to 1.5	Apply preplant and incorporate 2 to 3 inches deep with a rototiller or tandem disk before seeding or transplanting.
	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant incorporated (1 inch incorporation is optimum) or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
Most annual grasses and broadleaf weeds	pronamide, MOA 3 (Kerb) 50 WP (Kerb) 3.3 SC	2 to 4 lb 1.25 to 5 pt	0.5 to 2	**Kerb 3.3 SC has supplemental label allowing application on leaf lettuce as well as head lettuce.** Also labeled in endive, escarole or radicchio greens. Can be used preplant or preemergence. Application can also be made postemergence to head lettuce but should be made before weed germination if possible or before weeds are beyond the 2-leaf stage. Moisture is necessary to activate. Do not apply within 55 days of harvest. Make only 1 application per crop. Consult label for planting restrictions for rotational crops.
Lettuce, Postemergence				
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Arrow, Clethodim, and Select are only registered for leaf lettuce. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Use of Poast or clethodim with crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply sethoxydim within 30 days of harvest on head lettuce or within 15 days of harvest on leaf lettuce. For clethodim, do not apply within 14 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC	6 to 8 oz	0.09 to 0.125	
	(Select Max, Intensity One) 1 EC	9 to 16 oz	0.07 to 0.125	
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is FP contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Okra, Preplant and Preemergence				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Contact kill of green foliage	paraquat, MOA 22 (Gramoxone) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply to emerged weeds before planting or up to 1 day after planting. See label for further instructions.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply no later than 1 day before transplanting crop. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides. PHI 0 days.
Emerged broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan, Treflan HFP, Trifluralin, Trilin) 4 EC	1 to 2 pt	0.5 to 1	Apply preplant and incorporate into the soil 2 to 3 inches within 8 hr using a rototiller or tandem disk.
Broadleaf and grass weeds	prometryn, MOA 5 (Caparol) 4L	1.5 to 3 pt	0.75 to 1	Apply preemergence and or post-directed to okra. Do not exceed 3 pints per acre of Caparol per season. See label for crop rotation restrictions. PHI is 14 days.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Okra, Preplant and Preemergence (continued)				
Annual broadleaf weeds including pigweed spp.	mesotrione, MOA 27 (Callisto) 4 L	6 oz	0.19	May be applied as row middle or hooded POST-directed application but not both. For preemergence row middle application, apply as a banded application to the row middles prior to weed emergence. Leave 1 foot of untreated area over the okra row or 6 inches on each side of the planted row. Do not apply Callisto directly over the planted row or severe injury may occur. Injury risk is greatest on coarse textured soils (sand, sandy loam or loamy sand).
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.3	Apply to actively growing grasses not under drought stress. Do not apply on days that are unusually hot and humid. Do not apply within 14 days of harvest.
Okra, Row middles				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides. PHI 0 days.
Contact kill of green foliage	paraquat, MOA 22 (Gramoxone) 3 SL	1.3 pt	0.5	Spray must not contact okra plants. Hooded sprayers must be used. Two applications can be made, allow 14-day interval between the 2 applications. See label for further instructions.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual broadleaf weeds including pigweed 3 inches or less	mesotrione, MOA 27 (Callisto) 4 L	3 oz	0.093	May be applied as a row middle or hooded POST-directed application but not both. For postemergence hooded application, okra must be at least 3 inches tall. Minimize amount of Callisto that contacts okra foliage or crop injury will occur. PHI 28 days.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048	Apply to row middles as a postemergence shielded or hooded spray to avoid contact of herbicide with planted crop. In plasticulture, do not allow spray to contact plastic. Do not apply more than 2 ounces per acre per 12-month period. PHI 30 days.
Onions, Preplant and Preemergence				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	**Dry bulb and green onion.** Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.7 to 2.7 pt	0.65 to 1	**Seeded onion only.** Apply in a minimum of 20 gallons spray mix per acre to emerged weeds before crop emergence or transplanting as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix. PHI 60 days.
Annual and perennial grass and broadleaf weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Use on direct seeded onions only. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 2.0 EC	Up to 2 oz	0.031	Apply no later than 30 days before planting. See label for specific Aim rate relating to weed species and proper adjuvant and rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Emerged broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 E	5 to 6 qt	5 to 6	**Dry bulb only.** Apply preplant incorporated (1 inch incorporation is optimum) or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions and for rotation restrictions.
Annual broadleaf weeds	oxyfluorfen, MOA 14 (Galigan) 2 E (Goal 2 XL) 2 EC (GoalTender) 4 E	 1 to 2 pt 1 to 2 pt 1 pt	 0.25 to 0.5 0.25 to 0.5 0.5	**Transplanted dry bulb only.** Apply as a single application immediately (within 2 days) after transplanting for preemergence control of weeds. Injury can occur if applications are made during cool, wet weather or prior to the full development of the true leaves. See label for rates and instructions for use. Do not apply within 45 days of harvest.
Most annual grasses and some broadleaf weeds	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) 3.8 AS	See label	See label	**Dry bulb and green onion (chives, leeks, spring onions, scallions, Japanese bunching onions, green shallots, and green eschalots). Prowl 3.3 EC is not registered for green onion.** For preemergence weed control. Apply when onions have 2 to 9 true leaves (dry bulb) and 2 to 3 leaves (green onion) but prior to weed emergence. For green onion the soil must be a muck soil or be a mineral soil with at least 3% organic matter. See label for additional information on rate depending on soil type. PHI for dry bulb onion is 45 days. PHI for green onion is 30 days.
	dimethenamid-P, MOA 15 (Outlook) 6 EC	12 to 21 oz	0.6 to 1	**Dry bulb and green onion (leeks, spring onions or scallions, Japanese bunching onions, green shallots or eschalots).** For preemergence weed control. Apply after crop has reached 2 true leaves until a minimum of 30 days before harvest. If applications are made to transplanted crop, DO NOT apply until transplants are in the ground and soil has settled around transplants with several days to recover. See label for further details.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Onions, Postemergence				
Annual grasses, small seeded broadleaf weeds and yellow nutsedge	*S*-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	0.5 to 1 pt	0.47 to 0.96	A Section 24(c) North Carolina Label must be obtained at syngenta-us.com/labels/indemnified-label-login prior to use. **Seeded (green or dry bulb).** Do not apply before 4-leaf stage. From the 4- to 6-leaf stage may apply 0.5 pt/A; rate can be increased to 1 pt/A after the 6-leaf stage. **Transplant (dry bulb only).** Transplant, irrigate to seal soil around the root ball, and then apply Dual Magnum within 48 hours of planting and sealing soil around onions.
Most annual broadleaf weeds	oxyfluorfen, MOA 14 (Galigan) 2 E (Goal 2 XL) 2 EC (GoalTender) 4 E	 0.5 pt 0.5 pt 0.25 pt	0.12	**Dry bulb only.** May be used as a postemergence spray to both the weeds and crop after the onions have at least 2 fully developed true leaves. Some injury to onions may result. Injury will be more severe if the chemical is applied during cool, wet weather. Weeds should be in the 2 to 4leaf stage for best results. Do not make more than 4 applications per year. Do not apply within 45 days of harvest.
Common lambsquarters, common chickweed, common purslane, black nightshade, ladysthumb, Pennsylvania smartweed, redroot pigweed, and some annual grasses	ethofumesate, MOA 15 (Nortron) 4 SC	16 to 32 oz	0.5 to 1	Apply at planting or just after planting prior to weed emergence. Can be used postemergence at 16 oz per acre. See label for more information. Rainfall of at least 0.5 inch is needed for activation.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	**Dry bulb only.** Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Do not apply on days that are unusually hot and humid. Do not apply within 45 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	**Dry bulb and green.** Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and humidity. Do not apply within 30 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	 6 to16 oz 9 to 32 oz	 0.09 to 0.25 0.07 to 0.25	**Dry bulb only.** Apply to emerged grasses. Consult label for specific rates and best times to treat and adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and humidity. Do not apply within 45 days of dry bulb onion harvest. Intensity One may be applied to dry bulb onions or green onions (Leeks, scallions or spring onions, Japanese bunching onion, shallots or eschalots). Do not exceed 16 ounces of Intensity One per acre on green onions. Do not apply Intensity One herbicide within 14 days of green onion harvest.
Peas, Green, Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in minimum of 10 gallons spray mix per acre to emerged weeds before crop emergence as broadcast or band treatment over preformed row. Use sufficient water for thorough coverage. Row should be formed several days before planting and treating to allow maximum weed emergence. Use nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply prior to planting or emergence of crop. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid , MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 AS	1.5 to 3 pt	0.75 to 1.5	**Southern peas (cowpeas) and snap beans only.** Apply preplant and incorporate into the soil 2 to 3 inches using a power-driven rototiller or by cross disking. **Do not apply after seeding. Do not apply when air temperature is below 45°F.**
Broadleaf weeds	saflufenacil, MOA 14 (Sharpen) 3.42 SL	1 oz	0.027	**Dry field pea, edible pea (sugar snap, English pea, garden pea, green pea, marrowfat pea) and chickpea only:** Apply as a preplant/ preemergence burndown of small actively growing broadleaf weeds. Can also be used preplant incorporated or preemergence in edible pea. See label for directions. Do not apply more than 2 fluid ounces per acre per season.
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan, Trifluralin, Trifluralin HF, other brands) 4 EC	1 to 1.5 pt	0.5 to 0.75	**English peas only.** Apply preplant and incorporate to a depth of 2 to 3 inches within 8 hr with a rototiller or tandem disk.
Annual grasses and broadleaf weeds; weak on pigweed	clomazone, MOA 13 (Command) 3ME	1.3 pt	0.5	Apply to the soil surface immediately after seeding. See label for further instruction. Limited research has been done on this product in this crop in North Carolina.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Peas, Green, Preplant and Preemergence (continued)				
Annual grasses, small-seeded broadleaf weeds, and suppression of yellow nutsedge	*S*-metolachlor, MOA 15 (Brawl, Dual Magnum, Medal) 7.62 EC (Brawl II, Dual II Magnum, Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	Apply to soil surface immediately after seeding. Shallow cultivations will improve control. See label for specific rate.
Annual broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	Up to 3 oz	Up to 0.047	**English peas only.** Apply preplant incorporated or to soil surface immediately after planting. See label for more details.
Peas, Green, Postemergence				
Annual broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	Apply overtop of peas when weeds are small and peas have at least 3 pairs of leaves (4 nodes). **Do not add crop oil concentrate to spray mix.** Do not apply within 10 days of harvest. Do not apply when peas are in bloom.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See Label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. With sethoxydim, add 1 quart of crop oil concentrate per acre. Adding crop oil to Poast or Assure II may increase the likelihood of crop injury at high air temperatures. With quizalofop, add 1 gallon oil concentrate or 1 quart nonionic surfactant per 100 gallons spray. Do not apply Poast or Assure II on days that are unusually hot and humid. Do not apply sethoxydim within 15 days or Assure II or Targa within 30 days of harvest.
	quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC (Targa) 0.88 EC	6 to 12 oz	0.04 to 0.08	
Annual broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	Up to 3 oz	Up to 0.047	**See label for pea type.** Apply postemergence to 1 to 3-inch weeds (1 to 4 leaves) when peas are at least 3 inches high but prior to 5 nodes and before flowering. Add nonionic surfactant at 2 pints per 100 gallons of spray mix. See label for crop rotation restrictions. PHI 30 days.
Broadleaf and grass weeds	imazamox, MOA 2 (Raptor) 1 SL	4 fl oz	0.31	**Dry peas only:** Apply postemergence before bloom stage but after dry peas have at least 3 pairs of leaves. See label for further information.
Peas, Southern (cowpeas, blackeyed peas), Preplant or Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 20 gallons spray solution to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply prior to planting or emergence of crop. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application.	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 AS	1.5 to 3 pt	0.75 to 1.5	**Not labeled for blackeyed peas**. Apply preplant and incorporate into the soil 2 to 3 inches using a power-driven rototiller or by cross disking. **Do not apply after seeding**.
	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF) 4 EC	1 to 2 pt	0.5 to 1	Apply preplant and incorporate into the soil 2 to 3 inches deep within 8 hr with a rototiller or tandem disk.
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3ME	0.4 to 0.67 pt	0.15 to 0.25	**Succulent southern peas only.** Apply to the soil surface immediately after seeding. Offers weak control of pigweed. See label for further instruction. Limited research has been done on this product in this crop in North Carolina.
Annual grasses, small-seeded broadleaf weeds, and suppression of yellow nutsedge	*S*-metolachlor, MOA 15 (Brawl, Dual Magnum, Medal) 7.62 EC (Brawl II, Dual II Magnum, Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	Apply to soil surface immediately after planting. Shallow cultivations will improve control. May also be soil incorporated before planting.
Annual grasses and broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	Up to 4 oz	Up to 0.063	Apply preemergence or preplant incorporated. See label for rate for specific pea species.
Peas, Southern, Postemergence				
Annual broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	Apply overtop of peas when weeds are small and peas have at least 3 pairs of leaves (4 nodes). **Do not add crop oil concentrate to spray mix.** See label for weeds controlled with Basagran. Do not apply within 30 days of harvest. Do not apply when peas are in bloom.
Annual broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	Up to 4 oz	Up to 0.063	**Southern peas and certain dry peas.** Apply postemergence to 1 to 3-inch weeds (1 to 4 leaves) when peas are at least 3 inches in height but prior to five nodes and flowering. Add nonionic surfactant at 2 pints per 100 gallons of spray mixture with all postemergence applications. Do not apply within 30 days of harvest. See label for rate for specific pea species.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Peas, Southern, Postemergence (continued)				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses	quizalofop p-ethyl, MOA 1 (Assure II, Targa) 0.88 EC sethoxydim, MOA 1 (Poast) 1.5 EC clethodim, MOA 1 (Intensity One, Select Max) 1 EC	6 to 12 oz 1 to 1.5 pt 9 to 16 oz	0.04 to 0.08 0.2 to 0.3 0.07 to 0.125	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and humidity. Do not apply on days that are unusually hot and humid. With sethoxydim, do not apply within 15 days and 30 days of harvest for succulent and dry peas, respectively. With quizalofop, do not apply within 60 days of harvest of dry Southern peas, or within 30 days of harvest of succulent Southern peas. See label for adjuvant and rate. Apply before bloom. Do not make more than 1 application per acre per season. Do not apply clethodim within 21 days of harvest.
Peppers, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting second crop on mulch however adhere to label guidelines on crop plant back interval. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information. Chloropicrin (150lb/A broadcast) will also be needed when laying first crop mulch to control nutsedge.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 10 gallons of spray mix per acre to emerged weeds before transplanting as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	**Transplanted crop. Apply no later than 1 day before transplanting crop.** **Seeded crop. Apply no later than 7 days before planting seeded crop.** Use a nonionic surfactant or crop oil. See label for rate. Coverage of weed is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds at least 3 days before seeding or transplanting. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 inch natural rainfall or by applying water via a sprinkler system. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Emerged broadleaf weeds and some annual grasses	caprylic acid + capric acid, (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Broadleaf weeds including Carolina geranium and cutleaf eveningprimrose and a few annual grasses	oxyfluorfen, MOA 14 (Goal) 2XL (GoalTender) 4 F	Up to 2 pt Up to 1 pt	0.5	**Plasticulture only.** Apply to soil surface of pre-formed beds at least 30 days prior to transplanting crop. While incorporation is not necessary, it may result in less crop injury. Plastic mulch can be applied any time after application, but best results are likely if applied soon after application.
Palmer amaranth, redroot pigweed, smooth pigweed, galinsoga sp., black nightshade, Eastern black nightshade, common purslane, partial control of yellow nutsedge	fomesafen, MOA 14 (Reflex) 2 EC	1 to 1.5 pt	0.25 to 0.375	This is a Section 24(c) special local needs label for transplanted pepper in North Carolina. Growers must obtain the label at syngenta-us.com/labels/indemnified-label-login prior to making an application of Reflex. **See label for further instructions.** **Plasticulture In-row Application for Transplanted Pepper.** Apply after final bed formation and the drip tape is laid but prior to laying plastic mulch. Avoid soil disturbance after application. Unless restricted by other products such as fumigants, pepper may be transplanted immediately following the application of Reflex and the application of the mulch. **Bareground for Transplanted Pepper.** Apply pretransplant up to 7 days prior to transplanting pepper. Weed control will be reduced if soil is disturbed after application. During the transplanting operation make sure the soil in the transplant hole settles flush or above the surrounding soil surface. Avoid cultural practices that may concentrate Reflex-treated soil around the transplant root ball. An overhead irrigation or rainfall event between Reflex herbicide application and transplanting will ensure herbicide activation and will likely reduce the potential for crop injury due to splashing. **Plasticulture Row Middle Application.** Apply to row middles with a hooded or shielded sprayer. Avoid drift of herbicide on mulch. If drift occurs, 0.5 inch of rain or irrigation must occur prior to transplanting. **Carryover is a large concern; see label for more information.**

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Peppers, Preplant (continued)				
Annual grasses and small-seeded broadleaf weeds	clomazone, MOA 13 (Command) 3 ME	0.67 to 2.67 pt	0.25 to 1	**Not labeled for banana pepper.** Apply preplant before transplanting. Weak on pigweed. See label for instructions on use.
	napropamide, MOA Unknown (Devrinol, Devrinol DF-XT) 50 DF (Devrinol, Devrinol 2-XT) 2 EC	2 to 4 lb 2 to 4 qt	1 to 2	**Bare ground:** Apply preplant and incorporate into the soil 1 to 2 inches as soon as possible with a rototiller or tandem disk. Can be used on direct-seeded or transplanted peppers. See label for instructions on use. **Plasticulture:** Apply to a weed-free soil before laying plastic mulch. Soil should be well worked yet moist enough to permit a thorough incorporation to a depth of 2 inches. Mechanically incorporate or irrigate within 24 hours after application. If weed pressure is from small seeded annuals, apply to the surface of the bed immediately in front of the laying of plastic mulch. If soil is dry, water or sprinkle irrigate with sufficient water to wet to a depth of 2 to 4 inches before covering with plastic mulch. **Between rows:** Apply to a weed free soil surface between the rows (bareground or plastic mulch). Mechanically incorporate or irrigate Devrinol into the soil to a depth of 1 to 2 inches within 24 hours of application. See XT labels for information regarding delay in irrigation event.
	pendimethalin, MOA 3 (Prowl H_2O) 3.8	1 to 3 pt	0.5 to 1.5	May be applied in chili pepper, cooking pepper, pimento, Jalapeno, and sweet pepper. Do not apply more than 3 pints per acre per season. See label for specific use rate for your soil type. Avoid direct contact with pepper foliage or stems. Do not apply within 70 days of harvest. See label for further instructions and precautions. **Between rows.** Can be applied as a post-directed spray on the soil at the base of the plant beneath plants and between rows. **In-row.** May be applied as a broadcast preplant incorporated surface application prior to transplanting peppers. Limited research has been conducted in NC.
	trifluralin, MOA 3 (Treflan, Treflan HFP, Trifluralin HF) 4 EC	1 to 2 pt	0.5 to 1	Apply pretransplant and incorporate to a depth of 2 to 3 inches within 8 hr with a rototiller or tandem disk. Do not apply after transplanting.
Peppers, Preplant and Preemergence				
Annual grasses and small seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant incorporated (1 inch incorporation is optimum) or preemergence. With preemergence application, irrigate immediately after application. See label for directions.
Annual grass and broadleaf weeds, yellow nutsedge suppression	*S*-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	8 to 12 oz	0.47 to 0.7	**Bell pepper transplants only.** This is a Section 24(c) North Carolina Special Local Needs Label. Growers must obtain label from syngenta-us.com/labels/indemnified-label-login prior to making Dual Magnum applications. Option 1: Apply 8 to 12 ounces to the soil surface of pre-formed beds prior to laying plastic. Insure the plastic laying process does not incorporate or disturb the treated bed. Option 2: Apply 12 ounces overtop of bell pepper between 1 and 3 weeks after planting. Does not control emerged weeds. Limited data are available for NC. Do not apply more than 12 ounces per acre as it is likely that injury will occur including decreased crop vigor. Read label for further instructions.
Peppers, Postemergence				
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 7 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence to control grasses. See label for adjuvant and rate. Adding crop oil may increase likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 20 days of harvest.
Broadleaf, grass (suppression only), and yellow nutsedge	imazosulfuron, MOA 2 (League) 0.5 DF	4 to 6.4 oz	0.19 to 0.3	**Pepper (Bell and non-bell).** Apply to pepper plants that are well established and at least 10 inches tall. Apply directed to the base of the plants stem, no higher than 2 inches from the soil surface and do not contact fruit. Consult label for approved surfactants and crop rotation restrictions. PHI 21 days.
Peppers, Row Middles				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayer for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides. PHI 0 days.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75, Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048	Apply to row middles as a postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution.
Contact kill of all green foliage	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 pt	0.5	Apply in a minimum of 20 gallons spray mix per acre as a shielded spray to emerged weeds between rows of peppers. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix. Do not apply more than 3 times per season.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply prior to planting, or within 1 day after planting crop. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage of weed is essential for good weed control. Can be tank mixed with other registered burndown herbicides.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Potato, Irish, Preplant and Preemergence				
Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 AS	 1.8 to 3.6 pt 1.5 to 3 pt	 0.75 to 1.5 0.75 to 1.5	Apply just after planting or drag-off to weed-free soil before crop emerges or from emergence until crop reaches 6 inches tall.
	trifluralin, MOA 3 (Treflan) 4 EC (Trifluralin) 4 L	 1 to 1.5 pt	0.5 to 0.75	Apply and incorporate after planting but before emergence, immediately following dragoff, or after potato plants have fully emerged. Rate is soil texture dependent.
Annual grasses and small-seeded broadleaf weeds, plus yellow nutsedge suppression	*S*-metolachlor, MOA 15 (Brawl, Dual Magnum, Medal) 7.62 EC (Brawl II, Dual II Magnum, Medal II) 7.64 EC	1 to 2 pt	0.95 to1.91	Apply just after planting or drag-off to weed-free soil before crop emerges. Dual Magnum can also be applied at lay-by for control of late season weeds. Do not apply within 60 days after the at-planting to drag-off application, or within 40 days after a lay-by application. See label for further instruction.
	dimethenamid-P, MOA 15 (Outlook) 6 EC	12 to 21 oz	0.6 to 1	Apply just after planting or drag-off to weed-free soil before crop emerges. See label for further instruction. PHI 40 days.
Annual grasses, most broadleaf weeds, plus yellow and purple nutsedge suppression	EPTC, MOA 15 (Eptam) 7 EC	3.5 pt	3	Apply preplant and incorporate into the soil 2 to 3 inches with a rototiller or tandem disk. The variety “Superior” has been shown to be sensitive to Eptam. See label for specific methods of incorporation. For late season preemergence nutsedge control, apply and incorporate as a directed spray to the soil on both sides of the crop row. See label for more detail.
Most annual broadleaf weeds and some annual grasses	flumioxazin, MOA 14 (Chateau) 51 SW	1.5 oz	0.047	Apply immediately after hilling. A minimum of 2 inches of soil must cover the vegetative portion of the potato plant at the time of application of Chateau. DO NOT apply to emerged potatoes. DO NOT incorporate Chateau or weed control will be reduced. Can be tank mixed with burndown herbicides if weeds present at application. See label for further instructions.
	linuron, MOA 5 (Lorox DF) 50 WDG (Linex) 4L	 1.5 to 3 lb 1.5 to 3 pt	0.75 to 1.5	Apply just after planting or drag-off or hilling but before crop emerges. If emerged weeds are present, add 1 pint surfactant for each 25 gallons spray mixture. Weeds may be up to 3 inches tall at time of application.
	metribuzin, MOA 5 (TriCor DF, Dimetric DF, and other trade names) 75 WDG	0.33 to 1.33 lb	0.23 to 1	Apply just after planting or drag-off but before crop emerges. Weeds may be emerged at time of application. On sand soils or sensitive varieties, do not exceed 0.67 pound per acre. See label for list of sensitive varieties.
	rimsulfuron, MOA 2 (Matrix, Pruvin) 25 WDG	1 to 1.5 oz	0.016 to 0.023	Apply after drag-off or hilling but before potatoes and weeds emerge. If emerged weeds are present, add surfactant. See label for specific rate. Can be tank mixed with Eptam, Prowl, Sencor, Lorox, or Dual Magnum. See label for further instructions.
Broadleaf, weeds and yellow nutsedge	fomesafen, MOA 14 (Reflex) 2 EC	1 pt	0.25	Apply as a preemergence after planting but prior to potato emergence. Do not apply as s pre-plant incorporated application or emerged potato plant severe crop injury may occur. Do not exceed Reflex at 1 pint per acre per season. PHI 70 days.
Broadleaf weeds and nutsedge	imazosulfuron, MOA 2 (League) 0.5 DF	4 to 6.4 oz	0.19 to 0.3	Apply as a preemergence (4 to 6.4 oz per acre) after crop has been planted but prior to emergence or immediately after hilling. Postemergence application (3.2 to 4 oz per acre) may be made after crop has emerged if weeds are less than 3 inches in height. Do not apply League more than 6.4 oz per acre per season. Consult label for sequential application program and crop rotation restrictions. PHI 45 days.
Potato, Irish, Postemergence				
Most annual broadleaf weeds and some annual grasses	metribuzin, MOA 5 (TriCor DF, Dimetric DF and other trade names) 75 WDG	0.33 to 0.67 lb	0.25 to 0.5	Do not use on early maturing smooth-skinned white or red-skinned varieties. Apply only if there have been at least 3 successive days of sunny weather before application. Treat before weeds are 1 inch tall. Treatment may cause some chlorosis or minor necrosis. Do not apply within 60 days of harvest.
	rimsulfuron, MOA 2 (Matrix, Pruvin) 25 WDG	1 to 1.5 oz	0.016 to 0.023	Apply to young actively growing weeds after crop emergence. More effective on small weeds. Add nonionic surfactant at 1 to 2 pints per 100 gallons water. Can be tank mixed with Eptam or Sencor or some foliar fungicides. See label for further instructions. PHI 60 days.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides. Do not apply within 7 days of harvest.
Most emerged weeds	glyphosate, MOA 9 ((numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity. Select 2 EC (Intensity One, Select Max) 1 EC	 6 to 8 oz 9 to 32 oz	 0.094 to 0.125 0.07 to 0.25	Apply postemergence for control of grasses. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 30 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer’s label for specific rates and best times to treat and adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 30 days of harvest.
Pumpkin, Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before crop emergence or transplanting as a band or broadcast treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting or treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray solution or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	**Not registered for use on seeded crop.** Apply prior to transplanting crop. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Pumpkin, Preplant and Preemergence (continued)				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds at least 3 days before seeding or transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Morningglory and small pigweed < 1 inch	pyraflufen ethyl, MOA 14 (ET Herbicide) 0.208 L	1 to 2 oz	0.016 to 0.0032	**Bareground.** Wait 1 day following preplant burndown application before planting. **Plasticulture.** May apply over mulch; however, a single 0.5 inch irrigation/rain event plus a 7-day waiting period is needed before transplanting.
Palmer amaranth, redroot pigweed, smooth pigweed, galinsoga sp., black nightshade, Eastern black nightshade, common purslane, partial control of yellow nutsedge	fomesafen, MOA 14 (Reflex) 2 EC	8 to 10 oz	0.13 to 0.16	A Section 24(c) North Carolina Local Need Label must be obtained at syngenta-us.com/labels/indemnified-label-login prior to this use. **Bareground transplants.** Prepare land for planting; apply Reflex; lightly irrigate to activate herbicide and move it into soil; and then prepare plant holes and plant.
Annual grasses and some small-seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Registered for cucurbit vegetable group (Crop grouping 9). Apply preplant and incorporate into the soil 1 to 2 inches (1 inch incorporation is optimum) with a rototiller or tandem disk or apply to the soil surface after seeding and follow with irrigation. Check replant restrictions for small grains on label. See label for use rate if Prefar 4 EC is used.
	ethalfluralin, MOA 3 (Curbit) 3 EC	3 to 4.5 pt	1.1 to 1.7	Apply postplant to seeded crop prior to crop emergence, or as a banded spray between rows after crop emergence or transplanting. See label for timing. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. Do not use under mulches, row covers, or hot caps. Under conditions of unusually cold or wet soil and air temperatures, crop stunting or injury may occur. Crop injury can occur if seeding depth is too shallow.
	ethalfluralin, MOA 3 + clomazone, MOA 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after crop seeding for preemergence control of weeds. **Do not apply prior to planting the crop. Do not soil incorporate**. May also be used as a **banded** treatment **between** rows after crop emergence or transplanting.
Yellow and purple nutsedge suppression, non-ALS resistant pigweed, wild radish, and ragweed	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	**Direct-seeded pumpkin or winter squash:** Apply after seeding but prior to soil cracking. **Transplanted pumpkin and winter squash:** Apply 7 days prior to transplanting. See label for specific rate. See label for crop rotational restrictions and other information. **Post Transplant in pumpkin and winter squash:** Can be applied as an over-the-top application, a directed spray application, or with crop shields. Apply to transplants that are established, actively growing and in the 3 to 5-true leaf stages or no sooner than 14 days after transplanting unless local conditions demonstrate safety at an earlier interval, but before first female flowers appear. **Row middle/furrow applications in direct-seeded and transplant pumpkin and winter squash:** Apply between rows of direct-seeded or transplanted crop while avoiding contact of the herbicide with the planted crop. If plastic is used on the planted row, adjust equipment to keep the application off the plastic. Reduce rate and spray volume in proportion to area actually sprayed. Rate can be increased to 1 oz per acre if needed for row middle/furrow applications.
Annual broadleaf, grass and yellow nutsedge	*S*-metolachlor, MOA 15 (Brawl™, Dual Magnum)	1 to 1.33 pt	0.95 to 1.26	Apply as interrow or interhill application. Leave a 1-foot untreated area over the seeded row (6 in. on either side of the row). **Application made as a broadcast spray over the planted row or hill or directly to crop foliage will increase the risk of injury to the crop.** Apply before weeds emerge. See label for further instructions.
Pumpkin, Postemergence				
Yellow and purple nutsedge suppression, non-ALS resistant pigweed, wild radish, and ragweed	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	**Direct-seeded pumpkin and winter squash:** Apply after crop has reached the 2 to 5-true leaf stage, preferably 4 to 5 true leaves, but before first female flowers appear. Do not apply within 30 days of harvest. **Post Transplant in pumpkin and winter squash:** Can be applied as an over-the-top application, a directed spray application, or with crop shields. Apply to transplants that are established, actively growing and in the 3 to 5-true leaf stages or no sooner than 14 days after transplanting unless local conditions demonstrate safety at an earlier interval, but before first female flowers appear. Do not apply within 30 days of harvest. **Row middle/furrow applications in direct-seeded and transplant pumpkin or winter squash:** Apply between rows of direct-seeded or transplanted crop while avoiding contact of the herbicide with the planted crop. If plastic is used on the planted row, adjust equipment to keep the application off the plastic. Reduce rate and spray volume in proportion to area actually sprayed. Rate can be increased to 1 oz per acre if needed for row middle/furrow applications. Do not apply within 30 days of harvest.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC (Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of grasses. See label for adjuvant and rate. Adding crop oil concentrate may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. See label for adjuvant and rate. Crop oil may increase the likelihood of crop injury at high temperatures and high humidity. Do not apply within 14 days of harvest.
Pumpkin, Row Middles				
Annual grasses and some small- seeded broadleaf weeds	trifluralin, MOA 3 (Treflan) 4 EC (Treflan HFP) 4 EC	1 to 1.5 pt	0.5 to 0.75	**Row middles.** To improve preemergence control of late emerging weeds. Apply after emergence when crop plants have reached the 3 to 4-true leaf stage of growth. Apply as a directed spray to soil between the rows. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 30 days of harvest.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides. PHI 0 days.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Sandea, Profine 75) 75 DG	0.5 to 1 oz	0.024 to 0.048	**Row middles.** Apply to row middles as a postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution.
Radish, Preplant				
Annual and perennial grass and broadleaf weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before planting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations may require addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Emerged broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows, as a harvest aid or desiccant, or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Annual grasses and broadleaf weeds	trifluralin, MOA 3 (Treflan, Treflan HFP, Trifluralin, Trifluralin HF) 4 EC	1 to 1.5 pt	0.5 to 0.75	Apply preplant and incorporate immediately after application for preemergence weed control. Low rate should be used on coarse-textured soil.
Radish, Postemergence				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Annual and perennial grasses	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 8 oz 9 to 16 oz	0.94 to 0.125 0.07 to 0.125	Apply postemergence to emerged grasses. See label for rates for specific grasses. See label for adjuvant and rate. Do not spray within 15 days of harvest.
Spinach, Preemergence				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before crop emergence. Do not feed residue to livestock for 8 weeks. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses (crabgrass spp., foxtail spp., barnyardgrass, annual ryegrass, annual bluegrass) and broadleaf weeds (Lamium spp., lambsquarters, common purslane, redroot pigweed, shepherdspurse)	cyclohexylethylthio-carbamate, MOA 3 (Ro-Neet) 6E	2 qt	3	Use on sandy mineral soils only. Read label for further instructions.
Annual grass and broadleaf weeds, Palmer amaranth, yellow nutsedge suppression	*S*-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	0.33 to 0.67 pt	0.32 to 0.65	This is a section 24(c) North Carolina Special Local Need Label. Growers must obtain label from syngenta-us.com/labels/indemnified-label-login. Apply to the soil surface as a preemergence application prior to crop and weed emergence. Only one application of Dual Magnum is permitted per spinach growing season on the same ground in one calendar year or illegal residues may occur. PHI = 50 days. **Note:** Applications of Dual Magnum Herbicide may cause significant injury to spinach resulting in reduced yields. This product is available to the end user/grower solely to the extent that the benefit and utility, in the opinion of the end user/grower, outweigh the extent of potential injury associated with the use of this product. Due to the risk of crop damage, all such use is at the end user/grower's risk. See label for further information.
Spinach, Postemergence				
Broadleaf weeds including sowthistle clover, cocklebur, jimsonweed, and ragweed	clopyralid, MOA 4 (Stinger) 3 EC	0.17 to 0.33 pt	0.0625 to 0.125 lb	Apply to spinach in the 2 to 5-leaf stage when weeds are small and actively growing. Will control most legumes. See label for more precautions. Do not apply within 21 days of harvest.
Broadleaf weeds	phenmedipham, MOA 5 (Spin-aid) 1.3 EC	3 to 6 pt	0.5 to 1	**For processing spinach only.** Do not use when expected high temperatures will be above 75ºF. For best results, spray when weeds are in the 2-leaf stage. Use the 6-pints rate only on well-established crops that are not under stress. Do not apply within 21 days of harvest. Spinach plants must have more than 6 true leaves.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Spinach, Postemergence (continued)				
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. See label for adjuvant and rate. Adding crop oil to Poast or Select may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply sethoxydim within 15 days of harvest or clethodim within 14 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC	6 to 8 oz	0.094 to 0.125	
	(Intensity One, Select Max) 1 EC	9 to 16 oz	0.07 to 0.125	
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Squash, Preplant and Preemergence				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Apply before crop emergence and control emerged weeds. There is no residual activity. May be tank mixed with soil residual compounds. See label for instruction. May also be used as a banded spray between row middles. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before transplanting or crop emergence as a band or broadcast treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting or treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Not registered for seeded crop. Apply prior to transplanting crop. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds at least 3 days before seeding or transplanting. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 inch natural rainfall or by applying water via a sprinkler system. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Emerged broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Morningglory and small pigweed < 1 inch	pyraflufen ethyl, MOA 14 (ET Herbicide) 0.208 L	1 to 2 oz	0.0016 to 0.0032	**Bareground.** Wait 1 day following preplant burndown application before planting. **Plasticulture.** May apply over mulch, however, a single 0.5 inch irrigation/rain event plus a 7-day waiting period is needed before transplanting.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA Unknown (Prefar) 4 EC	5 to 6 qt	5 to 6	Registered for cucurbit vegetable group (Crop grouping 9). Apply preplant and incorporate into the soil 1 to 2 inches (1 inch incorporation is optimum) with a rototiller or tandem disk or apply to the soil surface after seeding and follow by irrigation. Check replant restrictions for small grains on label.
	ethalfluralin, MOA 3 (Curbit) 3 EC	1.5 to 2 pt	0.56 to .75	**For squash grown on bare ground only.** Apply to the soil surface immediately after seeding. Seed must be covered with soil to prevent crop injury. For coarse-textured soils, use lowest rate of rate range. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. If weather is unusually cold or soil wet and cold, crop stunting or injury may occur. Crop injury can also occur if seeding depth is too shallow. See label for further precautions and instruction.
		3 to 4.5 pt	1.1 to 1.7	**For squash grown on plastic only.** Apply to soil surface between the rows of black plastic immediately after seeding or transplanting. **Do not use under mulches, row covers, or hot caps.** Do not apply prior to planting or over plastic. See label for further instruction.
Annual grasses and broadleaf weeds	ethalfluralin, MOA 3 + clomazone, 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after crop seeding for preemergence control of weeds. **Do not apply prior to planting crop. Do not soil incorporate**. May also be used as a **banded** treatment **between** rows after crop emergence or transplanting.
Suppression of annual grasses and broadleaf weeds; weak on pigweed and morningglory	clomazone, MOA 13 (Command) 3 ME	0.67 to 1.3 pt	0.25 to 0.48	Apply immediately after seeding or prior to transplanting. Seeds and roots of transplants must be below the chemical barriers when planting. Command should only be applied between rows when squash is grown on plastic. Some cultivars may be sensitive to Command (see label). Use lower rates on coarse soils. Higher rates can be used on winter squashes. See label about rotation restrictions.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Squash, Preplant and Preemergence (continued)				
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Sandea, Profine 75) 75 DG	0.5 to 1 oz	0.024 to 0.048	**Row middles only.** Apply to row middles as preemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution. **WINTER SQUASH: Direct seeded:** Apply 0.5 to 0.75 ounce per acre Sandea as preemergence after planting, but before soil cracking **OR** postemergence after crop has reached 2 to 5-true leaf stage, but before first female flowers appear. **Transplanted:** Apply 0.5 to 0.75 ounce per acre Sandea prior to transplant. Transplanting should not be made sooner than 7 days after application. May be applied after crop emergence over the top of the crop when plants reach the 4- to 5-true leaf stage but before first female flowers appear. See label for further instructions.
Squash, Postemergence				
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan) 4 EC (Treflan HFP) 4 EC	1 to 1.5 pt	0.5 to 0.75	**Row middles only.** To improve preemergence control of late emerging weeds. **Apply as a directed spray to soil between rows after crop emergence when crop plants have reached** 3 to 4-true leaf stage of growth. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 30 days of harvest. Will not control emerged weeds.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides. PHI 0 days.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Sandea, Profine 75) 75 DG	0.5 to 1 oz	0.024 to 0.048	**Row middles only.** Apply to row middles as postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of grasses. See label for adjuvant and rate. Adding crop oil may increase likelihood of crop injury at high air temperatures and high humidity. Very effective control of annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
	sethoxydim, MOA 1 (Poast)1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply Poast on days that are unusually hot and humid. Do not apply within 14 days of harvest.
Sweetpotato, Preplant				
Annual and perennial grass and broadleaf weeds, stale seed bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds before transplanting. Perennial weeds may require higher glyphosate rates. Consult label for rates for specific weeds. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application in propagation beds after seed roots are planted and covered but before crop emergence, as a directed and shielded application between rows, as a harvest aid or desiccant, or as a post-harvest application. Use 3% solution for easy-to-kill weeds, less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Palmer amaranth, redroot pigweed, smooth pigweed, Galinsoga sp., black nightshade, Eastern black nightshade, common purslane, partial control of yellow nutsedge	fomesafen, MOA 14 (Reflex) 2 EC	1 pt	0.25	This is a Section 24(c) special local needs label for sweetpotato in North Carolina. Growers must obtain the label at syngenta-us.com/labels/indemnified-label-login prior to making an application of Reflex. **See label for further instructions.** **Carryover is a large concern; see label for more information.** Apply prior to transplanting for preemergence control. May be tank-mixed with other herbicides registered for preplant application **however do not tank mix with flumioxazin.**
Annual broadleaf weeds including Palmer amaranth and other pigweeds, smartweed, morningglory, wild mustard, wild radish, common purslane, common lambsquarters	flumioxazin, MOA 14 (Valor SX, Chateau) 51 WDG	3 oz	0.094	Apply prior to transplanting crop. Do not incorporate. Movement of soil during transplanting should not occur or reduced weed control may result. Do not apply postemergence or serious crop injury will occur. Do not use on transplant propagation beds. See label for further instructions. Do not tank mix with fomesafen.
Sweetpotato, Preemergence				
Annual grass and broadleaf weeds, Palmer amaranth, yellow nutsedge suppression	*S*-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	0.75 pt	0.7 to 0.96	This is a Section 24(c) Special Local Needs Label. Growers must obtain label from syngenta-us.com/labels/indemnified-label-login. Apply over top of sweetpotatoes after transplanting but prior to weed emergence. Do not apply preplant. Do not incorporate after application. Injury potential is greatest when applied to sands or loamy sands especially if a heavy rainfall event occurs following application. See label for further information.
Annual grasses such as large crabgrass and broadleaf weeds including velvetleaf, purslane, prickly sida	clomazone, MOA 13 (Command) 3 ME	Up to 2 pt	Up to 0.75	Apply preplant or after transplanting prior to weed emergence for preemergence control. Weak on pigweed. The label allows up to 4 pt per acre. See label for other instructions and precautions.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Sweetpotato, Preemergence (continued)				
Annual grasses including large crabgrass and broadleaf weeds including purslane, Florida pusley, common lambsquarters	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	8 to 10 lb 8 to 10 pt	6 to 7.5	Apply to the soil surface immediately after transplanting. May also be applied at layby for preemergence weed control late in the growing season. Do not apply in plant beds or crop injury will occur.
Annual grasses including crabgrass, foxtail, goosegrass, fall panicum and broadleaf weeds including pigweed, Florida pusley, purslane	napropamide, MOA Unknown (Devrinol, Devrinol DF-XT) 50 DF (Devrinol, Devrinol 2-XT) 2 EC	2 to 4 lb 2 to 4 qt	1 to 2	**Plant Beds.** Apply to the soil surface after sweetpotato roots are covered with soil but prior to soil cracking and sweetpotato plant emergence. Does not control emerged weeds. Check label for more information. **Production Fields.** Apply to the soil surface immediately after transplanting. If rainfall does not occur within 24 hr, shallow incorporate or irrigate with sufficient water to wet the soil to a depth of 2 to 4 inches Check label for more information. See XT labels for information regarding delay in irrigation event.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 16 oz 9 to 32 oz	0.094 to 0.25 0.07 to 0.25	Apply to actively growing grasses not under drought stress. See label for adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Do not apply within 30 days of harvest.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 12 oz	0.1 to 0.188	Apply to actively growing grasses not under drought stress. Consult manufacturer's label for specific rates and best times to treat and adjuvant and rate. Do not apply Fusilade on days that are unusually hot and humid. Do not apply within 14 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to actively growing grasses not under drought stress. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 30 days of harvest.
Sweetpotato, Row Middles				
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 ((numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed roots, or other parts of crop. May cause cracking of sweetpotato storage roots if spray solution comes in contact with sweetpotato foliage. Do not apply within 14 days of harvest.
Tomato, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch; however, adhere to label guidelines on crop plant back interval. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information. Chloropicrin (150 pounds per acre broadcast) will also be needed when laying first crop mulch to control nutsedge.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	**Transplanted crop: Apply no later than 1 day before transplanting.** **Seeded crop (Aim 2EC only): Apply no later than 7 days before planting seeded crop.** Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Gramoxone SL) 3 SL (Various Brands) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply to emerged weeds in a minimum of 10 gallons spray mix per acre before crop emergence as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.
Broadleaf weeds including Carolina geranium and cutleaf eveningprimrose and a few annual grasses	oxyfluorfen, MOA 14 (Goal) 2 XL	Up to 2 pt	0.5	**Plasticulture only.** Apply to soil surface of pre-formed beds at least 30 days prior to transplanting crop. While incorporation is not necessary, it may result in less crop injury. Plastic mulch can be applied any time after application, but best results are likely if applied soon after application.
Annual grasses and small-seeded broadleaf weeds including common lambsquarters, pigweed, carpetweed, and common purslane	napropamide, MOA Unknown (Devrinol, Devrinol DF-XT) 50 DF (Devrinol, Devrinol 2-XT) 2 EC	2 to 4 lb 2 to 4 qt	1 to 2	**Bare ground:** Apply preplant and incorporate into the soil 1 to 2 inches as soon as possible with a rototiller or tandem disk. Can be used on direct-seeded or transplanted tomatoes. See label for instructions on use. **Plasticulture:** Apply to a weed-free soil before laying plastic mulch. Soil should be well worked yet moist enough to permit a thorough incorporation to a depth of 2 inches. Mechanically incorporate or irrigate within 24 hours after application. If weed pressure is from small seeded annuals, apply to the surface of the bed immediately in front of the laying of plastic mulch. If soil is dry, water or sprinkle irrigate with sufficient water to wet to a depth of 2 to 4 inches before covering with plastic mulch. **Between rows:** Apply to a weed free soil surface between the rows (bareground or plastic mulch). Mechanically incorporate or irrigate Devrinol into the soil to a depth of 1 to 2 inches within 24 hours of application. See XT labels for information regarding delay in irrigation event.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Tomato, Preplant (continued)				
Annual grasses and small-seeded broadleaf weeds including common lambsquarters, pigweed, carpetweed, and common purslane (continued)	pendimethalin, MOA 3 (Prowl H_2O) 3.8 CS	1 to 3 pt	0.5 to 1.5	**Plasticulture In-row:** May be applied as a preplant surface application or a preplant incorporated application prior to transplanting tomato. Limited research has been conducted in NC. **Bareground In-row:** May be applied as a broadcast preplant surface application or preplant incorporated application prior to transplanting tomato. **Post-directed spray:** May be applied as a post-directed spray on the soil at the base of the plant, beneath plants, and between rows. Avoid direct contact with tomato foliage or stems. Do not apply over the top of tomato. Do not apply within 21 days of harvest. Do not apply more than 3 pt per acre per season. See label for specific use rate for your soil type. Emerged weeds will not be controlled. See label for further instructions and precautions.
	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF, various other trade names),) 4 EC	1 pt	0.5	**Transplant tomato.** Apply pretransplant and incorporate into the soil 2 to 3 inches within 8 hr using a rototiller or tandem disk. Can be applied post-plant as a directed spray to soil between the rows and beneath plants and then incorporated. Not suggested for mulch systems.
Yellow and purple nutsedge and broadleaf weeds including non-ALS resistant pigweed, wild radish, common ragweed, suppression of purslane	halosulfuron-methyl, MOA 2 (Profine, Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048	For pretransplant application under plastic mulch, apply to pre-formed bed just prior to plastic mulch application and delay transplanting at least 7 days. Can be applied for pretransplant application in bareground tomato. Early season application will give postemergence and preemergence control. The 1 ounce rate is for preemergence and postemergence control in row middles only. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution. Do not apply within 30 days of harvest.
Yellow nutsedge, annual grasses, and broadleaf weeds including pigweed, Palmer amaranth, Florida pusley, Hairy galinsoga, Eastern black nightshade, and carpetweed	*S*-metolachlor, MOA 15 (Brawl, Dual Magnum) 7.62 EC	1 to 2 pt	0.95 to 1.50	Apply preplant or postdirected to transplants after the first settling rain or irrigation. In plasticulture, apply to preformed beds just prior to applying plastic mulch. Lower rates of rate range for *S*-metolachlor are safest to tomato. May also be used to treat row middles in bedded tomato. Minimize contact with crop. Do not apply within 30 days of harvest if total amount of Dual Magnum applied does not exceed 1.33 pt/A/year; Do not apply within 90 days of harvest if total amount of Dual Magnum applied is greater than 1.33/ ptA/year. Also registered for use in row middles, and in seeded crop. See label for further instructions.
Palmer amaranth, redroot pigweed, smooth pigweed, Galinsoga sp., black nightshade, Eastern black nightshade, common purslane, partial control of yellow nutsedge	fomesafen, MOA 14 (Reflex) 2 EC	1 to 1.5 pt	0.25 to 0.375	This is a Section 24(c) special local needs label for transplanted tomato in North Carolina. Growers must obtain the label at syngenta-us.com/labels/indemnified-label-login prior to making an application of Reflex. **See label for further instructions.** **Plasticulture In-row Application for Transplanted Tomato.** Apply after final bed formation and the drip tape is laid but prior to laying plastic mulch. Avoid soil disturbance after application. Unless restricted by other products such as fumigants, tomato may be transplanted immediately following the application of Reflex and the application of the mulch. **Bareground for Transplanted Tomato.** Apply pretransplant up to 7 days prior to transplanting tomato. Weed control will be reduced if soil is disturbed after application. During the transplanting operation, make sure the soil in the transplant hole settles flush or above the surrounding soil surface. Avoid cultural practices that may concentrate Reflex-treated soil around the transplant root ball. An overhead irrigation or rainfall event between Reflex herbicide application and transplanting will ensure herbicide activation and will likely reduce the potential for crop injury due to splashing. **Plasticulture Row Middle Application.** Apply to row middles with a hooded or shielded sprayer. Avoid drift of herbicide on mulch. If drift occurs, 0.5 inch of rain or irrigation must occur prior to transplanting. **Do not harvest tomatoes within 70 days of a Reflex application.** **Carryover is a large concern; see label for more information.**
Annual grasses and broadleaf weeds including jimsonweed, common ragweed, smartweed, and velvetleaf	metribuzin, MOA 5 (TriCor DF, Metribuzin, Dimetric) 75 WDG (Dimetric) 3 F	0.33 to 0.67 lb 0.67 to 1 pt	0.25 to 0.5	Apply to soil surface and incorporate 2 to 4 inches deep before transplanting. See label for instructions. Place tomato transplant roots below herbicide layer to avoid injury. Use lower rate when on sands or if it is cool/wet.
Broadleaf weeds including Carolina geranium and cutleaf eveningprimrose and a few annual grasses	oxyfluorfen, MOA 14 (Goal) 2XL (GoalTender) 4 F	Up to 2 pt Up to 1 pt	0.5	**Plasticulture (fallow beds) only.** Apply to soil surface of pre-formed beds at least 30 days prior to transplanting crop. While incorporation is not necessary, it may result in less crop injury. Plastic mulch can be applied any time after application, but best results are likely if applied soon after application.
Broadleaf, grass (suppression), yellow nutsedge (PRE or POST), purple nutsedge (POST only)	imazosulfuron, MOA 2 (League) 0.5 DF	4 to 6.4 oz	0.19 to 0.3	Apply to planting beds before plastic is laid. Tomato may be transplanted 1 day after application. Postemergence application may be made on direct-seeded plants that are well established (4- to 5-leaf stage) and in transplanted tomato 3 to 5 days after transplanting and through the early bloom stage if a preplant application was not applied. Consult label for approved surfactants and crop rotation restrictions. PHI 21 days.
Common lambsquarters, ivyleaf morningglory, redroot pigweed, and yellow nutsedge	sulfentrazone, MOA 14 (Spartan, Helm, Sulfentrazone) 4 F	2.25 to 8 oz	0.07 to 0.25	**Transplant.** Pretransplant application. Application rate depends on soil type.
Tomato, Postemergence				
Annual grasses and small-seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	6 to 10 lb 6 to 10 pt	4.5 to 7.5	Apply over the top of transplants only between 4 to 6 weeks after transplanting to improve preemergence control of late emerging weeds. Will not control emerged weeds.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Sandea, Profine 75) 75 DG	0.5 to 1 oz	0.024 to 0.048	Apply no sooner than 14 days after transplanting. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution. Some weeds, such as nutsedge, may require 2 applications of Sandea; if a second application is needed, spot-treat only weed-infested areas. Do not apply within 30 days of harvest. See label for further instructions.
Annual grasses and broadleaf weeds, including cocklebur, common ragweed, smartweed, velvetleaf, jimsonweed, yellow nutsedge, and morningglory	metribuzin, MOA 5 (TriCor DF, Metribuzin) 75 WDG	0.33 to 1.33 lb	0.25 to 1	Use either as a broadcast or directed spray but do not exceed 0.5 pound a.i. with a broadcast spray. Do not apply within 7 days of harvest. Do not exceed 1 pound a.i. per year. Do not apply as a broadcast spray unless 3 sunny days precede application.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Tomato, Preplant (continued)				
Most broadleaf weeds including wild radish, common purslane, redroot and smooth pigweed	rimsulfuron, MOA 2 (Matrix) 25 WDG (Pruvin) 25 WDG	1 to 2 oz	0.25 to 0.5	Apply in tomatoes after the crop has at least 2 true leaves and weeds are small (1 inch or less) and actively growing. Add nonionic surfactant at 1 quart per 100 gallons of spray solution. Do not apply within 45 days of tomato harvest. See label for further instruction.
Yellow nutsedge, morningglory, common cocklebur, common lambsquarters, and other broadleaf weeds	trifloxysulfuron-sodium, MOA 2 (Envoke) 75 DG	0.1 to 0.2 oz	0.0047 to 0.0094	Apply post-directed to tomato grown on plastic for control of nutsedge and certain broadleaf weeds. Crop should be transplanted at least 14 days prior to application. The application should be made prior to fruit set and at least 45 days prior to harvest. Use nonionic surfactant at 1 quart per 100 gallons spray solution with all applications.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max, Intensity One) 1 EC	6 to 16 fl oz 9 to 32 oz	0.094 to 0.25 0.07 to 0.25	Apply to actively growing grasses not suffering from drought stress. See label for specific adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Do not apply within 20 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to actively growing grasses not under drought stress. See label for specific adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 20 days of harvest.
Tomato, Row Middles				
Yellow nutsedge, morningglory, common cocklebur, common lambsquarters, and other broadleaf weeds	trifloxysulfuron-sodium, MOA 2 (Envoke) 75 DG	0.1 to 0.2 oz	0.0047 to 0.0094	Crop should be transplanted at least 14 days prior to application. Use nonionic surfactant at 1 quart per 100 gallons spray solution with all applications. The application should be made prior to fruit set and at least 45 days prior to harvest. See label for information on registered tank mixes. Tank mixtures with Select or Poast may reduce grass control. See label for more information.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine, Sandea) 75 DG)	0.5 to 1 oz	0.024 to 0.048	For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution. Some weeds, such as nutsedge, may require 2 applications of Sandea; if a second application is needed, spot-treat only weed-infested areas. Do not apply within 30 days of harvest. See label for further instructions.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides. PHI 0 days.
Annual grasses and small-seeded broadleaf weeds	napropamide, MOA Unknown (Devrinol, Devrinol DF-XT) 50 DF (Devrinol, Devrinol 2-XT) 2 EC	2 to 4 lb 2 to 4 qt	1 to 2	**Plasticulture:** Apply to a weed-free soil surface. Apply within 24 hours of rainfall, or mechanically incorporate or irrigate into the soil to a depth of 1 to 2 inches
	pendimethalin, MOA 3 (Prowl H_2O) 3.8	1 to 3 pt	0.5 to 1.5	Post-directed spray on the soil at the base of the plant, beneath plants and between rows. Avoid direct contact with tomato foliage or stems. Do not apply more than 3 pints per acre per season. See label for specific use rate for your soil type. Emerged weeds will not be controlled. Avoid direct contact with tomato foliage or stems. Do not apply within 21 days of harvest. See label for further instructions and precautions.
Contact kill of all green foliage	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 pt	0.5 to 1	Apply for control of emerged weeds between rows of tomatoes. Do not allow spray to contract crop or injury will occur. Do not make more than 3 applications per season. Do not apply within 30 days of harvest. See label for further instructions.
Watermelon, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 inches apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone SL) 3 SL	1.3 to 2.7 pt	0.5 to 1	Apply in a minimum of 10 gallons spray mix per acre to emerged weeds before crop emergence or transplanting as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 2 pints per 100 gallons spray mix or 1 gallon approved crop oil concentrate per 100 gallons spray mix.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	**Transplants only.** Apply prior to transplanting of crop. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply to emerged weeds at least 3 days before seeding or transplanting. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 inch natural rainfall or by applying water via a sprinkler system. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Emerged broadleaf weeds and some annual grasses	caprylic acid + capric acid, MOA (Homeplate)	See label	See label	May be applied prior to planting as a burndown treatment for emerged weeds, as a preemergence application after seeding but before emergence, as a directed or shielded application between rows or as a post-harvest application. Use 3 to 6% solution for weeds less than 5 inches tall; 3 to 6% solution for larger perennial weeds and grasses; 5 to 9% solution for tough to kill weeds, vines. Apply at 35 to 400 gallons per acre. Use higher spray volumes for high weed density and weeds larger than 5 inches. Coverage is important for acceptable weed control. May be tank mixed with other herbicides. See label for further instructions.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Watermelon, Preplant (continued)				
Morningglory and small pigweed < 1 inch	pyraflufen ethyl, MOA 14 (ET Herbicide) 0.208 L	1 to 2 oz	0.0016 to 0.0032	**Bareground.** Wait 1 day following preplant burndown application before planting. **Plasticulture.** May apply over mulch; however, a single 0.5 inch irrigation/rain event plus a 7-day waiting period is needed before transplanting.
Emerged broadleaf and grass weeds	pelargonic acid, MOA Unknown (Scythe) 4.2 EC	See label	See label	Apply as a preplant burndown treatment, or prior to crop emergence from seed, or as a directed or shielded spray between beds. Avoid contact of watermelon foliage.
Annual grasses	bensulide, MOA Unknown (Prefar) 4 E	5 to 6 qt	5 to 6	Registered for cucurbit vegetable group (Crop grouping 9). Apply preplant and incorporate into the soil 1 to 2 inches (1 inch incorporation is optimum) with a rototiller or tandem disk or apply to the soil surface after seeding and follow with irrigation. Check replant restrictions for small grains on label.
Watermelon, Preplant or Preemergence				
Palmer amaranth, redroot pigweed, smooth pigweed, galinsoga sp., black nightshade, Eastern black nightshade, common purslane, partial control of yellow nutsedge	fomesafen, MOA 14 (Reflex) 2 EC	10 to 12 oz	0.16 to 0.19	This is a Section 24(c) Special Local Needs Label for watermelon in North Carolina. Growers must obtain the label at syngenta-us.com/labels/indemnified-label-login prior to making an application of Reflex. **See label for further instructions.** **Plasticulture transplants or seeds.** May apply under plastic mulch as long as plastic laying process does not disturb treated soil; thus, do not apply prior to laying drip or forming bed. May apply over plastic mulch as long as the mulch is washed with 0.5" rainfall/irrigation in a single event prior to punching holes and planting; bed formation must allow herbicide to wash off the mulch and not concentrate in low areas on the mulch. **Bareground transplant.** Prepare land for planting; apply Reflex; lightly irrigate to activate herbicide and move it into soil; and then prepare plant holes and plant. **Bareground seeded.** Apply within 1 day of planting; lightly irrigate after application but at least 36 hours prior to emergence. **Row middles.** Must apply prior to crop emergence or transplanting. May use up to 16 oz/A in watermelon. **Carryover is a large concern; see label for more information.**
Watermelon, Preemergence				
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3 ME	0.4 to 0.67 pt	0.15 to 0.25	Apply immediately after seeding, or just prior to transplanting. Roots of transplants must be below the chemical barrier when planting. Offers weak control of pigweed. See label for further instructions.
Annual grasses and some small-seeded broadleaf weeds	ethalfluralin, MOA 3 (Curbit) 3 EC	3 to 4.5 pt	1.1 to 1.7	Apply postplant to seeded crop prior to crop emergence, or as a banded spray between rows after crop emergence or transplanting. See label for timing. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. Do not use under mulches, row covers, or hot caps. Under conditions of unusually cold or wet soil and air temperatures, crop stunting or injury may occur. Crop injury can occur if seeding depth is too shallow.
Annual grasses and broadleaf weeds	ethalfluralin, MOA 3 + clomazone, MOA 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to soil surface immediately after crop seeding for preemergence control of weeds. **Do not apply prior to planting. Do not incorporate. Do not apply under mulch.** May also be used as a banded treatment between rows after crop emergence or transplanting.
Broadleaf weeds	terbacil, MOA 5 (Sinbar) 80 WP	2 to 4 oz	0.1 to 0.2	Apply after seeding but before crop emerges, or prior to transplanting crop. With plasticulture, Sinbar may be applied preemergence under plastic mulch or to row middles. May be applied over plastic mulch prior to transplanting, or prior to punching holes into the plastic mulch for transplanting. However, Sinbar must be washed off the surface of the plastic mulch with a minimum of 0.5 inch of rainfall or irrigation prior to punching transplant holes or transplanting watermelon. Do not apply within 70 days of harvest. See label for further instructions.
Yellow and purple nutsedge suppression, pigweed and ragweed control	halosulfuron-methyl, MOA 2 (Profine 75, Sandea) 75 DG	0.5 to 0.75 oz 0.5 to 1 oz	0.024 to 0.036 0.024 to 0.048	**Bareground.** Apply after seeding but before cracking or prior to transplanting crop. **Plasticulture.** Application may be made to preformed beds prior to laying plastic. If application is made prior to planting, wait 7 days after application to seed or transplant. Stunting may occur but should be short lived with no negative effects on yield or maturity in favorable growing conditions. **See label for information on rotation and other restrictions.** **Row middles only.** Apply to row middles as a preemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 57 days of harvest. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution.
Watermelon, Postemergence				
Annual grasses and some small seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	8 to 10 lb 8 to 10 pt	6 to 7.5	**Not labeled for transplanted crop.** To improve preemergence control of late emerging weeds, apply only when crop has 4 to 5 true leaves, is well-established, and growing conditions are favorable. Will not control emerged weeds. Incorporation not recommended.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of emerged grasses. See label for adjuvant and rate. Adding crop oil may increase the likelihood of crop injury at high air temperatures and high humidity. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. See label for adjuvant and rate. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures and high humidity. Do not apply within 14 days of harvest.

Table 7-16. Chemical Weed Control in Vegetable Crops

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Watermelon, Row Middles				
Annual grasses and some small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF) 4 EC	1 to 2 pt	0.5 to 0.75	To improve preemergence control of late emerging weeds. Apply when watermelon plants have reached the 3 to 4-true leaf stage of growth. Apply as a directed spray to soil between the rows. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 60 days of harvest.
Broadleaf weeds	terbacil, MOA 5 (Sinbar) 80 WP	2 to 4 oz	0.1 to 0.2	With plasticulture, Sinbar may be applied to row middles. Do not apply within 70 days of harvest. See label for further instructions.
Most broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter; does not control grasses	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	See comments on resistance management in TABLE 7-10. Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or postharvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75, Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048	Apply to row middles as a postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. For postemergence applications, use nonionic surfactant at 1 quart per 100 gallons of spray solution. Do not apply within 57 days of harvest.
Broadleaf weeds and yellow and purple nutsedge	imazosulfuron, MOA 2 (League) 0.5 DF	4 to 6.4 oz	0.19 to 0.3	Apply any time during the cropping season (up to 48 days before harvest), as long as the melons are well established and at least 5 inches wide. Avoid contact with the melon. In plasticulture prevent the spray from contacting the plastic. Consult label for further instructions. PHI = 48 days.

* Mode of action (MOA) code developed by the Weed Science Society of America.

Chemical Weed Control in Forest Stands

Compiled by C. Lambert and R. Bardon, NC State University Forestry and Environmental Resources

With professional assistance by:
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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management.

Table 7-17. Pine Release

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Foliar Spray	Many broadleaf weeds, grasses, and woody species (black locust, cherry, oaks, persimmon, maple, sassafras, sumac, sweetgum, yellow-poplar)	glyphosate, MOA 9 (Rodeo, Aquaneat or Glyphosate 5.4) 5.4# per gallon OR Other brands 1.125 to 1.875 qt 12 to 18 oz OR Dryphosate 75SG (75% soluble granule)	0.75 qt (liquid 5.4#) or 1-2 lb of granular formulation Rate may vary	Use at end of first growing season for first-year plantings after planted pine seedlings buds have hardened off or for site preparation prior to planting. May be tank mixed with Oust XP/'SFM 75 or Arsenal/Imazapyr 4SL or Arsenal AC or Chopper Gen2/Rotary 2SL after planting or with Boulder 6.3 during site preparation. See labels for mix details.
			Use late summer or early fall after conifers have hardened off (second and subsequent growing seasons).	
			Herbaceous release (early season) for loblolly and longleaf pines. May be tank mixed with Oust XP or Arsenal or Arsenal AC for many species. See labels for mix details.	
	Woody plants (oaks, sweetgum, elm, and sumac)	hexazinone, MOA 5 (Tide Hexazinone 2SL)	4 to 6 pt (established trees)	Use spring to early summer. All rates depend on soil type. Use lower rates on coarser soils. See label.
	Many grasses, broadleaf weeds, vines, brambles, woody brush, and trees	imazapyr, MOA 2 Arsenal AC (4#), Arsenal 2NS (2#), Imazapyr 4SL or Polaris AC Complete or Rotary 2 SL (2#)	12 to 20 oz (4# formulation) or 24 to 40 oz (2# formulation) See label for specific rates on Loblolly Pine	See label for rates for specific species of pine. May be tank mixed with Rodeo or other glyphosate products (only loblolly after late summer hardening off), Oust XP, SFM 75, and, for loblolly only, Oust Extra or SFM Extra.
	Many grasses, broadleaf weeds, vines, brambles, woody brush, and trees	imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Rotary 2SL (2#) + metsulfuron methyl, MOA 2 (60%) (MSM 60)	12 to 24 oz 4# imazapyr, or 24-48 oz 2# imazapyr + 0.5-1.0 oz MSM	Labeled for loblolly and slash pines. Can use up to 19 oz for mid rotation release of pines.
	Herbaceous plants (crabgrass, dog fennel, fescue, willowweed [fireweed], goldenrod, horseweed, Kentucky bluegrass, yellow nutsedge, panicums [broadleaf, fall, narrow], pokeweed, ragweed, white snakeroot, and yellow sweetclover)	sulfometuron methyl, MOA 2 (Oust XP 75% or Spyder or SFM 75)	2 to 8 oz	Rates depend on soil type and species. Labeled for loblolly, slash, longleaf, Virginia, and white pines. May be tank mixed with Velpar or Arsenal for some species. See labels. Do not exceed 8 oz per acre per year.
	Many annual grasses and broadleaf weeds	hexazinone, MOA 5 63.2% + sulfometuron methyl, MOA 2 11.8% (Oustar or SFM 75)	10 to 19 oz (first-year control) + 12 to 24 oz (after first year)	Use spring to early summer. All rates depend on soil type. For loblolly, slash, and longleaf pine only. See labels.
	Certain hardwoods, weeds, and grasses	sulfometuron methyl, MOA 2 (15%) + metsulfuron methyl, MOA 2 (56.25%) (Oust Extra or Spyder Extra or SFM Extra)	2.66 to 4 oz	Loblolly and slash only. May be tank mixed with Arsenal AC or other Imazapyr products for loblolly only. Use lower rates on coarser soils.
	Herbaceous weeds	imazapyr, MOA 2, (Arsenal 2NS (2#) or Arsenal AC (4#), Imazapyr 4SL or Polaris AC Complete)	8 to 20 oz 4 to 10 oz 4 to 10 oz	May be tank mixed with Oust or SFM 75 see label for rates for specific species of pine.

Table 7-17. Pine Release

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Foliar Spray (continued)	Broadleaf herbaceous plants such as bedstraw, hemp dogbane, sericea lespedeza, cocklebur, coffeeweed, common and giant ragweed, dog fennel, grape, marestail, morning glory, goldenrod, blackberry, ironweed, wild carrot, common mullein, mustard, vetch, and prickly pear cactus.	fluroxypyr MOA 4, (Vista XRT or Flagstaff – 2.8# OR Comet 1.5# (fluroxypyr)	6 to 23 fl oz .67 to 2.3 pts	Do not apply as an over-the-top broadcast treatment during active terminal growth (from initiation of budbreak/growth flush until seasonal terminal growth has hardened off and overwintering buds have formed). Directed spray applications may be made to pines during periods of active growth, but care should be taken to avoid spray contact with actively growing foliage.
	Broadleaf herbaceous plants such as ragweed, coffeeweed, clover, marestail, knapweed, partridge pea, sicklepod, smartweed, thistle, and morning glory	clopyralid MOA 4, (Transline or Clean Slate or Sonora)	8 to 21 fl oz	Labeled for use on first year pine seedlings and older trees. Will not control henbit or chickweed.
	Herbaceous weeds (ragweed, marestail, morning glory, sicklepod, pigweed, and blackberry.) See label for complete list of susceptible broadleaf weeds	aminopyralid MOA 4 (Milestone or Whetstone)	5 to 7 fl oz	Labeled for use for release of longleaf pine only. Do not apply over the top of other desirable pine species. May be tank mixed with approved products for use over longleaf. Applications can be performed over the top of longleaf still in the "grass stage." Newly planted seedlings should be at least three months old before application and not under stress. Read and follow label recommendations. Do not add surfactant/ adjuvant.
	Many broadleaf weeds and warm season grasses	topramezone, MOA 27 (Frequency)	4 to 16 fl oz	Labeled for use for grass and broadleaf weed release for loblolly and longleaf pine. Can be tank mixed with Arsenal AC for increased weed control. See label for rates. Excellent control of bermudagrass and other warm season grasses. DO NOT add surfactant/adjuvant when applying to longleaf pine.
Preemergent/Foliar	Most annual grasses and many broadleaf weeds	pendimethalin, MOA 3 (Pendulum) 2 G OR (Pendulum) 3.3 EC OR Pendulum AquaCap (38.7%)	100 to 200 lb 2.4 to 4.8 qt 2.1 to 4.2 qt	Apply at time of planting or to established trees. Planting slit must be closed to avoid root contact. Labeled for loblolly, white and Virginia pines and a number of hardwood species. See label for details. See label for details.
Spot-gun	Woody plants (cherry, blackgum, dogwood, elm, hawthorn, hickory, oaks, maple, sweetgum, and sumac)	hexazinone, MOA 5 (Tide Hexazinone 2 SL)	2 to 8 qt	Apply in calibrated spots on grid pattern. Rate per acre and grid pattern depend on soil texture and species composition. Apply with exact-delivery handgun. Apply late winter to early summer. Do not apply spots within 36 inches or directly upslope from seedlings. Poor results may occur if site is burned 3 to 6 months before treatment or on stump sprouts less than 1 year old.

Forest Site Preparation, Stand Conversion, Timber Stand Improvement

Compiled by C. Lambert and R. Bardon, NC State University Forestry and Environmental Resources

With professional assistance by:
Luke Barnett, BASF Corporation

Table 7-18. Forest Site Preparation, Stand Conversion, Timber Stand Improvement

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Foliar Spray	For control of many broadleaf weeds, annual and perennial grasses, brush, vines, and brambles	imazapyr, MOA 2 (4#) + metsulfuron methyl, MOA 2 (60%) MSM 60	8 to 25 oz for loblolly and slash pine	Can tank mix with KRENITE-S at 4 to 6 quarts for control of natural pines.
		OR		
		Tank Mix Polaris AC Complete + Patriot	10 to 24 oz + 1 to 2 oz	
		OR		
		imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) + metsulfuron methyl, MOA 2 (60%)	20 to 40 oz or 40 to 80 oz or 32 to 64 oz + See label	For loblolly and slash pine. See label for details.
Foliar Spray	For control of natural pines	ammonium salt of fosamine, MOA 17 (41.2%) (Krenite-S)	4 to 6 qts	Can be tank mixed with most other site prep products. Need highest label rate for control of Virginia pine.
		Detail	2 oz/A	See label for further instructions. Detail should be used in combination with 4 qt/A of glyphosate or 4 qt/A Glufosinate.
Foliar Spray	Control of woody brush, including but not limited to loblolly pine, oak species, legumes, maple, cherry, poplar, blackberry.	glyphosate, MOA 9 (Accord XRT II) 5.07 lb/gal + aminopyralid, MOA 4 (Milestone or Whetstone) + imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) or Polaris AC Complete	6 to 7 qts + 7 fl oz + 12 to 40 oz or 24 to 80 oz or 24 to 64 oz or 12 to 40 oz	Recommended for use from June – July 31. Offers broad spectrum hardwood and natural pine control. See label for details.
Foliar Spray	Control of woody brush, including but not limited to southern pines, oak species, legumes, maple, cherry, blackberry, poplar, gallberry, wax myrtle, yaupon, bay spp.	glyphosate, MOA 9 (Accord XRT II) 5.07 lb/gal + aminopyralid, MOA 4 (Milestone or Whetstone) + triclopyr ester, MOA 4 (Forestry Garlon XRT or Boulder 6.3) + imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) or Polaris AC Complete	5 qts + 7 fl oz + 21 fl oz + 16 to 40 oz or 24 to 80 oz or 24 to 64 oz or 16 to 40 oz	Recommended for use from Aug. 1 to Oct. 15th. Offers broad spectrum hardwood and natural pine control. See label for details.
Foliar Spray	Control of woody brush, including but not limited to southern and Virginia pine, oak spp., cherry, maple, poplar, legumes, wax myrtle, blackberry. Create a pine control tankmix of the following: 1 gallon Finale VU 2 oz. Detail No triclopyr All the listed Imazapyr product rates	glyphosate (Accord XRT II 5.07 lb/gal or Aquaneat) + saflufenacil MOA14 (Detail) + triclopyr ester, MOA 4 (Forestry Garlon XRT), Boulder 6.3 + imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) or Polaris AC Complete	6 qts + 2 fl oz + 21 fl oz + 12 to 40 oz or 24 to 80 oz or 24 to 64 oz or 12 to 40 oz	Recommended for use from June 1 to Sept. 15. Recommended when VA pine are part of the target species. See label for details.
Foliar Spray	Woody brush, trees, vines, grasses, and broadleaf weeds (Alder, berries [blackberry, dewberry, raspberry], elderberry, honeysuckle, maples [red, sugar], oaks [red, Northern pine, white], multi flora rose, poison ivy, poison oak, trumpet creeper, willow)	glyphosate, MOA 9 (Accord XRT II) 5.07lb/gal OR Razor Pro OR Other brands	2% solution as a high volume spray using a spray to wet basis Rates may vary	Apply over actively growing plants when foliage has fully developed. See labels for appropriate rates for weeds and woody brush. See labels.
Foliar Spray	Kudzu, wisteria	aminopyralid, MOA 4 (Milestone or Whetstone)	7 fl oz	0.5 oz/gal of water for spot treatments (assuming 20 gpa). See label for full details. Do not apply over the top of susceptible tree species.
	Kudzu	clopyralid, MOA 4 (Transline or Sonora) Clean Slate	21 fl oz	Application June to October to actively growing plants.
Directed Foliar Spray	Woody vines and brush	aminopyralid, MOA 4 + triclopyr Amine, MOA 4 (Capstone)	5 to 7%	Excellent control of woody vines such as kudzu, wisteria, blackberry, honeysuckle, and small seedling brush. For example, cherry, maple, southern pine, oak spp., and legumes. Does not hurt most grass species.
	Over 50 species of woody brush, broadleaf perennials.	2,4-D, 2,4-DP (Patron 170)	1.5% to 4.25%	Selective to most grasses, control of over 50 broadleaf perennial and woody species including poison ivy, kudzu, blackberry, dewberry, honeysuckle, locust, and many more.

Table 7-18. Forest Site Preparation, Stand Conversion, Timber Stand Improvement

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Cut Stumps	Sweetgum, poplar, oak, sycamore. Suppression of dogwood, blackgum, hickory, and red maple	glyphosate, MOA 9 (Rodeo or Aquaneat) 5.4L OR Other brands	Spray or brush 50 to 100% solution to freshly cut stumps Rates may vary	Best used mid growing season. Avoid spring sapflow. Treat stumps immediately after cutting. Treat entire stump surface for small trees and just cambium for large trees. See labels.
Cut Stump and Basal treatment	Works on more than 90 woody brush and vine species. See label for a complete list	triclopyr ester, MOA 4 (Garlon 4 Ultra or Triclopyr 4) or Relegate or Triclopyr ester (Pathfinder II), Triclopyr RTU	20 to 25% Garlon 4 Ultra + 75 to 80% basal oil or use Pathfinder II as a ready-to-use	Treat the lower 12 to 15 inches of the target stem down to the ground line making sure to treat completely around the stem. Treat to wet not to the point of runoff. See label for full details. May be used on smooth bark species up to 6 inches in basal diameter and up to 4 inches in basal diameter for rough bark species. Can be performed all year except when the bark is wet and any time after cutting.
Foliar Spray	Annual bluegrass, ash, aspens (bigtooth, trembling), asters, balsam poplar, barnyardgrass, bentgrass, birch, common groundsel, common ragweed, elksedge, elm, false dandelion, fleabane, flowering dogwood, foxtail, hawthorn, hazel, hickory, oaks, oxeye daisy, Pennsylvania smartweed, pinegrass, red maple, sourwood sweetgum, velvetgrass, wild carrot, wild cherry, and willows. Treatment provides partial control of Canada thistle (suppression only), catsear, crabgrass, curly dock, dandelion, willowweed (fireweed) fescue, goldenrod, heath aster, honeysuckle, horseweed, orchardgrass, and perennial grasses (quackgrass and ryegrass)	hexazinone, MOA 5 (Tide Hexazinone 2SL)	4 to 10 qt	Labeled for longleaf pine, shortleaf pine, slash pine, Virginia pine, loblolly pine, Scotch pine, and white spruce. All rates depend on soil type. Use lower rates on coarser soils. Read and follow label directions.
Spotgun	Many woody plants (black cherry, blackgum dogwood, elm, hawthorn, hickory, oaks, maple, sweetgum, and sumac)	hexazinone, MOA 5 (Tide Hexazinone 2SL)	3 to 10 qt	Use an exact-delivery handgun applicator and calibrate for precise delivery of the undiluted product. Selection of the rate per acre and "grid" pattern will depend on soil texture and woody plant species composition. Use the higher rates on fine-textured soils and when the major component of the hardwoods is a difficult-to-control species such as blackgum, dogwood, hickory, or red maple. Use the lower rates on medium-to-coarse textured soils where elm, cherry, oak, and sweetgum are dominant. Results may be unsatisfactory where stump sprouts of less than one year's growth predominate. Labeled for loblolly, slash, shortleaf, and longleaf pines. Suspensions of DF require intermittent agitation.
Foliar Spray	Many grasses, broadleaf annual, and perennial weeds, vines, brambles, woody brush, and trees	imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) or Polaris AC Complete	12 to 40 oz or 24 to 80 oz or 24 to 64 oz or 12 to 40 oz Add 0.5% v/v nonionic surfactant to mix.	Broadcast spray during growing season to prepare site for many conifers. May be tank mixed with Accord XRT II, Oust, Oust Extra (loblolly only), and others. See labels. Not labeled for hardwood site preparation.
Tree Injection, Frill, or Hack 'N' Squirt	Brush species listed above	imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) or Polaris AC Complete OR aminopyralid, MOA 4 + triclopyr amine, MOA 4 (Capstone) OR triclopyr choline, MOA 4 (Vastlan) Or triclopyr 4 Ester (4#)	25% solution in water Use undiluted and apply 1 ml of undiluted product into each cut 40% solution mixed with water	Use hatchet or tree injector and space sloping cuts evenly around the trunk. Apply 1 ml/3 in. DBH. Best used mid-growing season but dormant applications may be used. Avoid spring sapflow. Nearby desirable hardwoods may be injured or killed. See label for details. Use hatchet or machete and space cuts no more than 2 inches apart and at a 45-degree angle. Make cuts around the tree trunk at a convenient height so that the cuts overlap slightly and make a continuous circle around the trunk. Avoid treatment during periods of heavy sap flow such as the spring. Use hatchet or machete and space cuts no more than 2 inches apart and at a 45-degree angle. Make cuts around the tree trunk at a convenient height so that the cuts overlap slightly and make a continuous circle around the trunk. Avoid treatment during periods of heavy sap flow such as the spring.
Tree Injection Frill, or Hack 'N Squirt	Sweetgum, poplar, oak, sycamore. Suppression of dogwood, blackgum, hickory, and red maple	glyphosate, MOA 9 (Rodeo) 5.4 lb/gal or Aquaneat OR imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) or Polaris AC Complete	1 ml/2 to 3 in. of trunk diameter or use continuous frill and a diluted mix. 1 mL of solution in each cut site Rates for other brands may vary	Use hatchet or tree injector and space sloping cuts evenly around the trunk. Best used mid growing season. Avoid spring sapflow. See label for details. See labels.

Table 7-18. Forest Site Preparation, Stand Conversion, Timber Stand Improvement

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Cut Stumps	Brush species listed above	imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) or Polaris AC Complete	25% solution in water 6 oz/gal water on freshly cut stump surface.	Arsenal AC Dilute solution mix 4 to 6 ounces in 1 gallon of water. Concentrate solution mix 1 quart with 1 pint of water. See label for details. Arsenal (27.8%) Dilute solution mix 8 to 12 ounces in 1 gallon of water. Concentrate solution mix 2 quarts with 1 pint of water. See label for details. Chopper Gen2 Dilute solution mix 8 to 12 ounces in 1 gallon of water. Concentrate solution mix 2 quarts with 1 pint of water. See label for details. Best used during growing season; avoid spring sapflow. Treat stumps promptly after cutting. Nearby desirable hardwoods may be killed or injured.
		OR aminopyralid, MOA 4 + triclopyr amine, MOA 4 (Capstone)	Use 100% solution.	Best used immediately after cut. Avoid spring sapflow. Spray or brush cambium layer immediately after cut.
		OR triclopyr ester, MOA 4 (Garlon 4 Ultra 4lb/gal or Relegate, contains no petroleum distillates or triclopyr 4)	Use 20 to 25% solution mixed with 75 to 80% basal oil.	Can be used all year except when bark is wet. Treat the cambium layer and root collar down to the ground line. Treat to wet and not to the point of runoff. Can be used up to several weeks after cutting.
Foliar Spray	Many species of brush and broadleaf weeds, including: **BRUSH:** Ash, aspen, birches, brambles, cedar, cherry, dogwood, elms, gooseberry, honeylocust, multiflora rose, oak, poplar, shortleaf pine, sumac, wild plum, willows, sycamore, spruce, blackberry, black locust, buckbrush, cottonwood, honeysuckle. **WEEDS:** bedstraw, burdock, chicory, dock, kudzu, morning glory, poison ivy, poison oak, thistles, trumpet vine	imazapyr, MOA 2 (Chopper GEN2 or Polaris SP or Rotary 2SL) + glyphosate, MOA 9 (Accord XRT II) Tankmix 4 qts Finale VU All listed imazapyr rates	32 to 64 oz + 2 qts	Apply during growing season to prepare site for many conifers. A seed oil mix that is 12 to 50% of volume is recommended. Use 5 to 40 gallons mix/acre for good coverage. Not labeled for hardwood site preparation. Tank mixing Accord XRT II with Chopper treatments will enhance brown-out of target vegetation thus enabling landowner to more effectively burn.
Foliar Spray	Most grasses, broadleaf annual and perennial weeds, vines, brambles, hardwoods, and pines	imazapyr, MOA 2 Arsenal AC (4#) or Arsenal 2NS (2#) or Chopper Gen2 (2#) or Rotary 2SL (2#) or Polaris AC Complete + glyphosate, MOA 9 (Accord XRT II)) + aminopyralid, MOA 4 (Milestone or Whetstone)	16 to 40 oz or 24 to 80 oz or 24 to 64 oz or 32 to 64 oz + 6 to 7.5 qts + 7 fl oz	Effective broad-spectrum site preparation for hardwoods and natural pine.
Basal Bark	Controls over 90 woody plants and vines	triclopyr, MOA 4 (Pathfinder II), Triclopyr RTU OR triclopyr, MOA 4 (Garlon 4 Ultra or Relegate or Triclopyr 4) Tankmix of 1% STALKER + 15% Garlon 4 Ultra	100% solution ready to use formulation of Garlon 4 Ultra 20 to 25% solution mixed with 75-80% basal oil	Spray or wet lower 12 to 15 inches of stems. Best used on rough bark species no more than 4 inches diameter and smooth bark species no more than 6 inches diameter. Perform year round except when bark is wet. Spray to wet but not to the point of runoff.
Foliar Spray	Many woody species and broadleaf weeds, grasses	glufosinate-ammonium, MOA 10 (Finale VU) 1 lb a.i./gal	2 to 6 qt	May be used to prepare site for planting hardwoods and conifers. Use higher rate for woody or heavy dense brush. See label for specific details. May be tank mixed with Arsenal AC and Chopper for conifer site preparation.
Foliar Spray	Alder, birch, blackberry, black cherry, blackjack oak, black locust, currant, fir, gooseberry, hemlock, honeysuckle, oaks, pine, poison ivy, poison oak, poplar, red elm, red maple, serviceberry, spruce, sycamore, tulip poplar, willow, winged elm	dicamba, MOA 4 + 2,4-D, MOA 4 (Veteran 720) 2.9 lb a.i./gal	1 gal	Apply 1 gallon in 20 to 100 gallons water per acre depending upon density of brush. Do not apply more than 1 gallon per acre per year.
Foliar Spray	Many brush species (alder, ash, basswood, beech, birch, blackberry, black gum, cedar, cherry, cottonwood, dogwood, elm, grape, hawthorn, hemlock, hickory, honeysuckle, hornbeam, poison ivy, kudzu, locust, maple, oaks, persimmon, pines, poplar, sassafras, sumac, sweetgum, sycamore, willow) Controls many woody plants including yaupon, gallberry, wax myrtle, Baccharis spp., and many bay species.	triclopyr (choline), MOA 4 (Vastlan) 4 lb a.i./gal OR triclopyr (ester), MOA 4 (Forestry Garlon XRT or Boulder 6.3) 6.3 lb/gal	0.5 to 1.5 gal 21 fl. oz. to 1 gal	Ground applications: Mix product in water (20 to 100 gallons; enough for good coverage) + 0.5% v/v nonionic surfactant. May also be tank mixed with other products. See label for details. Use higher rates for woody plant control.
Tree Injection, Frill, Hack 'N' Squirt	Same as above	triclopyr (choline), MOA 4 (Vastlan) 4 lb a.i./gal Or triclopyr 4 (ester)	Mix 40:60 ratio with water to make a 40% solution	Inject 0.5 ml undiluted or 1 ml diluted/inch tree diameter. Space cuts evenly. Best used during growing season.
Cut Stump	Same as above	triclopyr (choline), MOA 4 (Vastlan) 4 lb a.i./gal Or triclopyr 4 (ester)	Use 40% solution mixed with water	Spray or paint fresh cut stumps immediately after cut. Best used during the growing season but avoid period of spring sapflow.

Table 7-18. Forest Site Preparation, Stand Conversion, Timber Stand Improvement

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Cut Surface Treatment	Same as above	dicamba, MOA 4 (Banvel CST) 1 S	See label	Inject 1 ml undiluted at 1- to 2-inch intervals. Spray or paint frill or girdle OR spray or paint cut stumps with undiluted herbicide.
Basal Bark or Dormant Stem Treatment	Same as above	dicamba, MOA 4 + 2,4-D(ester), MOA 4 (Banvel 520) 2.9 lb total a.i./gal	1 to 5 gal	For hydraulic sprayers use 1 to 3 gallons Banvel 520 per 100 gallons water or oil to water emulsion per acre. For backpack sprayers mix 8 to 16 gallons Banvel per 100 gallons water or oil to water emulsion and apply 30 gallons mix per acre. **BASAL BARK**—Apply year around to lower 1.5 to 2 feet of stem, allowing runoff. **DORMANT STEM**—Apply anytime brush is dormant by thoroughly wetting stems to point of runoff.
Foliar Spray	**WOODY**: Alder, ash, beech, birch, blackberry, blackgum, cherry, cottonwood, dogwood, elderberry, elm, hawthorn, hickory, hornbeam, locust, maples, mulberry, oaks, persimmon, pine, poison oak, poplar, sassafras, sumac, sweetbay, magnolia, sweetgum, sycamore, tulip poplar, willow, winged elm **ANNUAL AND PERENNIAL BROADLEAF WEEDS**: Bindweed, burdock, Canada thistle, chicory, curly dock, dandelion, field bindweed, lambsquarter, plantain, ragweed, smartweed, tansy ragwort, vetch, wild lettuce	triclopyr-(choline), MOA 4 (Vastlan) 4 lb/gal Or triclopyr 4 (ester)	0.3 to 1.5 gal	**Aerial Application**—Mix 0.75 to 1 gallon herbicide with 0.25 to 1 pint agricultural surfactant. For broader spectrum control, tank mix with other suitable herbicides. Apply in 10 to 30 gal water per acre. **Ground High-Volume Application**—Mix 0.5 to 1 gallon herbicide in water to make 100 gallons solution + 8 to 16 oz adjuvant. For broader spectrum control, tank mix with other suitable herbicides. **Ground Low-Volume Directed Spot Application**—Mix 0.5 to 2% solution (0.64 to 2.5 fl oz herbicide/gallon of water) with 1% (1.28 fl oz surfactant/gal of water)
Tree Injection, Frill, Hack 'N' Squirt	See woody plants above	aminopyralid, MOA 4 + triclopyr amine, MOA 4 (Capstone) OR Picloram, MOA 4 + 2,4-D, MOA 4 (Pathway) 1.25 lb a.i./gal	Apply as ready to use mixtures (100% solution)	Inject Capstone undiluted making cuts no more than 2 inches apart. Use 1 ml/inch of Pathway undiluted. Space injections evenly. Best used during the summer or fall.
Frill or Girdle	See woody plants above	Same as above	Use undiluted	Make a single hack girdle or "frill" of overlapping cuts through the bark completely around the tree. Spray or paint the cuts with undiluted product using enough volume to wet the treated areas.
Cut Stump	See woody plants above	aminopyralid, MOA 4 + triclopyr amine, MOA 4 (Capstone) OR picloram, MOA 4 + 2,4-D, MOA 4 (Pathway) 1.25 lb a.i./gal	Apply as ready to use mixtures (100% solution)	Spray or paint cambium of freshly cut stumps with undiluted herbicide solution.
Foliar Spray	Same as above	triclopyr (ester), MOA 4 (Forestry Garlon XRT or Boulder 6.3) 6.3 lb a.i./gal OR 4 lb/gal triclopyr (Relegate)	21 fl oz to 1 gal 32 oz to 1.5 gal	Use higher rates to control woody species. Apply in enough water for good coverage, usually 20 to 40 gallons per acre. A nonionic surfactant (0.5 to 1.0%) is recommended. Tank mixes may provide additional benefits. Will not control most native grasses. Complete coverage of target vegetation is necessary for best results.
Basal Bark	Same as above	Same as above OR triclopyr, MOA 4 (Pathfinder II) 0.75 lb a.i./gal, Triclopyr RTU	13% Forestry Garlon XRT or Boulder 6.3 + 87% basal oil Apply as a ready to use formulation (100% solution)	Spray 13% solution of Forestry Garlon XRT in oil penetrant (diesel or vegetable oil) to lower 12 to 18 inches of tree trunk to point of runoff. Most effective on trees less than 6 inches in diameter with smooth or thin bark. Apply to dry bark in winter or summer. Avoid spring sapflow
Foliar	Many annual and biennial broadleaf weeds and woody brush	picloram, MOA 4 (Tordon K or Triumph 22K) 2 lb a.i./gal	0.25 to 4 qt	Restricted use chemical. See label for specific rates for given situations, tank mixes, and volumes per acre.
Foliar	Many annual and biennial broadleaf and woody brush species	diglycolamine salt of dicamba, MOA 4 Clash 4 lb a.i./gal	0.5 to 4 pt	Use lower rates for annual and biennial weeds and heavy rates for woody brush. Many tank mixes are available. Apply in 15 or more gallons of water/acre with a nonionic surfactant (0.5 to 1% v/v).
Tree Injection, Frill, Hack 'N' Squirt	Many species of hardwood trees and brush	Same as above	See label	Apply undiluted product using injector or hatchet with one cut per inch tree diameter. Or apply diluted mixture (1:1-3 parts water) to overlapping cuts (frill).
Cut Stump	Same as above	Same as above	See label	Dilute 1 to 1 with water. Spray or paint the freshly cut stump cambium.
Dormant Stem	Many species of hardwood trees and brush. Controls woody vines and conifers	triclopyr ester (Garlon 4 Ultra or Triclopyr 4) 4 lb/gal	2 to 3 gallons of Garlon 4 Ultra + 3 gal of Crop oil per 100 gallons of water	Spray upper and lower stems of dormant brush to wet. See label for more details.
Cut Surface and Basal Spray	Many species of hardwood trees and brush	triclopyr ester, MOA 4 + 2,4-D, MOA 4 (Crossbow or Candor or Everett)	See label	Read label carefully as rates and dilutions vary widely depending on tree species to control and type of application.

Aquatic Weed Control

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Several options, including hand removal, cultural, mechanical, biological, and chemical control techniques are available for the management of aquatic weeds. The applicator should choose the most efficacious, environmentally acceptable, and cost-effective alternative that is available for a particular weed problem. The site-specific management strategy to use in each situation will depend on the intended use of the body of water, fish, and wildlife populations that may be impacted, type of environment in which the weed problem occurs, and the particular weed species of concern. Before selecting your management strategy, **be sure to have the weed(s) of concern identified by a qualified individual**.

Assistance in weed identification is available from the Cooperative Extension center in your county. Additional information on management techniques also may be obtained from the local Extension center; ask for AG-437, *Weed Management in Small Ponds*; AG-438, *Weed Control in Irrigation Water Supplies;* and AG-449, *Hydrilla: A Rapidly Spreading Aquatic Weed in North Carolina*. Information on pond construction, stocking, and general pond management may be found in AG-424, *Pond Management Guide*. Additional information may be found on the Aquatic Weed Management Web site: cals.ncsu.edu/applied-ecology/extension/fisheries/.

For the purpose of description and management, aquatic weeds may be grouped either on the basis of their botanical relationships or on the basis of their growth habits. Most plants in each group are managed similarly, with some exceptions.

Table 7-19A. Aquatic Plant Groups — Grouping of Aquatic Plants on the Basis of Botanical Relationships

Category and Description	Examples
Algae — These plants may be either microscopic or visible to the naked eye, exist as single cells or occur in clusters or filaments containing many cells and may be either free floating (planktonic) or attached to the soil, rocks, or vegetation. Filamentous algae may be unbranched, slightly or highly branched, or net-like. Some planktonic algae are mobile. Certain types of algae (macroalgae) may be large, very coarse, and resemble submersed vascular plants. Most algae (except macroalgae) usually require magnification to be identified accurately. Algae do not contain vascular (water conducting) tissues, consequently all chemicals used for algae control have only contact activity. Algae reproduce by cell division, fragmentation, and sexually by spores.	**Filamentous Algae** Bluegreens or Cyanobacteria Giant *Lyngbya* Green algae *Oedogonium* *Hydrodictyon* (water net) *Spirogyra* *Pithophora* **Planktonic Algae** Bluegreens or Cyanobacteria *Lyngbya* *Anabaena* *Oscillatoria* *Microcystis* Euglenoids (*Euglena*) **Macroalgae** Muskgrass (*Chara*) Stonewort (*Nitella*)
Mosses — These plants are visible to the naked eye and resemble delicate, leafy submersed plants. The mosses lack vascular tissues or roots, but usually are attached to the soil. Mosses reproduce sexually by spore production.	*Fontinalis* *Sphagnum* (peat moss)
Ferns — These plants are visible to the naked eye, either free floating or rooted to the bottom, occasionally forming loosely consolidated floating mats. Ferns have vascular tissues and reproduce by vegetative propagation and sexually by spores.	Giant salvinia (*Salvinia molesta*) Mosquito fern (*Azolla* spp.) Water clover (*Marsilea quadrifolia*) Water spangles (*Salvinia minima*)
Vascular flowering plants — These plants may be rooted or unrooted, free floating, submersed, floating-leaved, or emergent. Most reproduce vegetatively by means of rhizomes, stolons, and various other vegetative perennating structures including turions and tubers. Most also produce flowers and may set seeds. This group has a vascular system that shows varying degrees of development from rudimentary in the case of the duckweeds and submersed species to very complex and highly developed in emergent plants and includes annual and perennial herbaceous forms and several woody species.	Bald cypress (*Taxodium distichum*) Bladderwort (*Utricularia* spp.) Bulrushes (*Scirpus* spp.) Cattail (*Typha* spp.) Duckweed (*Lemna* spp. and *Spirodela* spp.) Hydrilla (*Hydrilla verticillata*) Naiads (*Najas* spp.) Pondweeds (*Potamogeton* spp.) Rushes (*Juncus* spp.) Spikerushes (*Eleocharis* spp.) Waterhyacinth (*Eichhornia crassipes*) Watermilfoils (*Myriophyllum* spp.)
Submersed plants — Plants in this group grow beneath the surface of the water and may be rooted to the bottom or free floating, with or without roots. Flowers usually are produced above the surface of the water and occasionally may be supported by specialized floatation structures. Some species will produce emergent floral spikes that extend several inches above the surface of the water and are covered with bracts that resemble leaves. Submersed plants usually have poorly developed vascular systems and very limited structural tissue and depend on the water's buoyancy for support. Filamentous algae and macroalgae also could be considered submersed plants.	American elodea (*Elodea canadensis* and *E. nuttallii*) Bladderwort (*Utricularia* spp.) Brazilian elodea (*Egeria densa*) Brittle naiad (*Najas minor*) Coontail (*Ceratophyllum demersum*) Creeping rush (*Juncus repens*) Eurasian watermilfoil (*Myriophyllum spicatum)* Fanwort (*Cabomba caroliniana*) Hydrilla (*Hydrilla verticillata)* Parrotfeather (*Myriophyllum aquaticum*) Pondweeds (*Potamogeton* spp.) Proliferating spikerush (*Eleocharis baldwinii*) Southern naiad (*Najas guadalupensis*) Variable-leaf milfoil (*Myriophyllum heterophyllum*) Widgeongrass (*Ruppia maritima*) Wild celery (*Vallisneria americana*)

Table 7-19B. Aquatic Weed Groups — Grouping of Aquatic Plants on the Basis of Growth Habit

NOTE: Some species have growth habits that overlap and may be listed more than once.

Category and Description	Examples
Submersed plants — Plants in this group grow beneath the surface of the water and may be rooted to the bottom or free floating, with or without roots. Flowers usually are produced above the surface of the water and occasionally may be supported by specialized floatation structures. Some species will produce emergent floral spikes that extend several inches above the surface of the water and are covered with bracts that resemble leaves. Submersed plants usually have poorly developed vascular systems and very limited structural tissue and depend on the water's buoyancy for support. Filamentous algae and macroalgae also could be considered submersed plants.	American elodea (*Elodea canadensis* and *E. nuttallii*) Bladderwort (*Utricularia* spp.) Brazilian elodea (*Egeria densa*) Brittle naiad (*Najas minor*) Coontail (*Ceratophyllum demersum*) Creeping rush (*Juncus repens*) Eurasian watermilfoil (*Myriophyllum spicatum)* Fanwort (*Cabomba caroliniana*) Hydrilla (*Hydrilla verticillata)* Parrotfeather (*Myriophyllum aquaticum*) Pondweeds (*Potamogeton* spp.) Proliferating spikerush (*Eleocharis baldwinii*) Southern naiad (*Najas guadalupensis*) Variable-leaf milfoil (*Myriophyllum heterophyllum*) Widgeongrass (*Ruppia maritima*) Wild celery (*Vallisneria americana*)
Free-floating plants — Plants in this group float on the surface of the water and may lie flat on the water or be raised well above the surface. These plants, except for the duckweeds, watermeal, and mosquito ferns, have well-developed vascular systems and substantial supportive tissues. Most form true roots. Flowers extend above the surface of the water in the flowering plants.	Duckweeds (*Lemna* spp. and *Spirodela* spp.) Floating heart (*Nymphoides aquatica*) Frogbit (*Limnobium spongia)* Giant salvinia (*Salvinia molesta)* Mosquito fern (*Azolla caroliniana*) Waterhyacinth (*Eichhornia crassipes*) Waterlettuce (*Pistia stratiotes*) Watermeal (*Wolffia* spp.)
Floating leaf plants — These plants are rooted in the bottom and have their leaves attached to long, tough stems that extend to the surface from depths up to 6 ft or more. The leaves float directly on the surface of the water. Mature leaves of some species may push well above the surface into an emergent position. Most of these plants have extensive root and rhizome systems and well-developed vascular systems and supportive tissues. Flowers float just above the surface or are extended well above the surface on a tough stem. A few nonvascular representatives.	American lotus (*Nelumbo lutea)* Fragrant waterlily (*Nymphaea odorata*) Illinois pondweed (*Potamogeton illinoiensis*) Spatterdock (*Nuphar luteum*) Water clover (*Marsilea quadrifolia*) Watershield (*Brasenia schreberi*)
Emergent plants — These plants grow rooted in the bottom with their leaves and green stems extending well above the surface of the water. A few species also may form floating mats. All have extensive root and rhizome systems and well-developed vascular systems and supportive tissues. Reproduction occurs vegetatively by rhizomes and stolons; floating mat-forming species also reproduce readily by stem fragmentation. Most flower prolifically and form many seeds.	**Broadleaf Species** Arrow arum (*Peltandra virginica*) Arrowhead (*Sagittaria* spp.) Asian spiderwort (*Murdannia keisak*) Frogbit (*Limnobium spongia*) Lizard's tail (*Saururus cernuus)* Pickerelweed (*Pontederia cordata*) Smartweeds (*Polygonum* spp.) **Mat-forming Broadleaf Species** Alligatorweed (*Alternanthera philoxeroides)* Creeping waterprimrose (*Ludwigia hexapetala*) Water pennywort (*Hydrocotyle* spp.) Water willow (*Justicia americana*) **Sedges, Rushes, Spikerushes, and Grasses** Bulrush (*Scirpus* spp.) Cattail (*Typha* spp.) Common reed (*Phragmites australis)* Flat sedge (*Carex* spp.) Foursquare (*Eleocharis quadrangulata*) Maidencane (*Panicum hemitomon*) Rushes (*Juncus* spp.) Sedge (*Cyperus* spp.) Soft rush (*Juncus effusus*) Softstem bulrush (*Scirpus validus*) Southern wildrice (*Zizaniopsis miliacea*) Spikerushes (*Eleocharis* spp.) Threesquare bulrush (*Scirpus americanus*) Torpedograss (*Panicum repens*) Water paspalum (*Paspalum repens*) Woolgrass (*Scirpus cyperinus)* **Other Common Species** Bur-reed (*Sparganium americanum)* Scouring rush (*Equisetum hymale*)
Woody plants — These are obligate, aquatic species of trees usually growing totally flooded or in saturated soils, but occasionally occur in upland areas (usually planted there). Some form systems of "knees" to provide aeration for the root systems. They are deciduous, dropping leaves in the autumn, and are rarely if ever vegetative during winter months.	Bald cypress *(Taxodium distichum)* Pond cypress *(Taxodium ascendens)* Tupelo *(Nyssa aquatica)*

Biological Control of Aquatic Weeds with Triploid Grass Carp

While the triploid, sterile grass carp is a cost-effective control method, it is best suited for use in small ponds, where submersed aquatic plants are not required for fish and wildlife habitat. Grass carp are effective on most submersed weeds. They generally are less effective on algae and weeds in the floating and emergent groups. Refer to the chart below for information on the relative effectiveness of grass carp for different weeds.

Grass carp are normally stocked at 15 fish per acre in ponds. Moderately sized fish (minimum of 10 to 12 inches long) should be stocked to prevent loss due to predation by large bass and wading birds. If the surface of the pond is completely covered with vegetation, some limited herbicide application or mechanical removal of weeds from a portion of the pond will be necessary before stocking to allow oxygen to reach the underlying water. Spring and fall are the best seasons for grass carp stocking.

No specific permit is required to purchase up to 150 triploid grass carp for stocking a private pond that is completely impounded. At a stocking rate of 15 fish per acre of water, 150 triploid grass carp are adequate to control vegetation in a 10-acre pond. A permit from the Wildlife Resources Commission is required for larger stockings. Grass carp may be purchased from a licensed distributor. Permits, a list of certified distributors, and additional information on stocking of triploid grass carp may be obtained from the Wildlife Resources Commission, Chief of Inland Fisheries, 1721 Mail Service Center, Raleigh, NC 27699-1721, or call at 919-707-0220.

Table 7-20. Biological Control of Aquatic Weeds with Triploid Grass Carp

Weed	Relative Effectiveness	Comments
Algae Filamentous (green and bluegreen) and planktonic	Poor	High stocking rates (60 to 75 or more fish per acre) with small fish (4 to 6 inches size) are required to achieve temporary control; control usually decreases as fish grow larger and are unable to feed on the algae.
Macroalgae *Chara* and *Nitella*	Good to Excellent	*Chara* usually is beneficial to fish and wildlife.
Floating and Floating-Leaved Weeds Duckweeds, watermeal	Poor	Small fish at very high stocking rates (see filamentous algae above) may give control; larger fish at normal stocking rates usually are not effective.
Water ferns (*Azolla* and *Salvinia*)	Fair to Poor	
Alligatorweed, water lilies, water primrose, lotus, watershield, spadderdock, waterhyacinth	Poor	Grass carp may feed lightly on weeds in this group, but control is usually unacceptable.
Emergent and Marginal Weeds Cattails, rushes, common reed, bulrushes, pickerelweed, pennywort, arrowhead	Poor	Grass carp may feed lightly on weeds in this group, but control is usually unacceptable.
Submersed Weeds	Good to Excellent	Most rooted and free-floating submersed weeds in ponds are readily controlled with triploid grass carp; control may be poorer on the watermilfoils, particularly Eurasian waterfoil.

Chemical Control of Aquatic Plants

Table 7-21. Chemical Control of Aquatic Plants

Plant	Herbicide, Formulation, and Mode of Action Code[1]	Amount of Formulation	Active Ingredient Rate or Concentration	Precautions and Remarks[2]
Algae, filamentous and planktonic	copper complex (various)	0.6 gal/acre ft	0.2 ppm	Dilute with water in ratio of at least 9-to-1 and apply uniformly. For best results, apply on a clear day and break up floating mats of filamentous algae before treatment. **Warning: Copper is toxic to fish.**
	copper sulfate (various)	See label	0.5 to 1 ppm	Apply crystals or powder at early stage of growth by any method to give rapid and uniform dispersion. For best results, apply on a clear day. Do not apply to muddy water. **Warning: Copper is toxic to fish.** Copper products formulated with a chelating agent (copper complex) have a greater margin of safety to fish.
	diquat (Reward) 2 lb/gal MOA 22	See label	0.18 to 0.37 ppm	For certain filamentous algae—*Pithophora* spp. and *Spirogyra* spp. Check label for application instructions. For best results, break up floating mats before treatment.
	sodium carbonate peroxyhydrate (various)	See label	0.3 to 1.7 ppm	Apply with 8 to 10 hours of daylight remaining. Do not reapply within 48 hours.
Algae, macro, *Chara*, *Nitella*	copper complex (Cutrine-Plus Granular) 3.7 G (Cutrine-Plus) 0.9 lb/gal (K-Tea) 0.8 lb/gal	60 lb/surface acre 1.2 gal/acre ft 1.7 to 3.4 gal/acre ft	2.2 lb/acre 0.4 ppm 0.5 to 1.0 ppm	Distribute granular formulation evenly over infested area when plants are young. If *Chara* is in water less than 3 ft deep or growth is near the surface, the liquid formulation may be used. Dilute with water in ratio of at least 9-to-1 and apply uniformly. **Warning: Copper is toxic to fish.**
Algae, *Pithophora* and *Cladophora*	flumioxazin (Clipper) 51% MOA 14	6 to 12 oz/A	3 to 6 ai/A or 100 to 400 ppb	Early morning applications may be more effective when water pH tends to be lower. If vegetation is dense, treat in sections to avoid reducing dissolved oxygen. Water pH greater than 7.5 will reduce effectiveness.
Floating Weeds (except watermeal)	2,4-D amine (various) MOA 4	See label	2 to 4 lb/acre	Thorough wetting of foliage is essential. Apply with 100 gallons of water per acre. Use low pressure, large nozzle, and spray thickener.
	bispyribac (Tradewind) 80% MOA 2	1 to 2 oz/A	0.8 to 1.6 oz ai/A	Controls duckweed, mosquito fern, *Salvinia*, water hyacinth, water lettuce, and water pennywort. Apply with at least 30 gpa water volume. Include aquatic-approved adjuvant.
	carfentrazone (Stingray) 1.9 lb/gal, MOA 14	3.4 to 13.5 fl oz/ acre	0.05 to 0.2 lb/acre	Controls water lettuce, waterhyacinth, salvia, duckweed, mosquito fern, and water spinach. Rates vary according to target species. Methylated seed oil or nonionic surfactant (aquatic-approved) recommended.
	diquat (Reward) 2 lb/gal MOA 22	0.5 to 0.75 gal/ surface acre	1 to 1.5 lb/acre	Weeds controlled: pennywort, *Salvinia*, waterhyacinth, waterlettuce. Apply in a spray volume of 150 to 200 gallons of water per acre plus aquatic-approved nonionic surfactant.
		1 gal/surface acre	2 lb/acre	For duckweed control, apply in a spray volume of 50 to 150 gallons of water per acre. Take care to cover all plants on water and damp marginal areas. Will require retreatment. An aquatic-approved nonionic surfactant at 0.5% by volume may be used.
	florpyrauxifen (Procellacor)	1 to 2 prescription dose units (PDU)	1 to 2 prescription dose units (PDU)	Controls several emergent species including alligatorweed. Labelled rates provided as PDUs. Product only available to approved aquatic applicators. Addition of aquatic-approved nonionic surfactant is recommended.
	glyphosate (various) MOA 9	See label	See label	For control of waterlilies, spadderdock, and lotus, apply as foliar spray on a calm day when there is little to no wave action. Vegetation must be on or above the surface for treatment to be effective. A nonionic surfactant approved for aquatic use is required with some formulations. If applying from a boat, take care not to create waves that may wash the herbicide off floating leaves. Will not control small floating plants, such as *Azolla*, duckweed, or watermeal.

Table 7-21. Chemical Control of Aquatic Plants

Plant	Herbicide, Formulation, and Mode of Action Code[1]	Amount of Formulation	Active Ingredient Rate or Concentration	Precautions and Remarks[2]
Floating Weeds (except watermeal) (continued)	imazamox (Clearcast) 1 lb/gal, MOA 2	32 to 64 fl oz/acre	0.25 to 0.5 lb ai/ acre 50 to 150 ppb	See label for specific weeds controlled. An aquatic-approved nonionic surfactant or methylated seed oil is recommended for foliar applications. Spot treatments may be made with up to 5% solution by volume.
	imazapyr (Habitat) MOA 2	1 to 4 pt/acre	0.25 to 1.5 lb/acre	Rates vary according to target species. Retreatment of some plants may be required. An aquatic-approved nonionic surfactant is recommended. Will not control small floating plants, such as *Azolla*, duckweed, or watermeal.
	penoxsulam (Galleon) 2 lb/gal, MOA 2	2 to 5.6 fl oz/acre	0.03 to 0.09 lb/acre 5 to 150 ppb	An aquatic-approved nonionic surfactant is recommended for foliar applications.
	triclopyr (Renovate 3) MOA 4	0.5 to 2 gal/acre	1.5 to 6 lb/acre	Rates vary according to target species. Addition of aquatic-approved nonionic surfactant is recommended.
	topramezone (Oasis) 29.7%	up to 16 fl oz/acre	up to 0.35 lb/acre	Use of an aquatic-approved surfactant is recommended for foliar applications. Check label for specific irrigation restrictions.
	flumioxazin (Clipper) 51% MOA 14	6 to 12 oz/acre	3 to 6 ai/A or 100 to 400 ppb	Early morning applications may be more effective when water pH tends to be lower. If vegetation is dense, treat in sections to avoid reducing dissolved oxygen. Water pH greater than 7.5 will reduce effectiveness. A follow-up application will likely be needed for long-term watermeal control. Application with diquat, flumioxazin, or fluridone may provide enhanced watermeal control.
	fluridone (Sonar) 4 AS MOA 12	Ponds: 0.16 to 1.5 qt/acre	0.16 to 1 lb/acre 45 to 90 ppb	Product amount will depend on average depth of water body. Do not apply when there is substantial outflow from the pond. Do not apply as a spot treatment. See label for specific weeds controlled. For watermeal, use 45 to 90 ppb. Other floating species may be controlled with lower rates. Do not use treated water for irrigation for 7 to 30 days. See label for irrigation precautions. **Warning: 30 days may be insufficient restriction if pond water will be used to irrigate very sensitive crops, such as tobacco, tomatoes, or peppers.**
Emergent, Marginal, and Ditchbank Weeds	2,4-D amine (various) MOA 4	See label	2 to 4 lb/acre	Thorough wetting of foliage is essential. Apply in 100 to 400 gallons of water per acre. Use low pressure, large nozzle and spray thickener. An aquatic-approved adjuvant may improve efficacy.
	2,4-D granular (Navigate) 20 G (2,4-D Gran 20) 20 G MOA 4	150 to 200 lb/ surface acre	30 to 40 lb/acre	Weeds controlled: arrowhead, bulrush, creeping waterprimrose, pickerelweed, smartweed, spadderdock, waterchestnut, waterlily, watershield. Rate depends upon species and depth of water. Check label. Apply early, when weeds are actively growing, with a rotary seeder. Spadderdock may require retreatment.
	bispyribac (Tradewind) 80% MOA 2	1 to 2 oz/A	0.8 to 1.6 oz ai/A	Controls alligatorweed and parrotfeather. Apply with at least 30 gpa water volume. Include aquatic-approved adjuvant.
	carfentrazone (Stingray) 1.9 lb/gal, MOA 14	6.7 to 13.5 fl oz/ acre	0.2 lb/acre	Suppresses alligatorweed and waterprimrose. Methylated seed oil or nonionic surfactant (aquatic-approved) recommended.
	diquat (Reward) 2 lb/gal (Weedtrine) 0.4 lb/gal MOA 22	1 gal/surface acre	2 lb/acre	For control of cattails in ponds or lakes. For top kill, apply in 100 gal of water per acre with 0.25% to 0.5% nonionic surfactant. Apply before flowering for best results. Retreat as needed.
	florpyrauxifen (Procellacor)	1 to 2 prescription dose units (PDU)	1 to 2 prescription dose units (PDU)	Controls several emergent species including alligatorweed. Labelled rates provided as PDUs. Product only available to approved aquatic applicators. Addition of aquatic-approved nonionic surfactant is recommended.
	flumioxazin (Clipper) 51% MOA 14	6 to 12 oz/A	3 to 6 ai/A or 100 to 400 ppb	Early morning applications may be more effective when water pH tends to be lowest. If vegetation is dense, treat in sections to avoid reducing dissolved oxygen. Ensure adequate coverage of dense vegetation or a follow-up application may be necessary. Addition of aquatic-approved nonionic surfactant is recommended.
	glyphosate (various) MOA 9	See label	See label	Rates vary according to target species. Retreatment of alligatorweed is necessary. Aquatic-approved nonionic surfactant is recommended. Note: The use of very hard water or water containing high concentrations of iron to prepare spray solutions may result in reduced efficacy of glyphosate.
	imazamox (Clearcast) 1 lb/gal MOA 2	32 to 64 fl oz/acre	0.25 to 0.5 lb ai/ acre 50 to 500 ppb	See label for specific weeds controlled. An aquatic-approved nonionic surfactant or methylated seed oil is recommended for foliar applications. Spot treatments may be made with up to 5% solution by volume. Rates vary according to target species. Retreatment of some plants may be required. An aquatic-approved nonionic surfactant is recommended.
	imazapyr (Habitat) MOA 2	1 to 6 pt/acre	0.25 to 1.5 lb/acre	Rates vary according to target species. Retreatment of some plants may be required. An aquatic-approved nonionic surfactant is recommended.
	penoxsulam (Galleon) 2 lb/gal, MOA 2	2 to 5.6 fl oz/acre	0.03 to 0.09 lb/acre 5 to 500 ppb	See label for specific weeds controlled and application details. An aquatic-approved nonionic surfactant is recommended.
	triclopyr (Renovate 3) MOA 4	0.5 to 2 gal/ acre	1.5 to 6 lb/acre	Rates vary according to target species. Addition of an aquatic-approved nonionic surfactant is recommended.
	topramezone (Oasis) 29.7%	up to 16 fl oz/acre	up to 0.35 lb/acre	Use of an aquatic-approved surfactant is recommended for all foliar applications. Check label for specific irrigation restrictions.
Submersed Weeds[3]	2,4-D granular (Navigate) 20 G, MOA 4	100 to 200 lb/ surface acre	20 to 40 lb/acre	Controls milfoils and certain other submersed species. Rate depends upon weed to be controlled and depth of water. Check labels for species and rates. Apply uniformly with a rotary spreader.
	bispyribac (Tradewind) 80% MOA 2	See label	10 to 45 ppb	Controls *Hydrilla*, sago pondweed, and Eurasian watermilfoil. Do not apply in areas of high-water flow or water diffusion. Refer to label for specific details on application rate based on water volume.
	carfentrazone (Stingray) 1.9 lb/gal MOA 4	0.286 to 5.75 gal/ acre	200 ppb	Controls Eurasian watermilfoil. Apply in spring or early summer as a subsurface application or with an appropriate adjuvant to ensure sinking and mixing of the spray mix. Early morning applications may be more effective when water pH tends to be lowest. Water pH greater than 7.5 will reduce effectiveness.
	diquat (Reward) 2 lb/gal MOA 22	1 to 2 gal/ surface acre	2 to 4 lb/acre	Weeds controlled: bladderwort, coontail, elodea, naiads, pond weeds. Apply early in season by pouring directly into water in strips 40 feet apart. Later in season, as weeds reach surface, pour in strips 20 feet apart or inject a dilute solution. Not effective in turbid or muddy water. If vegetation is dense, treat in sections to avoid reducing dissolved oxygen.
	endothall (Aquathol K) 4.2 lb/gal (Aquathol Super K) 63 G	0.3 to 2.6 gal/acre ft 2.2 to 17.6 lb/acre ft	0.5 to 5 ppm	Weeds controlled: bass weed, bur reed, coontail, *Hydrilla* (Aquathol K only), pondweeds, watermilfoil, water star grass. Rate depends upon weed species and type of treatment. Spot or marginal treatments require higher rates. Aquathol Granular is especially useful for spot or marginal treatments.

Table 7-21. Chemical Control of Aquatic Plants

Plant	Herbicide, Formulation, and Mode of Action Code[1]	Amount of Formulation	Active Ingredient Rate or Concentration	Precautions and Remarks[2]
Submersed Weeds[3] (continued)	florpyrauxifen (Procellacor)	1 to 5 prescription dose units (PDU)	1 to 5 prescription dose units (PDU)	Controls several submersed species including *Hydrilla* and milfoils. Labelled rates provided as PDUs. Product only available to approved aquatic applicators.
	flumioxazin (Clipper) 51% MOA 14	See label	100 to 400 ppb	Early morning applications may be more effective when water pH tends to be lowest. If vegetation is dense, treat in sections to avoid reducing dissolved oxygen. Water pH greater than 7.5 will reduce effectiveness.
	fluridone (Sonar) AS MOA 12 (Sonar SRP) MOA 12	 Ponds: 0.16 to 1 qt/acre Lakes: 0.2 to 4 qt/acre Canals: 2 qt/acre Ponds: 3.2 to 30 lb/acre Lakes: 4 to 80 lb/acre Canals: 40 lb/acre Rivers: 40 lb/acre	 0.16 to 1 lb/acre 0.2 to 4 lb/acre 2 lb/acre 0.16 to1.5 lb/acre 0.2 to 4 lb/acre 2 lb/acre 2 lb/acre	Do not use water for irrigation for 7 to 30 days. See label for specific irrigation precautions. Application to canals should be made only if water flow can be restricted. **Warning: 30 days may be insufficient restriction if applied to small ponds and pond water will be used to irrigate very sensitive crops, such as tobacco, tomatoes, or peppers.**
	imazamox (Clearcast) 1 lb/gal, MOA 2	See label	50 to 500 ppb	Rates vary according to target species and depth to be treated. See label for specific weeds controlled and application details.
	penoxsulam (Galleon) 2 lb/gal, MOA 2	See label	5 to 150 ppb	Rates vary according to target species and depth to be treated. See label for specific weeds controlled and application details.
	triclopyr (Renovate 3 or OTF), MOA 4	See label	1.5 to 6 lb/acre 0.5 to 2.5 ppm	Controls milfoils and certain other submersed species. Rates vary according to target species and depth to be treated. See label for specific weeds controlled and application details.
	topramezone (Oasis) 29.7%	up to 16 fl oz/acre	up to 0.35 lb/acre	Rates vary according to target species and depth to be treated. See label for specific weeds controlled and application details. Check label for specific irrigation restrictions.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. Cooper compounds, endothall. and sodium carbonate peroxyhydrate have not been assigned codes.
[2] Also see comments for specific herbicides under "Table 7-25. Labeled Sites and Restrictions."
[3] Grass carp give cost-effective control on the majority of the weeds in this group and should be given consideration *before* using herbicides. See text at beginning of this section under *Biological Control of Aquatic Weeds with Triploid Grass Carp*. A permit is required to purchase more than 150 grass carp or for stocking in impoundments larger than 10 acres. Grass carp usually are **not effective** on filamentous algae, duckweed, watermeal, or any of the plants in the floating or emergent groups.

Table 7-22. Waiting Period (in Days) Before Using Water After Application of Herbicides for Aquatic Weed Control

Herbicide	Irrigation[1]	Fish Consumption	Watering Livestock	Swimming
2,4-D (Various formulations and manufacturers)	Water use restrictions vary by formulation and manufacturer. In general, if water is used for irrigating sensitive crops, 2,4-D should not be used. Turfgrasses are generally tolerant to low concentrations of 2,4-D. Also, many 2,4-D formulations are NOT labelled for aquatic use. Read the label before purchasing or use.			
bispyribac (Tradewind)	Do not irrigate until concentrations are < 1 ppb	No restrictions	Do not water livestock until concentrations are ≤ 1 ppb	No restrictions
carfentrazone (Stingray)	1 to 14[2]	No restrictions	0 to 1	No restrictions
copper (Copper sulfate pentahydrate, including Bluestone and EarthTec; and complexed copper formulations, including Algae-Pro, Captain, Clearigate, Cutrine-Plus, Cutrine-Plus Granular, K-Tea, Komeen.)	No restrictions	No restrictions	No restrictions	No restrictions
diquat (Reward)	3 to 5[3]	No restrictions	1	No restrictions
endothall (Aquathol K) (Aquathol Super K) (Hydrothol 191) (Hydrothol 191 granular)	No restrictions for many situations. See label for specific restrictions	No restrictions	7 to 25	No restrictions
florpyrauxifen (Procellacor)	Do not use treated water for irrigation unless allowed by product label	No restrictions	Do not allow livestock to drink treated water unless allowed by product label	No restrictions
flumioxazin (Clipper)	0 to 5[3]	No restrictions	No restrictions	No restrictions
fluridone (Sonar 4AS, Sonar SRP)	7 to 30[3]	No restrictions	No restrictions	No restrictions
glyphosate (AquaMaster, Aqua Neat, Rodeo, Touchdown Pro)	No restrictions	No restrictions	No restrictions	No restrictions
imazamox (Clearcast)	0+[3]	No restrictions	No restrictions	No restrictions
imazapyr (Habitat)	120	No restrictions	No restrictions	No restrictions
penoxsulam (Galleon)	Do not irrigate food crops until residues ≤ 1 ppb	No restrictions	No restrictions	No restrictions
sodium carbonate peroxyhydrate (GreenClean Pro, Pak 27)	No restrictions	No restrictions	No restrictions	No restrictions
topramezone (Oasis)	See label for specific irrigation restrictions	No restrictions	No restrictions	No restrictions
triclopyr (Renovate 3, Renovate OTF)	120 0 to established grass	No restrictions	Next growing season for lactating dairy animals	No restrictions

[1] Irrigation restrictions may be removed for specific products if a laboratory assay of treated water meets a standard as stated on the product label.
[2] Do not use treated water for irrigation in commercial nurseries or greenhouses.
[3] Refer to product label for specific restrictions.

Table 7-23. Effectiveness of Herbicides and Triploid Grass Carp for Control of Common Aquatic Weeds in North Carolina

Weed Type	Weeds	2,4-D	bispyribac	carfentrazone	copper compounds	diquat	diquat +copper	endothall		florpyrauxifen	flumioxazin	fluridone	glyphosate	imazamox	imazapyr	peroxide compounds	penoxsulam	triclopyr	triploid grass carp
								Aquathol	Hydrothol										
Algae	Planktonic	NR	ID	NR	G	P	G	NR	P	NR	ID	NR	NR	NR	NR	G	NR	NR	NR
	Filamentous	NR	ID	NR	G	E	E	NR	E	NR	G	NR	NR	NR	NR	ID	NR	NR	P
	Chara / *Nitella*	NR	ID	ID	G	G	E	NR	G	NR	P	NR	NR	NR	NR	ID	NR	NR	E
Floating Plants	*Azolla* (mosquito fern)	NR	G	F	F	E	E	NR	NR	G	ID	E	NR	ID	NR	NR	G	NR	P
	Duckweed	P	G	G	P	G	G	NR	NR	NR	E	E	NR	NR	NR	NR	G	P	P
	Frogbit	F	ID	ID	NR	E	E	NR	NR	ID	G	NR	P	E	E	NR	ID	G	P
	Salvinia, common	NR	G	G	P	E	E	NR	NR	NR	G	E	G	E	ID	NR	ID	NR	P
	Salvinia, giant	NR	G	G	P	E	E	F	NR	NR	F	E	G	P	G	NR	E	NR	P
	Waterhyacinth	E	G	G	NR	G	G	NR	NR	E	P	F	G	E	G	NR	E	E	P
	Watermeal	NR	NR	NR	NR	P	P	NR	NR	NR	G	G	NR	NR	NR	NR	P	NR	P
	Water lettuce	NR	G	G	NR	G	G	G	G	NR	E	NR	E	G	E	NR	E	NR	P
Emersed Plants	Alligatorweed	P	G	F	NR	NR	NR	NR	NR	G	F	F	G	G	G	NR	G	G	P
	American lotus	G	ID	NR	NR	NR	NR	NR	NR	ID	ID	G	E	F	G	NR	ID	G	P
	Cattail	F	ID	NR	NR	F	F	NR	NR	NR	P	G	E	G-E	E	NR	ID	F	P
	Creeping waterprimrose	E	ID	F	NR	NR	NR	NR	NR	G	ID	F	E	F	E	NR	G	E	P
	Floating hearts	P	ID	NR	NR	F	F	E	E	G	F	F	G	G	G	NR	F	P	P
	Fragrant waterlily	G	ID	NR	NR	NR	NR	NR	NR	E	ID	G	E	G	E	NR	ID	G	P
	Grass species	NR	ID	NR	NR	F	F	NR	NR	NR	NR	F	E	F	E	NR	ID	NR	P
	Parrotfeather	E	G	F	NR	NR	NR	NR	NR	E	F	NR	F	G	E	NR	G	E	NR
	Phragmites (Common reed)	NR	ID	NR	NR	NR	NR	NR	NR	NR	P	NR	G	F-G	E	NR	NR	F	P
	Pickerelweed	G	ID	NR	NR	NR	NR	NR	NR	E	ID	NR	F	E	E	NR	ID	G	P
	Rush	NR	ID	NR	NR	NR	NR	NR	NR	NR	ID	NR	G	ID	G	NR	ID	F	P
	Spatterdock	G	ID	NR	NR	NR	NR	NR	NR	P	ID	G	E	G	E	NR	ID	F	P
	Smartweeds	F	ID	NR	NR	F	F	NR	NR	G	ID	F	G	G	G	NR	F	G	P
	Waterpennywort	G	G	NR	NR	F	F	NR	NR	ID	G	G	E	E	E	NR	F	G	P
	Watershield	E	ID	NR	NR	F	F	NR	NR	G	ID	F	E	G	G	NR	ID	E	P
Submersed Plants	Bladderwort	P	ID	ID	NR	F	F	P	P	F	ID	E	NR	F-G	NR	NR	ID	P	E
	Cabomba	NR	ID	ID	NR	F	F	F	F	F	G	F	NR	F	NR	NR	ID	NR	F
	Coontail	G	ID	ID	NR	E	E	E	E	F	G	E	NR	NR	NR	NR	ID	G	E
	Egeria (Brazilian elodea)	NR	ID	ID	F	E	E	P	P	F	ID	E	NR	ID	NR	NR	G	NR	E
	Eurasian watermilfoil	E	G	G	NR	G	G	E	NR	E	G	E	NR	F	NR	NR	G	E	P
	Hydrilla, monoecious	NR	G	ID	F	G	E	E	E	E	G	E	NR	F	NR	NR	G	NR	E
	Naiad, brittle	NR	ID	ID	G	E	E	E	E	ID	G	E	NR	ID	NR	NR	F	NR	E
	Naiad, Southern	NR	ID	ID	G	P	G	P	P	ID	G	G	NR	ID	NR	NR	F	NR	E
	Parrotfeather	E	G	ID	NR	G	G	E	E	E	G	E	NR	F	NR	NR	G	E	F
	Pondweed species	NR	G	ID	NR	E	E	E	E	P-F	G	E	NR	G	NR	NR	G	NR	E
	Proliferating spikerush	NR	ID	ID	NR	NR	NR	NR	NR	F	P	F	NR	F	NR	NR	F	NR	E
	Variable leaf milfoil	E	ID	G	NR	E	E	E	E	E	E	G	NR	NR	NR	NR	NR	E	P

Key: NR = Not Recommended; P = Poor; G=Good; ID = Insufficient Data; F = Fair; E = Excellent

Pond Dyes

Pond dyes may be used to prevent the growth of filamentous algae and submersed macrophyte vegetation. Pond dyes are not herbicides and do not directly kill aquatic plants. They function by blocking light penetration to the bottom of the pond. As a result, these products are most effective when applied very early in the growing season.

The use of a pond dye in aquacultural ponds usually is not recommended, as they tend to inhibit phytoplankton productivity that is needed to produce oxygen and provide food for zooplankton, which are the major food of fry and the smaller juvenile fishes. Application rates usually are about one part per million or 1 gallon per acre for a pond averaging 4 feet deep (for instance, 1 gallon per 4 acre-feet of water) for algae and most submersed weeds. For *Hydrilla*, the rate needs to be doubled, due to its ability to grow at very low light levels. Several of the available pond dyes are registered by the USEPA for aquatic weed control. Pond dyes *should not be applied to drinking water supplies or to streams or any body of water where there is any substantial outflow.*

Table 7-24. Pond Dyes

Examples of Pond Dyes	USEPA Registered
Admiral Liquid	Yes
Aquashade	Yes

Table 7-25. Labeled Sites and Restrictions

Herbicide and Formulation	Labeled Sites	Restrictions (others may apply)[1]
2, 4-D amine (Weedar 64) 3.8 lb a.i./gal Other formulations	potable water reservoirs, farm and fish ponds, lakes, golf course water hazards, fish hatcheries	Delay the use of treated waters for irrigation and domestic purposes for 3 weeks after application unless an assay indicates that chemical water concentrates are below the minimum amount as specified on the product label. Do not treat irrigation ditches where water will be used for overhead irrigation of susceptible crops. Refer to specific product label for restrictions.
2,4-D granular (Navigate) 20 G	ponds and lakes	Do not apply to water used for irrigation, agricultural sprays, watering dairy animals, or domestic water supplies.
bispyribac (Tradewind) 80%	bayous, canals, fresh water ponds, lakes, marshes, and reservoirs	Do not irrigate until water concentrations are less than 1 ppb. Do not treat water used for crawfish production.
copper-complex (Cutrine-Plus) 0.9 lb/gal (Cutrine-Plus) 3.7 G (K-Tea) 0.8 lb/gal **copper sulfate**	potable water reservoirs, farm and fish ponds, lakes, golf course water hazards, fish hatcheries	No restrictions on use of treated water. Check tolerance of crop to copper applied in irrigation water. Trout are very susceptible to copper. Toxicity to other fish increases with decreasing hardness of water.
carfentrazone (Stingray) 1.9 lb/gal	ponds, lakes, reservoirs, marshes, wetlands, drainage ditches, canals, streams, rivers	Irrigation: Do not use treated water in commercial nurseries or greenhouses. Field crops may be irrigated after 1 day if less than 20% of surface area was treated, or after 14 days if treatment was 20% or more of surface area or until an assay indicates that chemical water concentrates are below a minimum amount as specified on the product label. Treated water may be used for turf irrigation with no restriction if less than 20% of the total water body was treated. A 14-day restriction applies for larger area treatments. Do not apply within 0.25 miles an active potable water intake (upstream only in flowing waters) or turn intake off for at least 24 hours as specified on product label. Do not drink or water livestock for 1 day if 20% or more of total surface area was treated. Applicators must be licensed or certified by the state.
diquat (Reward) 2 lb/gal	lakes, still ponds, ditches, laterals, waterways	Apply only to still water or public waters. Do not apply to turbid waters. Do not use treated water for irrigation of food crops, preparation of agricultural sprays, or for drinking for 5 days after application. Turf and nonfood crops may be irrigated 3 days after treatment. Do not use water for livestock for 1 day after treatment. Water use restrictions may be removed if an approved assay is conducted, and water concentration is less than the maximum contaminant level as specified on product label. Refer to product label for specific PPE requirements.
dyes (Admiral Liquid) (Aquashade)	ponds and lakes with little to no outflow	Do not apply to water bodies not under direct control of user. Do not apply to water that will be used for human consumption.
endothall (Aquathol K) 4.23 lb/gal (Aquathol Super K granular) 63% (Hydrothol 191) 2 lb a.i./gal (Hydrothol granular) 11.2%	drainage canals, lakes, ponds	Consult with appropriate authorities before applying to public waters. Observe setback distance of at least 600 feet from functioning potable water intakes. Refer to specific product label for current restrictions on PPE, domestic use, irrigation, livestock use, and setback distance. Hydrothol formulations may kill fish when rates exceed 0.3 ppm. Check label for drinking water restrictions. Fish may be killed by Hydrothol rates exceeding 0.3 ppm. Irrigation and animal consumption restrictions of 7 to 25 days, depending on rate.
florpyrauxifen (Procellacor)	ponds, lakes, reservoirs, drainage ditches	Irrigation and livestock watering are generally restricted unless specifically allowed by product label. Do not apply to salt or brackish water. Prevent contact to or drift on sensitive species. Do not use with organosilicone surfactants.
flumioxazin (Clipper) 51%	bayous, canals, fresh-water ponds, lakes, marshes, and reservoirs	Do not irrigate from treated water for at least 5 days. Do not treat water used for crawfish production.
fluridone (Sonar 4 AS or SRP)	lakes, ponds, canals	Treated ponds may not be used for irrigation for 7 to 30 days. See label for irrigation precautions.[1]
glyphosate (AquaMaster) 5.4 lb a.i./gal (AquaNeat) 5.4 lb a.i./gal (Rodeo) 5.4 lb a.i./gal (Touchdown Pro) 3 lb a.e./gal Other formulations	all bodies of fresh water and all types of aquatic sites	Do not apply within 0.5 mile of an active potable water intake (upstream only in flowing waters) or turn intake off for at least 48 hours as specified on product label. Refer to specific product label for restrictions.
imazamox (Clearcast)	in and around aquatic and noncropland sites	Irrigation: Do not apply to water to be used for irrigation of greenhouse or nursery plants. Do not irrigate from still or quiescent water bodies within 24 hours of application. Do not irrigate if concentrations exceed 50 ppb.
imazapyr (Habitat)	in and around standing and flowing waters, including estuarine and marine sites	Irrigation: Do not use treated water for 120 days following application or until an assay indicates that chemical water concentrations are below a minimum amount as specified on the product label. Do not apply within 0.5 mile of an active potable water intake (upstream only in flowing waters) or turn intake off for at least 48 hours as specified on product label. Do not apply to fast-moving waters. Do not apply to irrigation ditches or canals within 1 mile of an active irrigation water intake unless the irrigation restrictions can be observed. Applicators must be licensed or certified by the state.

Table 7-25. Labeled Sites and Restrictions

Herbicide and Formulation	Labeled Sites	Restrictions (others may apply)[1]
penoxsulam (Galleon)	in and around quiescent water bodies and exposed sediments of de-watered areas	Do not apply to flowing water. Irrigation: Do not apply to water to be used for irrigation of greenhouse or nursery plants. Do not irrigate established food crops, other than rice, if concentrations exceed 1 ppb. Do not irrigate established rice if concentrations in treated water exceed 30 ppb. No restrictions on use of treated water for turf irrigation if concentrations are less than 30 ppb. Consult SePRO for other situations/ commodities.
sodium carbonate peroxyhydrate (GreenClean Pro) (PAK 27)	ponds, lakes, lagoons, canals, ditches.	Do not apply to treated, finished drinking water reservoirs.
triclopyr (Renovate 3) 3 lb/gal (Renovate OTF) 10 G	quiescent and slow-moving waters; non-irrigation canals	Irrigation: Do not use treated water for 120 days following application or until treated water has a non-detectable triclopyr level by an assay as specified on the product label. No restriction on irrigation of established grass. Applications around potable water intakes must observe minimum setback distances or minimum water concentrations as specified on the product label. Do not apply directly to or allow to come in direct contact with grapes, tobacco, vegetable crops, flowers, and other desirable broadleaf plants. Do not apply to estuarine sites; do not apply directly to un-impounded rivers or streams; and do not apply to irrigation ditches or canals. Do not allow lactating dairy animals to graze treated areas until the next growing season after application unless spot-treatment was applied to less than 10% of total grazable area. Animals for slaughter must be removed from the treated area for at least 3 days. Do not treat more than ½ of water body in a single operation; wait 10 to 14 days for next treatment.

[1] Water use restrictions for irrigation vary with formulation. See label for precautions. A 30-day restriction may be insufficient if applied to small ponds intended for irrigation of very sensitive crops, such as tobacco, tomatoes, or peppers.

Chemical Control of Specific Weeds

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Table 7-26. Chemical Control of Specific Weeds

Species	Herbicide and Formulation	Amount of Formulation	Time of Application	Precautions and Remarks
Artichoke, Betony or Florida Betony	dichlobenil (Casoron) 4 G (Gordon's Barrier) 4 G (Proteam Zapzit) 4 G	100 to 250 lb/acre	Any time. Fall or winter best.	*Do not use on cropland*. See Precautions and Remarks under **Weed Control in Woody Ornamentals.** In order to comply with state noxious weed regulations, contact your local plant protection specialist or NCDA&CS weed specialist at 919-707-3749.
	mesotrione (Tenacity) 4 SC	4 to 8 fl oz/acre	Apply to young, actively growing weeds.	Use a nonionic surfactant at 0.25% v/v. Reapply in 3 weeks. Controls Florida betony.
Bamboo (Cane)	glyphosate (Accord) 4 SL (Roundup PRO) 4 SL and various other trade names	2% solution sprayed to wet 1 part herbicide + 2 parts water, applied with sponge	Midsummer to early fall while actively growing. Whenever new shoots are in the "husk" stage (before leaves open) and are 12 feet to 24 inches in height.	For large canes; first cut canes and allow to regrow to 4 to 6 feet in height. Avoid drift to desirable vegetation. Use Accord for forestry and utility rights-of-way sites. Wear rubber gloves. Wipe entire shoot with a sponge dampened with the herbicide. Sponge should not be dripping wet. Do not allow contact with desirable vegetation; avoid dripping onto grass.
Bermudagrass	glyphosate + fluazifop (Roundup PRO) 4 SL + (Fusilade DX) 2 EC	2 to 0.75 qt/acre	See Precautions and Remarks	Apply when bermudagrass is actively growing. Repeat applications when bermudagrass regrows. Wait 30 days after last application to seed, sprig, or sod new bermudagrass.
	Dazomet (Basamid)	218 to 525 lb/acre	See Precautions and Remarks	Restricted Use Pesticide. May be used to control many annual and perennial weed species including bermudagrass. Apply to properly prepared soil and incorporate physically or with water. Consult and follow label directions.
Berries (*Rubus* spp.)	glyphosate (Accord) 4 SL (Roundup PRO) 4 SL and various other trade names	3 to 4 qt/acre as broadcast spray or 1% to 1.5% solution with handheld equipment	After bloom stage	Use higher rate for plants that have reached the woody stage of growth. Best results are obtained when sprayed in late summer after berries are formed. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
	triclopyr amine (Garlon 3 A) 3 SL	1 gal/100 gal water	After leaves fully expand in spring and before leaf color change in fall	See comments under kudzu.
Florida Betony	atrazine (AAtrex 4L) 4L	1 to 2 qt/A	Fall or winter	May be used on centipedegrass, St. Augustinegrass and dormant bermudagrass. Do not apply after Dec. 31 on bermudagrass unless delay in greenup is acceptable.
	triclopyr + clopyralid (Confront) 3 SL	1 to 2 pt/A	Fall or winter	Do not apply to home lawns. May be used on centipedegrass, bermudagrass, and zoysiagrass. Do not apply to bermudagrass during transition. Repeat applications may be required.
	MCPA amine + triclopyr amine + dicamba (Horsepower) 4.56 L	2 to 3 pt/A	Fall or winter	May be applied to home lawns by a commercial applicator. Not for use on turf grown for resale or other commercial uses such as sod or seed production. May be used on bermudagrass, zoysiagrass and bahiagrass.
	MCPA ester + triclopyr ester + dicamba (Coolpower) 3.6 L	2.5 to 3.5 pt/A	Fall or winter	May be applied to home lawns by a commercial applicator. Not for use on turf grown for resale or other commercial uses such as sod or seed production. May be used on bermudagrass, zoysiagrass and bahiagrass.
Honeysuckle	dicamba (Banvel) 4 SL	1 gal/100 gal water	When actively growing, prior to bloom.	Using hand-held equipment, spray to wet leaves. Add a nonionic surfactant at the rate of 2 quarts per100 gallons of finished spray solution to improve wetting. Keep spray off desired plants. Do not spray in rooting zone of desired plants.
	2,4-D amine (various) 4 SL	1.5 qt/50 gal water		
	glyphosate (Accord) 4 SL (Roundup PRO) 4 SL and various other trade names	3 to 4 qt/acre as broadcast spray or 1% to 1.5% solution with handheld equipment	When plants are actively growing at or beyond the bloom stage of growth.	Use the higher rate for plants that have reached the woody stage of growth. Ensure thorough spray coverage with hand-held equipment. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.

Table 7-26. Chemical Control of Specific Weeds

Species	Herbicide and Formulation	Amount of Formulation	Time of Application	Precautions and Remarks
Kudzu	aminopyralid (Milestone) 2 SL	7 oz/A	Apply to young, actively growing plants	May be used in permanent grass pastures, rangeland, noncrop areas, nonirrigation ditch banks and other natural areas. Due to crop sensitivity, use extreme caution around sensitive crops including but not limited to alfalfa, cotton, potatoes, soybeans, tobacco and other broadleaf or vegetable crops, fruit trees, or ornamental plants. Do not use aminopyralid-treated plant residues, including hay or straw from treated areas, or manure from animals that have grazed treated areas in compost or mulch that will be in contact with susceptible broadleaf plants. There are no restrictions on grazing or hay harvest following aminopyralid applications. Check and follow label directions for completed list and precautions.
	clopyralid (Transline) 3 SL	1 to 3 qt/100 gal	During active growth.	Spray to wet leaves. Do not apply more than 1.337 pints per acre.
	dicamba (Banvel) 4 SL (Vanquish) 4 SL	1 gal/100 gal water 0.5 gal/100 gal water	When actively growing, before bloom. Dormant season; just prior to budbreak (early to mid-March).	Using hand-held equipment, spray to wet leaves. Keep spray off desired plants. Do not spray in rooting zones of desired plants. Add a nonionic surfactant at the rate of 2 quarts per 100 gallons of finished spray solution to improve wetting. Do not spray in rooting zones of desired plants. Regrowth should be sprayed in mid- to late summer with glyphosate or clopryalid.
	fosamine (Krenite S) 4 SL	1.5 to 3 gal/acre	August through September.	Spray to wet leaves thoroughly. Good coverage is necessary.
	glyphosate (Accord) 4 SL (Roundup PRO) 4 SL and various other trade names	4 qt/acre as broadcast spray or 2% solution with handheld equipment	When actively growing at or beyond bloom stage of growth.	Repeat applications are necessary to maintain control. Ensure thorough spray coverage with hand-held equipment. Apply before frost in the fall. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
	metsulfuron methyl (Escort) 60 WDG	3 to 4 oz/acre	When actively growing.	Add 1 quart nonionic surfactant per 100 gallons of water plus a drift control agent. Do not apply by air.
	sulfometuron methyl (Oust) 75 WDG	12 oz/acre per 100 gal water	When actively growing.	Add 1 quart nonionic surfactant per 100 gallons of water plus a drift control agent. Do not apply by air.
	triclopyr amine (Garlon 3 A) 3 SL	2 gal/100 gal water	During mid-season when plants are actively growing.	Spray to wet leaves thoroughly. Do not allow to drift; product is very toxic to tobacco, soybeans, many other broadleaf crops, trees, and ornamentals. Most grasses very resistant.
Mugwort ***(Artemisia vulgaris)***	dichlobenil (Casoron) 4 G (Gordon's Barrier) 4 G (Proteam Zapzit) 4 G	100 to 250 lb/acre	Any time. Fall or winter best.	*Do not use on cropland*. See Precautions and Remarks under **Weed Control in Woody Ornamentals.**
	EPTC (Eptam 7-E) 7 EC	6.75 pt/acre	Spring or fall.	Plow area before treatment. Incorporate chemical into soil immediately after application. Rototilling is the preferred method, but deep cross-disking is satisfactory. Treatment most effective when soil is moist but not wet. Under normal conditions the herbicide will be dissipated in 8 to 12 weeks. Tilling the soil several times before planting will help dissipate chemical from soil.
Multiflora Rose (See publication AG-536 for more details)	2,4-D + triclopyr (Crossbow) 3 EC	1 to 1.5 gal in 100 gal water (handgun application) or a 1% to 1.5% solution for smaller amounts Undiluted herbicide	At fall vegetative stage prior to full bloom	Spray to wet all leaves and green stems to drip point. Use low spraying pressure to prevent drift. For best results, apply when plants are actively growing during the early to mid-flowering stage. Small plants may be controlled by a thinline basal application of undiluted herbicide across all stems at a height where the stems are less than 0.5 inch in diameter. Apply approximately 20 ml of undiluted product per bush. Treat when bark is dry, and rain is not forecast. For bushes with more than 3 or 4 stems, coverage of each stem may be difficult; basal bark or dormant stem applications may be more effective (see these sections under **Chemical Control of Woody Vegetation**). **Warning:** *Restrictions on grazing or harvesting of green forage:* Do not graze lactating dairy animals or harvest green forage for 14 days following treatment with 2 gallons per acre or less; with treatment rates greater than 2 gallons per acre, do not graze or harvest green forage until the following growing season. For other livestock, no grazing restrictions apply at rates under 2 gallons per acre. Above 2 gallons per acre, do not graze or harvest green forage from treated areas for 14 days after treatment. *Restrictions on haying (harvesting of dried forage):* For lactating dairy animals, do not harvest hay until the next growing season. For other livestock, do not harvest hay for 7 days after treatment at rates under 2 gallons per acre. Above 2 gallons per acre, do not harvest hay for 14 days after treatment. *Slaughter restrictions:* Withdraw livestock from grazing treated grass or treated hay at least 3 days before slaughter. This restriction applies to grazing during the season following treatment or hay harvested during the season following treatment.
	dicamba (Banvel) 4 SL	1 gal/100 gal water	At full vegetative stage, prior to bloom.	Can be used in pastures and noncropland. A maximum of 200 gallons of spray solution can be used per acre. Spray with a handgun and completely wet foliage and stems, allowing spray solution to run down the stems. Add a nonionic surfactant at the rate of 2 quarts/100 gallons of finished spray solution to improve wetting. Do not graze dairy animals for 60 days. There is no waiting period between treatment and grazing beef cattle or other livestock. Do not spray desired plants or in rooting zone of desired plants. Follow-up treatments may be necessary in subsequent years.

Table 7-26. Chemical Control of Specific Weeds

Species	Herbicide and Formulation	Amount of Formulation	Time of Application	Precautions and Remarks
Multiflora Rose (See publication AG-536 for more details) (continued)	fosamine (Krenite S) 4 SL	1.5 to 3 gal/ 100 gal water	Apply to foliage during the 2-month period before fall leaf coloration.	Thoroughly and uniformly cover plants without drenching. Use 1 to 2 quarts per 100 gallons of a penetrating type, oil-based surfactant to improve activity. Use in noncropland, fence lines.
	glyphosate (Accord) 4 SL (Roundup PRO) 4 SL and various other trade names	1 gal/100 gal water	Apply to foliage after full bloom until August 1.	Use handgun and thoroughly cover bush. May be used in noncropland and pasture. Do not graze livestock for 10 days following treatment. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
	metsulfuron methyl (Escort) 60 WDG	0.5 to 1 oz/acre	Early spring after bushes are fully leaved out.	Escort is not labelled for pastures; Cimarron may be used to control roses in pastures. For effective broadcast treatments, rose bushes should not be taller than 3 feet. For spot treatment, apply as foliar spray to runoff, and do not exceed 75 gallons total spray per acre. Use 1 pint to 1 quart surfactant per 100 gallons spray.
	metsulfuron methyl (Cimarron) 60 WDG	0.3 oz/acre for broadcast; 1 oz per 100 gal water for spot treatment		
	tebuthiuron (Spike) 20 P	20 lb/acre	Apply after ground thaws in spring before or soon after leaf flush. May require 2 yr for kill of large canes.	Broadcast over root zone. Do not apply near desirable trees or shrubs. Ground may be bare for 3 to 5 years where applied.
	(Spike) 80 WP	5 lb/acre		Apply in water with a backpack sprayer as a band at the base of bushes or lace overtop of bushes. Same precautions as above for Spike 20 P.
Nutsedge	2,4-D amine (various brands) 4 SL	1 qt/acre	Early in growing season following a thorough disking. Repeat at 3-week intervals for 3 treatments.	Corn crop can be produced while using 2,4-D. Apply preemergence rate. Follow 3 to 4 weeks later with rate suggested for corn and repeat. Rate suggested can be used following tobacco harvest.
	dichlobenil (Casoron)	See section on **Weed Control in Woody Ornamentals**.		Do not use on row crop land.
	glyphosate (Accord) 4 SL (Roundup PRO) 4 SL and various other trade names	3 qt/acre	See remarks.	Apply when plants are in flower or when new nutlets can be found at rhizome tips. Tillage two weeks after application will improve control. Repeat treatment will be required for long-term control. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
	bentazon (Basagran) 4 SL	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression. Bentazon and S-metholachlor control yellow nutsedge only.
	chlorimuron (Classic) 25 WDG	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
	EPTC (Eptam 7-E) 7 EC	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
	halosulfuron (Permit, Sandea, Sedgehammer) 75 DF	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
	imazaquin (Image) 70 DG	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
	imazethapyr (Pursuit) 2 AS	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
	S-metolachlor (Dual Magnum, Dual II Magnum)	Follow label directions	Follow label directions.	See weed control for specific field, turf, or vegetable crop for nutsedge suppression. Bentazon and S-metholachlor control yellow nutsedge only.
	sulfosulfuron (Certainty) 75 WG	1.25 oz/acre	Apply in May for June.	Add a nonionic surfactant at 0.25% v/v. Make a second application in 6 to 10 weeks, if needed. Certainty and Monument control yellow nutsedge, purple nutsedge, and kyllinga species.
	trifloxysulfuron (Monument) 75 WG	0.45 to 0.56 oz/acre	Apply in May for June.	Add a nonionic surfactant at 0.25% v/v. Make a second application in 6 to 10 weeks, if needed. Certainty and Monument control yellow nutsedge, purple nutsedge, and kyllinga species.
Poison Ivy and Poison Oak	2,4-D amine (various brands) 4 SL	2 qt/100 gal water	Apply in late spring or early summer when the plants are growing rapidly.	Apply only to plant material to be killed. Apply as a wetting spray. Avoid drift. Repeat in 6 to 8 weeks if needed. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
	dicamba (Banvel) 4 SL	1 gal/100 gal water	At full vegetative stage, before bloom.	See comments for honeysuckle.
	glyphosate (Accord) 4 SL (Roundup PRO) 4 SL and various other trade names	4 to 5 qt/acre as a broadcast spray or 2% solution with handheld equipment	After leaves fully expand in the spring and before leaf color changes in the fall.	
	triclopyr amine (Garlon 3 A) 3 SL	1 gal/100 gal water	After leaves fully expand in spring and before leaf color changes in fall.	See comments for Kudzu.
Tree of Heaven *(Ailanthus altissima)*	metsulfuron methyl (Escort) 60 WDG	1 oz/100 gal water for high-volume treatment 1 oz/20 gal water for low-volume treatment	Mid-summer	For right-of-way use only. Escort is not labeled for pastures.

Chemical Control of Woody Plants

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Table 7-27. Chemical Control of Woody Plants

Treatment Type	Herbicide and Formulation	Amount of Formulation	Precautions and Remarks
Foliage Treatment, most woody species: ash, red maple, and persimmon generally resistant. Rhododendron resistant	2,4-D amine (various brands) 4 SL, MOA 4	2 gallons in 100 gallons water	Use amine formulations to reduce vapor drift hazard. Use low spraying pressure to prevent spray drift. Wet foliage and stems thoroughly. Most effective results obtained by spraying within 6 weeks after plants have reached full-leaf stage. This treatment used primarily on trees or brush less than 6 feet tall. Only certain brands of 2,4-D can be used on ditch banks or near other bodies of water; check labels.
	2,4-D low volatile ester or oil-soluble amine (various brands and concentrations)	varies	Use as invert emulsion to reduce drift hazards See remarks for 2,4-D amine.
	2,4-D + triclopyr (Crossbow) EC 2.0 + 1.0 pound/gallon, MOA 4	1 to 1.5 gallons in 100 gallons water (handgun application) 1.5 to 4 gallons in water to deliver 15 to 30 gallons total spray/acre	Spray to wet all leaves and green stems to drip point. Use low spraying pressure to prevent drift. For best results, apply when plants are actively growing after full leaf in spring to early summer. This treatment is used primarily on trees and brush less than 6 feet tall. For application via boom or other broadcast spray equipment. For aerial application (helicopter only), use Nalcotrol to prevent drift. See label for specific information. **Warning:** *Restrictions on grazing or harvesting of green forage:* Do not graze lactating dairy animals or harvest green forage for 14 days following treatment with 2 gallons per acre or less; with treatment rates greater than 2 gallons per acre, do not graze or harvest green forage until the following growing season. For other livestock, no grazing restrictions apply at rates under 2 gallons per acre. Above 2 gallons per acre, do not graze or harvest green forage from treated areas for 14 days after treatment. *Restrictions on haying (harvesting of dried forage):* For lactating dairy animals, do not harvest hay until the next growing season. For other livestock, do not harvest hay for 7 days after treatment at rates under 2 gallons per acre. Above 2 gallons per acre, do not harvest hay for 14 days after treatment. *Slaughter restrictions:* Withdraw livestock from grazing treated grass or treated hay at least 3 days before slaughter. This restriction applies to grazing during the season following treatment or hay harvested during the season following treatment.
	fosamine (Krenite S) 4 SL	1.5 to 3 gallons in 100 gallons water	Apply to foliage during the 2-month period prior to fall leaf coloration. Thoroughly and uniformly cover plants without drenching. Add surfactant WK at the rate of 1 quart per 100 gallons of spray. Surfactant WK is not needed with Krenite S. Rate and gallonage depend on plant size and species to be controlled. Check label. Use in noncropland, fence lines.
	dicamba (Banvel) 4 SL	1 gallon in 100 gallons	Apply when leaves are fully developed. Spray with a handgun to completely wet foliage and allow spray to run down the stem. Add a nonionic surfactant at the rate of 2 quarts per 100 gallons of finished spray solution to improve wetting. Retreatment may be required, but do not exceed 2 gallons per treated acre during one growing season. Keep spray off desired plants. Do not spray in rooting zone of desired plants.
	triclopyr (Garlon 3A) 3 SL (Garlon) 4.4 EC	 2 to 3 gallons in 100 gallons water 1 to 3 gallons in 100 gallons water	Spray to thoroughly wet leaves, stems, and root collars. Can be mixed with other woody plant herbicides. See label. Avoid drift.
Foliage Treatment, woody brush and trees	2,4-D amine (DMA 4 IVM) 3.8 SL, MOA 4	2 to 8 pints/acre	Apply when weeds are small and actively growing before bud stage. Biennial and perennial species are best controlled in seedling to rosette stage before flower stalks appear.
	Aminocyclopyrachlor (Method 240SL)	4 to 18 fl oz/acre	For non-crop areas. Include MSO type adjuvant at rate of 1% v/v. Do not use near the root zone of desirable, sensitive species. Do not use treated plant material for mulch. Refer to product label for full product restrictions and use directions.
	dicamba (Vanquish) 4 SL, MOA 4	0.5 to 4 pints in 25 to 200 gallons water	For low volume applications, apply 3 to 5% v/v rate. Check product label for tank mix partners for woody brush and vines.
	glyphosate (Accord Concentrate) 5.4 SL, MOA 9	5 to 8% solution	If brush has been mowed or trees cut, wait until regrowth reaches recommended stage before treating. Apply as a low volume directed spray on at least 50% of the targeted foliage using a lateral zigzag motion from top to bottom. Spray to wet, not runoff. Add NIS at 2 quarts per 100 gallons of spray solution.
	metsulfuron methyl (Escort XP) 60 DF, MOA 2	0.33 to 4 ounces/acre in 10 to 50 gallons water	For industrial, noncrop sites on young, actively growing weeds and brush. High volume ground application: mix 0.5 to 3 ounces per 100 gallons spray solution and apply at 100 to 400 gallons per acre. Low volume and ultra-low volume ground applications: mix 4 to 8 ounces per 100 gallons spray solution and apply at 10 to 50 gallons per acre.
	triclopyr (Remedy) 4 EC, MOA 4	2 pints in 10 gallons water/acre	Treat after rapid growth period in spring when leaf tissue is fully expanded, and terminal growth has slowed. During drought or for hard-to-control weeds, add 2 to 3 quarts of 2,4-D low volatile ester to spray solution.
	triclopyr + fluroxypyr (PastureGard) 2 EC 1.5 + 0.5 pounds/gallon, MOA 4	3 to 8 pints/acre	Broadcast applications: treat in late spring through summer when leaves are fully expanded, and terminal growth has slowed. If brush has been mowed, allow 9 to 12 months of regrowth before treating. NIS or liquid fertilizer at 1 to 2 quarts per 100 gallons of spray solution may improve control. High volume foliar treatment of individual plants: apply 1 to 2 gallons of PastureGard plus 1 quart NIS per 100 gallons of spray solution.
Foliage Treatment, black locust, honey locust, mimosa, redbud, and wisteria	aminopyralid (Milestone VM) 2 SL, MOA 4	4 to 7 fluid ounces/acre	Treat when weeds are actively growing. Include a non-ionic surfactant. Avoid mowing for 14 days after application.
Foliage Treatment, numerous woody species	aminopyralid + triclopyr (Milestone VM Plus) 1.1 SL, MOA 4	6 to 9 pints/acre	Treat when weeds are actively growing. Include a non-ionic surfactant.
Foliage Treatment, most vegetation	imazapyr (various) 2 SL, MOA 2	0.5 to 5% v/v 0.6 to 6.4 fluid ounces/gallon	Most effective with 1% methylated seed oil.

Table 7-27. Chemical Control of Woody Plants

Treatment Type	Herbicide and Formulation	Amount of Formulation	Precautions and Remarks
Basal Stem Treatment, most woody species; black locust resistant	2,4-D low volatile ester (various brands) 4 SL, MOA 4	2 gallons in 100 gallons high quality mineral oil	Spray lower 12 inches of stem or trunk and let some solution run into ground. May be used any time of year but is much more effective during dormant season. One growing season required before plants die completely. This treatment used primarily on plants less than 6 inches in diameter. Root suckering species may be resistant. *Both dormant stem and basal treatments useful to farmers and landowners because during winter there is less hazard to crops and more labor probably available.* Do not use around the home or ditch banks. Refer to product label for specific directions and restrictions.
	triclopyr (Garlon) 4.4 EC, MOA 4	1 to 3 gallons in 100 gallons high quality mineral oil	
	2,4-D + triclopyr (Crossbow) EC 2.0 + 1.0 pound/gallon, MOA 4	4 gallons in high quality mineral oil to make 100 gallons spray	Spray basal portions of trees or brush to a height of 15 to 20 inches from the ground. Thoroughly wet all basal bark areas, including crown and ground sprouts and ground area at base of stems or trunk. For trees larger than 6 to 8 inches diameter, use stump treatment. Winter and early spring treatments give best results. See warning for livestock and haying usage for Crossbow listed above under "Most Woody Species."
Basal Stem Treatment, most woody species	Aminocyclopyrachlor (Method 240SL)	4 to 18 fl oz/acre	Treat lower 18 inches of stem. Use dilute solution of 5 to 10% Method in basal oil. Refer to product label for specific directions and restrictions.
	imazapyr (Stalker) 2 SL, MOA 2	8 to 12 fluid ounces in 1 gallon high quality mineral oil	Treat lower 18 inches of stem. May be used on stems up to 4 inches DBH. Do not apply to point of dripping or puddling.
Basal Stem Treatment, woody brush and trees	2,4-D amine (DMA 4 IVM) 3.8 SL, MOA 4	8 qt in 100 gal water or 2.6 fl oz in 1 gal water	Thoroughly wet the base and root collar of all stems until the spray accumulates around the root collar at the ground line. Wetting the stems will aid in control.
	triclopyr (Remedy) 4 EC, MOA 4	2 gallons in 98 gallons high quality mineral oil	Spray basal 15 to 20 inches of plant to point of runoff at soil surface.
	triclopyr + fluroxypyr (PastureGard) 2 EC 1.5 + 0.5 pounds/gallon, MOA 4	50% PastureGard + 50% high quality mineral oil	Apply at any time to stems less than 6 inches in diameter except when snow or water prevents spraying to ground line. Use solid cone or flat fan nozzles at low pressure. Spray to wet but not runoff.
Dormant Stem Treatment, most woody species	2,4-D + triclopyr (Crossbow) EC 2.0 + 1.0 lb/gal, MOA 4	1 to 4 gallons in high quality mineral oil to make 100 gallons spray	Thoroughly wet upper and lower stems, including root collar and any ground sprouts. Treat when brush is dormant, and the bark is dry, but not when snow or water prevents spraying to ground line. Best results occur with late winter to early spring applications. Brush over 8 feet in height is difficult to control with this method. See warning for livestock and haying usage for Crossbow listed above under "Most Woody Species."
Dormant Stem Treatment, woody brush and trees	triclopyr (Remedy) 4 EC, MOA 4	3 to 6 quarts in high quality mineral oil to make 100 gallons spray	Treat any time brush is dormant and most foliage has dropped. Use 20 to 40 psi with knapsack or power spraying equipment. Do not apply if snow or water prevents spraying to ground line. Wet stems to point of runoff and ground below the plant for root suckering species, such as sumac, sassafras, or locust.
Stump Treatment to Prevent Regrowth, most woody species	2,4-D low volatile ester (various brands) 4 SL, MOA 4	3 gallons in 100 gallons high quality mineral oil	Soak freshly cut stumps with spray solution to prevent sprouting or use AMS crystals on stump. Hasten decay of stump by covering with layers of soil and a nitrogen fertilizer. Keep moist.
	2,4-D + triclopyr (Crossbow) EC 2.0 + 1.0 lb/gal, MOA 4	4 gallons in high quality mineral oil to make 100 gallons spray	Cut down trees and treat stumps, including the freshly cut surface, bark, crown, and ground sprouts. Winter and early spring treatments (before growth begins) give best results.
	dicamba (Banvel) 4 SL, MOA 4	16.5 gal in 100 gal water	Spray or paint freshly cut surface with the solution. Area adjacent to bark should be thoroughly wet.
Stump Treatment to Prevent Regrowth, woody brush and trees	2,4-D amine (DMA 4 IVM) 3.8 SL, MOA 4	8 qt in 100 gal water or 2.6 fl oz in 1 gal water	Apply as soon as possible after cutting trees. Thoroughly soak entire stump including cut surface, bark, and exposed roots.
	dicamba (Vanquish) 4 SL, MOA 4	1 gal in 1 to 3 gal water	NIS or oil may be added to enhance control. Make application within 30 minutes of cutting. Area adjacent to the bark should be thoroughly wet.
	triclopyr (Remedy) 4 EC, MOA 4	20 to 30 gallons in high quality mineral oil to make 100 gallons spray	Treat with a backpack or knapsack sprayer using low pressure and a solid cone or flat fan nozzle. Spray stump sides and outer portion of cut surface but not to point of runoff. Apply anytime except when snow or water prevent spraying to ground line.
	triclopyr + fluroxypyr (PastureGard) 2 EC 1.5 + 0.5 lb/gal, MOA 4	50% PastureGard + 50% high quality mineral oil	Apply to freshly cut stumps using solid cone or flat fan nozzles at low pressure. Wet stump sides, root collar, and outer portion of cut surface but not to point of runoff. Apply anytime except when snow or water prevent spraying to ground line.
Stump Treatment to Prevent Regrowth, woody species, such as alder, dogwood, hickory, maple, oak, poplar, sweet gum, sycamore, and willow	glyphosate (Accord Concentrate) 5.4 SL, MOA 9	50 to 100% solution	Treat freshly cut stumps or resprouts. Apply to freshly cut stumps immediately after cutting or reduced performance may occur.
Stump Treatment, numerous wood species	Aminocyclopyrachlor (Method 240SL)	4 to 18 fl oz/acre	Use dilute solution of 5 to 10% Method in basal oil. Apply as soon as possible after cutting stems. Refer to product label for specific directions and restrictions.
	aminopyralid + triclopyr (Milestone VM Plus) 1.1 SL, MOA 4	apply undiluted	Apply as soon as possible after cutting stems.
Stump Treatment, most woody species	imazapyr (Stalker) 2 SL, MOA 2	8 to 16 ounces in 1 gallon high quality mineral oil	Apply as soon as possible after cutting stems.
Soil Treatment Beneath Woody Plants, most woody species	hexazinone (Velpar L) 2 SL, MOA 5	2 to 4 gallons in 100 gallons water	Apply as a coarse spray, using a handgun applicator. Direct spray beneath plants to be controlled. Apply during the period between late winter and early summer. Do not apply in vicinity of desirable plants.
	bromacil (Hyvar X-L) 2 SL, MOA 5	varies	Apply as a coarse spray, using a handgun applicator. Use at least 200 gallons of spray per acre. Direct spray beneath plants to be controlled just before or during the period of active growth. Do not apply in vicinity of desirable plants. Rates depend on species to be controlled. Check label.
	tebuthiuron (Spike) 20 P, MOA 7	5 to 30 pounds/acre	Rates depend on species to be controlled. Check label for specific rates. Apply when ground is not frozen. Do not apply to the root zone of desirable trees or shrubs or where runoff can carry the herbicide to desired plants.

Total Vegetation Control in Noncropland

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Controlling all weeds for extended periods is expensive; it is practical only where complete vegetation control is desirable and soil erosion is not an important factor. Such areas are around signposts and buildings, along highways and railroads, under guardrails and fences, and in parking lots. Do not use any of the treatments where adjacent trees, ornamentals, or crops might be affected. Roots of nearby desirable plants, especially trees and shrubs, may grow into an area that has been treated and be killed.

Effective rates for control vary with the weed species, degree of infestation, soil type, and environmental conditions. The lower rates are generally applied to annuals, biennials, shallow-rooted perennials, and seedling perennials, whereas the higher rates are applied to established, deep-rooted, and other hard-to-kill perennials. For specific details, read and follow directions on the label.

Table 7-28. Total Vegetation Control in Noncropland

Herbicide and Formulation	Amount of Formulation	Precautions and Remarks
aminocyclopyrachlor (Method 240SL)	Up to 18 fl oz/acre	May be used preemergence or postemergence on sensitive species. May be applied in combination with other herbicides to improve efficacy, species controlled, or duration of control. Do not use treated plant material for mulch. Refer to product label for full product restrictions and use directions.
bromacil (Hyvar X) 80 WP (Hyvar X-L) 2 SL	 3 to 30 pounds/acre 1.5 to 12 gallons/acre	For handgun sprayer, use at least 200 gallons of water per acre. For treating small areas, use a hand sprayer or sprinkling can. For retreatment apply 2 to 6 pounds of active material per acre when annual weeds and grasses reappear on sites where weed growth has been controlled. Rates depend on weeds to be controlled. Check label.
bromacil + diuron (Krovar I) 80 WDG	4 to 30 pounds/acre	Rates depend on weeds to be controlled. Check label. For retreatment use 4 to 6 pounds per acre.
diuron (Karmex) 80 WDG	5 to 15 pounds/acre	For most annual weeds.
	20 to 60 pounds/acre	For perennial weeds. Addition of paraquat at the rate of 0.5 pound per acre plus nonionic surfactant will provide quick kill of existing vegetation and allow lower rates of diuron to be used.
flumioxazin (Payload) 51WDG	8 to 12 oz/acre	May be used preemergence or postemergence on sensitive species. May be applied in combination with other herbicides to improve efficacy, species controlled, or duration of control. Refer to product labels for specific guidance on product combinations.
indaziflam (EsplAnade) 200 SC	5 to 7 fl oz/acre	For preemergence residual control of many annual broadleaf and grass weeds. May be applied in combination with other herbicides to improve efficacy, species controlled, or duration of control. Existing weeds will require use of a postemergence herbicide. Refer to product labels for specific guidance on product combinations.
imazapic + glyphosate (Journey) 0.75 + 1.5 lb/gal AS	0.33 to 1 quart/acre	For broadcast or spot treatment of annual and perennial grass and broadleaf weeds and vine species. May be applied preemergence or postemergence but postemergence is preferred. Depending on weed species, use a 5 to 20% active MSO at 1 to 2 pints per acre or a NIS at least 60% active with HLB ratio between 12 and 17 at 0.25% v/v. Nitrogen-based liquid fertilizers may be added but not substituted for spray adjuvants. For extended residual control, tank mix with Arsenal, Endurance, Escort, Karmex, Krova, Oust, Pendulum, Roundup Pro, Sahara, Tordon, Vanquish, or 2,4-D. Spot treat with 0.8 to 17 ounces per gallon + 1% v/v MSO.
glyphosate (Roundup PRO) 4 SL (Roundup ULTRA) 4 SL	4 quarts/100 gallons water or 2 to 3 ounces/gallon water/1,000 square feet	For industrial and nonagricultural uses in hand-held, high-volume equipment, mix 4 quarts of Roundup PRO in 100 gallons of water and spray to wet. For farmstead weed control, use 1% to 2% solution of Roundup ULTRA. Use a 2% solution for perennial weeds. Glyphosate controls standing vegetation and does not have residual activity.
imazapyr (Arsenal) 2 SL	1.5 to 6 pints/acre	Imazapyr may be used for preemergence and postemergence control of many weed species. Use label recommended spray adjuvant for postemergence applications. May be applied in combination with other herbicides to improve efficacy, species controlled, or duration of control. Refer to product labels for specific guidance on product combinations.
imazapic + glyphosate (Journey) 0.75 + 1.5 lb/gal AS	0.33 to 1 quart/acre	For broadcast or spot treatment of annual and perennial grass and broadleaf weeds and vine species. May be applied preemergence or postemergence but postemergence is preferred. Depending on weed species, use a 5 to 20% active MSO at 1 to 2 pints per acre or a NIS at least 60% active with HLB ration between 12 and 17 at 0.25% v/v. Nitrogen-based liquid fertilizers may be added but not substituted for spray adjuvants. For extended residual control, tank mix with Arsenal, Endurance, Escort, Karmex, Krovan, Oust, Pendulum, Roundup Pro, Sahara, Tordon, Vanquish, or 2,4-D. Spot treat with 0.8 to 17 ounces per gallon + 1% v/v MSO.
oryzalin + glyphosate (Surflan AS Specialty) 4 AS + (Roundup PRO) 4 SL	 4 to 6 quart/acre + 4 to 6 quart/acre	For safer total vegetation control in vicinity of desirable vegetation. Rates depend upon size and weeds to be controlled. See Surflan label. Apply in 100 gallons water per acre.
prometon (Pramitol 25 E) 2 EC	 5 to 30 gallons/acre	For annuals, use 5 to 7.5 gallons per acre. For perennials, use 20 to 30 gallons per acre. Apply in 50 to 100 gallons of water. For faster knockdown of established weeds and grasses, apply in 100 to 200 gallons oil. For maintenance application in following seasons, reduce rate in half.
(Pramitol) 5 PS	0.5 to 2 pounds/100 square feet	Pellets containing 5% prometon, 0.5% simazine, 40% sodium chlorate, and 50% sodium metaborate. For maintenance use 1 pound per 100 square feet.
sulfometuron methyl + chlorsulfuron (Landmark MP) 50 + 25 DG (Landmark II MP) 56.25 + 18.75 DG	 4.5 to 9 ounces/acre 2.66 to 10 ounces/acre	Controls many annual and perennial grass and broadleaf weeds on terrestrial noncrop sites, including public, private, and military lands. Do not apply to recreation areas or paved surfaces. Can be applied to areas where temporary surface water has collected. Treat weeds preemergence or early postemergence when actively germinating or growing.

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