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PLANT GROWTH REGULATORS

Growth Regulators for Cotton

K. L. Edmisten and G. D. Collins, Crop and Soil Sciences Department

Table 8-1. Growth Regulators for Cotton

Purpose	Chemical and Formulation	Amount of Formulation Per Acre	Remarks
To suppress excessive vegetative growth	Mepiquat chloride (various brands) 0.35 lb/gal	0.5 to 1 pt	Base rate and timing on field conditions. Most consistent results occur when applied to cotton that is at least 24 inches tall at early bloom (5 to 6 white blooms per 25 feet of row). A follow-up application may be warranted 10 to 14 days later if excessive growth continues. When early season conditions promote excessive prebloom growth, mepiquat chloride may be applied at the rate of 0.125 to 0.25 pint beginning at match-head square (first square 0.125 to 0.25 inch in diameter). Repeat applications can be made when renewed growth occurs. Follow label directions. Mepiquat chloride will consistently suppress vegetative growth. Other benefits may include easier scouting, better insecticide coverage, less boll rot, earlier maturity, easier defoliation, and more efficient use of ground sprayers and low drum pickers. Yield response is inconsistent.
	Mepiquat pentaborate (Pentia)	0.82 lb/gal 0.5 to 1 pt	
	Cyclanilide 1.84 lb/gal + Mepiquat chloride 0.736 lb/gal (Stance)	2 to 3 fl oz	Use the 2 fluid ounces rate if applied at match-head square and the 2.5 to 3 ounces rate on applications following match-head square.
	Mepiquat chloride (Pix WSG) 0.90 lb/lb	0.1 to 1.2 oz	WSG formulation. Labeled rates range from 0.1 to 1.2 oz per acre. The 0.4 oz rate of this product is similar to 8 oz per acre of standard mepiquat products containing 0.35 lb/gal. The 0.6 oz rate of this product is similar to 11 to 12 oz per acre of standard mepiquat products containing 0.35 lb/gal.
	Mepiquat chloride 6X (various brands) 2 lb/gal	0.33 to 2 to 4.2 oz	These products are similar to standard mepiquat products but contain a much higher concentration of active ingredient and are therefore used at much lower rates than products containing 0.35 lb/gal. The 2 oz rate of this product is similar to 11 to 12 oz per acre of mepiquat products containing 0.35 lb/gal.

For more information, see Extension publication AG-417, *Cotton Information*, which is available at your local Cooperative Extension center.

Guide for Use of Defoliants on Cotton

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Apply defoliants when nodes above cracked boll reach four and the remaining bolls expected to be harvested are mature. A boll is mature enough for defoliation when it is too hard to be squeezed between thumb and fingers, when it is too hard to be sliced with a sharp knife, and when the seed coats turn light brown and seeds are well developed. Apply defoliants in a volume of 15 to 25 GPA by ground or at least 5 GPA by air. Consult the label for recommended rates when tank mixed with other harvest aids and for maximum season-long rates.

Table 8-2. Guide for Use of Defoliants on Cotton

Chemical Name	Brand Name and Formulation	Amount of Formulation Per Acre	Remarks
carfentrazone	Aim (2 lb/gal)	1 to 1.5 oz	Aim, like other herbicidal defoliants, can cause desiccation; however, the desiccation appears to be more transitory than that achieved with some of the other herbicidal defoliants. Aim appears to desiccate mature morningglories very well, and it does not seem like the addition of ethephon-type products is needed to improve morningglory desiccation. The label recommends a minimum of 10 gallons per acre for ground applications and the use of oil concentrate at 1% by volume (1 gallon per 100 gallons of spray solution). Use 0.5% COC during periods of hot weather, however the risk of desiccation is higher with this product during high temperatures. Do not use crop oil concentrate with Aim in mixtures with CottonQuik or FirstPick. Aim can be tank mixed with other defoliant products if boll opening or regrowth control is desired. Lower rates may be needed in defoliation mixtures.
ethephon	(various brands) 6 lb/gal	1.33 to 2.67 pt	Use higher rate during cool weather or when there are a significant number of harvestable bolls to open prior to killing frost. Ethephon will accelerate boll opening and enhance the activity of defoliants. It will not stimulate boll maturity. Micronaire may be reduced if ethephon is applied to cotton that is less than 60% open.
ethephon + cyclanilide	Finish or Terminate (6 lb/gal) (various brands)	1.33 to 2 pt	Use higher rates in cool weather. Finish is both a defoliant and boll opener. In situations where extended regrowth control is needed (in the 20 to 28-day range), adding thidiazuron would provide more acceptable regrowth control. Finish performance may benefit from the addition of a low rate of a standard defoliant in situations where cotton is actively growing with juvenile growth. Use compatibility agent when mixing with Def 6 or Folex.
flumiclorac-pentyl	Resource (0.86 lb/gal)	4 to 6 fl oz	Resource is an herbicidal defoliant that, like all herbicidal defoliants, can cause desiccation, although the desiccation tends to be more transitory than with some herbicidal defoliants. Under ideal defoliation conditions (warm, sunny days), add a NIS at 1 quart per 100 gallons of spray solution. Under dry or cool weather, use a methylated seed oil (MSO) or organosilicone spray solution. Apply in a minimum of 10 gallons per acre for ground applications and a minimum of 5 gallons per acre for aerial applications. Do not use flood jet or air induction nozzles. Resource can be tank mixed with other products if boll opening or regrowth control is desired. Resource only needs a 1-hour rain-free period. Preharvest interval (PHI) is 7 days.
fluthiacetmethyl	Blizzard (0.91 lb/gal)	0.5 to 0.66 fl oz	Blizzard is a PPO-inhibitor herbicidal-type defoliant. Experience with Blizzard has been limited in North Carolina. It can be tank mixed with ethephon-based products. Similar to other PPO-inhibitor defoliants, Blizzard should be very useful in desiccating juvenile foliage and as a second application prior to harvest. Add a crop oil concentrate or surfactant to tank mixes containing Blizzard according to label directions.
glyphosate	Roundup (various brands)	24 to 32 oz	Based on limited trials in NC concerning varieties that do not convey tolerance to glyphosate, Roundup provides effective regrowth control. Roundup provides very little defoliation and should be used in combination with a defoliant. Experience in NC is limited to tank mixes with 1.5 pints of Def or Folex per acre. Although Roundup prevents regrowth, it will not defoliate juvenile growth that may occur prior to defoliation. Roundup also provides some weed control when defoliating weedy cotton, especially grasses. Applicable only to conventional cotton.

Table 8-2. Guide for Use of Defoliants on Cotton

Chemical Name	Brand Name and Formulation	Amount of Formulation Per Acre	Remarks
paraquat	Gramoxone (2 lb/gal) (various brands)	5 oz to 2 pt	See label for specific brand requirements. Paraquat can be used as a harvest aid and to promote boll opening. It is best used when a second application is needed. Desiccation can occur and this product is temperature sensitive. Use only when the majority of unopened bolls are very mature. Use higher rates during periods of cool temperatures. The addition of COC, MSO, or NIS is often necessary according to label instructions. Most labels state that harvest should not occur within 3 days of application, however harvest should not be delayed much longer beyond this period as paraquat can kill the plant and cause fiber quality discounts due to bark contamination of lint.
pyraflufen-ethyl	ET (0.2 lb/gal)	1.5 to 2.5 oz	Like all herbicidal defoliants, ET can cause desiccation, although the desiccation tends to be transitory compared to some herbicidal defoliants. ET should help with desiccation of morningglory and other weeds listed on the herbicide label. ET can be mixed with other harvest-aid materials to provide boll opening or regrowth control. Consult the label for additive recommendations. In general, the use of a crop oil concentrate at 0.5% by volume is recommended. Do not use crop oil concentrate with ET in mixtures with CottonQuik or FirstPick. Use lower rates in warm weather.
thidiazuron	Dropp (50% WP) Free Fall (50% WP)	0.2 to 0.4 lb	Dropp is very effective at regrowth suppression. However, the activity of Dropp is reduced to a greater extent by cool weather than the activity of Def 6, Folex. Dropp requires the longest rain-free period of any of the defoliants—24 hours. Follow label directions and safety precautions.
thidiazuron	Freefall SC (4 lb/gal) (various brands)	1.6 to 6.4 oz	The addition of crop oil concentrate may improve performance in cooler or dry weather. Use the 3.2 oz rate in combination with most other defoliants in most cases that regrowth is expected. Use the higher rates when using this product as a stand-alone defoliant.
thidiazuron + diuron	Ginstar (1 lb/gal of thidiazuron plus 0.5 lb/ gal of diuron) (various brands)	0.4 to 1 pt	Ginstar is a mixture of Dropp and Diuron with an emulsifier that makes it more likely to desiccate than Dropp Ultra. Do not use Ginstar if temperatures are over 90°F. The addition of other defoliants is not recommended except for Finish at appropriate rates, Prep, or generic ethephon products. Ginstar rates should not exceed 10 ounces per acre in NC except under very adverse conditions or cold weather.
tribufos	Def 6 or Folex (6 lb/gal)	0.25 to 1.5 pt	Use lower range of rates (less than 1 pt) if crop is well matured as indicated by yellow- or red-tinged foliage or when temperatures are warm, especially when tankmixing with boll openers and thidiazuron. Use higher recommended rates when plants are still green and actively growing or in dry weather or cool weather, or when used as a stand-alone product or as a clean-up application; needs a 1-hour rain-free period. Follow label directions and safety precautions.
urea sulfate and ethephon	CottonQuik or FirstPick	1.5 to 3.5 qt	Use higher rates in cool weather. The 2-quart rate is recommended for most situations. Use a low rate of a standard defoliant with FirstPick unless the cotton is well cut-out with no juvenile growth.

Harvest Aids, Preharvest Desiccants, and Postharvest Desiccants

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All crops. Maximum coverage of plants is essential for adequate chemical desiccation. Dense vine growth and/or heavy weed growth necessitates use of maximum permitted rates and high spray gallonage per acre. Observe instructions for use of wetting agents.

Potato desiccation. Vine destruction in North Carolina has usually been accomplished by mechanical methods immediately before digging. Several chemicals are also available for preharvest destruction. All of these chemicals must be used in advance of digging. Vine killing with chemicals often aids skin set, depending upon maturity of the crop. Inhibition of heat sprouts has also been observed with chemical vine killing. Browning of the vascular ring of potato tubers sometimes occurs after using vine kill treatments.

Table 8-3. Harvest Aids and Preharvest Desiccants

Crop	Chemical and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Bulb Vegetable¹	pelargonic acid (Scythe) 4.2 L	7 to 10% solution	0.3 to 0.5	Preharvest interval is 24 hours. See label for further instructions.
Corn, Sweet	Carfentrazone Aim 2 EC	1 to 2 oz	0.016 to 0.031	Do not apply within 3 days of harvest. See label for further instructions.
Dry Bean, Southern Pea, Lentil, Guar Bean²	paraquat (Gramoxone SL) 2 SL (Gramoxone SL 2.0) 2 SL (Gramoxone SL) 3 SL	1.2 to 2 pt 1.2 to 2.0 pt 0.8 to 2.3 pt	0.3 to 0.5	Apply paraquat for weed and bean desiccation. Apply when the crop is mature and at least 80% of the pods are yellowing and mostly ripe with no more than 40% (bush-type beans) or 30% (vine-type bean and lentil) of the leaves still green. Add nonionic surfactant. Do not harvest or graze for at least 7 days after application. Make ground application in at least 20 gallons of water per acre. See label for further instructions.
	saflufenacil (Sharpen) 2.85 SC	1.0 to 2.0 oz	0.022 to 0.042	Registered for <i>Phaseolus</i> spp., <i>Vigna</i> spp. (adzuki bean, mung bean), garbanzo bean (chickpea) and lentils. Apply when beans have at least 80% yellow/brown pods and no more than 30% of leaves are still green for vine-type beans and lentils, and no more than 40% of leaves are still green for bush-type beans. Include a methylated seed oil (MSO) plus ammonium-based adjuvant for optimum desiccation. Allow up to 10 days for optimum desiccation. Preharvest interval is 2 (dry edible beans) or 3 (dry peas) days.
	sodium chlorate (Defol 750) 7.5 L (Defol 5) 5 L	3.2 qt 4.8 qt	6	Apply approximately 7 to 10 days before harvest. Do not graze livestock on treated fields or feed treated fodder or forage to livestock. See label for further instructions.
Herbs and Spices³	pelargonic acid (Scythe) 4.2 L	7 to 10% solution	0.3 to 0.5	To control weeds after harvest.
Pepper, Chili	sodium chlorate (Defol 750) 7.5 L (Defol 5) 5 L	1.6 to 4 qt 4 to 10 qt	3 to 7.5	Processing only. Apply 10 days before harvest. Consult with processor before applying. See label for further instructions.

Table 8-3. Harvest Aids and Preharvest Desiccants

Crop	Chemical and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Potato	diquat (Reglone) 2 L	1 to 2 pt	0.25 to 0.5	Preharvest desiccation of potato vines. Apply at least 7 days before harvest in 20 gallons of water per acre with ground equipment or 5 gallons of water per acre with aerial equipment. If vine growth is very dense, make a second application 5 days after the first application. Do not apply to drought-stressed potatoes.
	carfentrazone (Aim) 2 EC	2.0 to 5.8 oz	0.032 to 0.09	Apply Aim to potato foliage in the later stages of senescence for desiccation of potato foliage and vines. Aim will also desiccate susceptible broadleaf weeds. Adequate desiccation is achieved within 14 days after the initial treatment is applied. If the potato crop is in the active vegetative growth stage when desiccation is initiated, two applications may be required to provide desiccation of leaf and stem tissue. Dense potato canopy, large plant size and environmental conditions not conducive to product absorption or activity will reduce initial application efficacy and increase the need for a second application. If a second application is necessary, apply at 7 to 14 days after the first application. Thorough coverage is essential. See label for further instructions.
	glufosinate (Rely 280) 2.34 SL	1.3 pt	0.38	Desiccation of potato vines. Use sufficient water for thorough coverage of potato vines. For best results, apply at the beginning of the natural senescence of potato vines. See label for further instructions.
	sodium chlorate (Defol 750) 7.5 L (Defol 5) 5 L	3.2 qt 4.8 qt	6	Apply 10 days before harvest. DO NOT apply under conditions of extreme heat during the middle of the day.
	pelargonic acid (Scythe) 4.2 L	7 to 10% solution		Preharvest interval is 24 hours. See label for further instructions.
	pyraflufen (ET) 0.208 L (ETX) 0.335 L	2.75 to 5.5 oz 1.7 to 3.4 oz	0.045 to 0.009	Apply in early stage of crop senescence. Two applications may be necessary for complete desiccation. Preharvest interval is 7 days. See label for further information.
Root and Tuber Vegetable ¹	pelargonic acid (Scythe) 4.2 L	7 to 10% solution		Preharvest interval is 24 hours. See label for further instructions.
Sunflower	paraquat (Gramoxone SL) 2 SL (Gramoxone SL 2.0) 2 SL (Gramoxone SL) 3 SL	1.2 to 2 pt 1.2 to 2 pt 0.8 to 1.3 pt	0.3 to 0.5	Preharvest desiccation. Apply when sunflower seeds reach maturity (when seed moisture is 35% or lower). For many varieties, this corresponds to the time when the back of the heads are yellow and bracts are turning brown. Do not graze treated areas or feed treated forage to livestock. Do not apply within 7 days of harvest.
	safinufenacil (Sharpen) 2.85 SC	1.0 to 2.0 oz	0.022 to 0.042	Apply when sunflower has seed moisture less than 36% (often the back of the sunflower heads are yellow and the bracts are turning brown). Include a methylated seed oil (MSO) plus ammonium-based adjuvant for optimum desiccation. Allow up to 10 days for optimum desiccation. Preharvest interval is 7 days.
	sodium chlorate (Defol 750) 7.5 L (Defol 5) 5 L	3.2 qt 4.8 qt	6	Apply 7 or more days before harvest of mature sunflower. Do not graze livestock on treated fields or feed treated forage to livestock within 14 days of application. See label for further instructions.
Tomato	paraquat (Gramoxone SL) 2 SL (Gramoxone SL 2.0) 2 SL (Gramoxone SL) 3 SL	2.4 to 3.75 pt 2.4 to 3.75 pt 1.6 to 2.5 pt	0.6 to 0.94	Postharvest desiccation of crop and weeds. Add a nonionic surfactant at 1 pint per 100 gallons spray solution. Apply in a minimum of 40 gallons spray solution. See label for further information.

¹ Garlic, leek, onion, and shallot.² Sweet lupin, white sweet lupin, white lupin, grain lupin, adzuki beans, asparagus beans, black beans, broad beans, field beans, garbanzo beans, kidney beans, lablab beans, lima beans, moth beans, mung beans, navy beans, pinto beans, rice beans, tepary beans, urd beans, guar beans, black-eyed peas, chickpeas, cowpeas, crowder peas, southern peas, and catjang.³ Anise, basil, caraway, chive, cumin, curry, dill, fennel, oregano, mints, rosemary, sage, savory, sweet bay, tarragon, thyme, and wintergreen.⁴ Asparagus, artichoke, beet, carrot, ginger, ginseng, horseradish, parsnip, potato, rutabaga, sweet potato, and turnip.

Growth-Regulating Chemicals for Apples

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Table 8-4. Growth-Regulating Chemicals for Apples

Purpose	Material	Amount of Formulation per 100 Gallons	Minimum Interval (Days) Between Application and Harvest	Remarks and Precautions
To improve shape and increase fruit weight of responsive apple cultivars, such as Delicious, Gala, or Ginger Gold	Perlan or Promalin	1 to 2 pts	—	Apply between king bloom opening and full-bloom stage as a fine mist. Can be applied as a single spray at 1 or 2 pints per 100 gallons or as two split applications at 1 pint per 100 gallons. Do not exceed the maximum rate of 2 pints per acre for the combined sprays. Do not apply later than full bloom because only late blossoms will be affected, and early blossoms may be thinned. Do not apply when air temperatures are lower than 40°F or higher than 90°F. For optimum results, have the water pH near neutral (pH 7) and always below 8.5.
To increase lateral branching on one-year-old wood before bud break	MaxCel	1.2 to 4.0 fl oz/pint of latex paint (1,500 to 5000 ppm)	—	Make targeted applications to buds and bark on one-year-old wood where branching is desired. Apply at terminal bud swell but prior to visible lateral bud development. For two- and three-year-old wood, use the higher end of the rate range in conjunction with an additional tactic such as nicking, notching, partial scoring, or cambium crushing. For best results use interior latex paint as the solution carrier. Do not use exterior latex paint or paint that includes anti-fungal additives. Do not apply this rate of MaxCel or this application method after bud break, as late applications have been known to cause injury to tender shoot tips and fail to promote bud break. Apply at temperatures greater than 50 °F.
To minimize blind wood by forcing break of paradormant buds on older wood (2+ years old) of apple trees	MaxCel	1.2 fl oz/pint of water (1,500 ppm)	—	Make a notch immediately above dormant buds with a sharp instrument (box cutter, double-bladed hacksaw) and apply up to 1500 ppm of MaxCel directly into the notch using a squirt bottle or paint brush. For best results, the notch must penetrate through the cambium layer. Notching and application should be done in the spring when temperatures are warm. Optimal timing is between tight cluster and early bloom. Adding 500 ppm Promalin/Perlan has also been beneficial. If applications are made after bud break, use caution to prevent contact of the MaxCel solution with green tissue to avoid injury to tender shoot tips. Be aware of the associated risks of bacterial infection from <i>Erwinia</i> and <i>Pseudomonas</i> in open wounds, and implement appropriate risk-mitigation measures, including avoiding notching when conditions are favorable for infection.
To increase lateral bud break and shoot growth and improve branch angle on nonbearing and nursery trees	Perlan/Promalin ± nonionic surfactant	0.25 to 1 pt/5 gal ± 0.2 to 0.3% (v/v) or 1.25 fl oz/5 gal	—	Apply to previous season's leader growth with thorough coverage when new terminal growth is 1 to 3 inches long or nursery trees have reached the height where branching is required. Apply using a handheld sprayer and ensure thorough wetting of the foliage and bark. May also be applied as a latex paint mixture with a brush or sponge at 0.2 to 0.33 pints per pint of latex paint. Do not apply the latex paint mixture after bud break.
To increase branching of nursery stock and young (nonbearing) trees, improve branch angles, stimulate bud break and improve tree structure	MaxCel or Exilis 9.5 SC	128 fl oz/40 gal of water 16 to 32 fl oz/50 gal of water	—	Make the first of 3 to 4 applications to new growth at the height where branching is desired and apply at every 10 to 12 inches of new growth. Do not tank mix with streptomycin or apply streptomycin on the same day.
To promote lateral branching on current season's terminal growth	Perlan/Promalin or MaxCel	4 fl oz/5 gal (125 ppm) 3.2 fl oz/gal (500 ppm)	—	Apply to every 8 to 10 inches of new terminal growth in conjunction with removal of at least half of each immature terminal leaf. Do not damage the growing point (Summer Knipping). Apply 2 to 3 times with a single nozzle directed to the shoot tip, beginning when the leader has reached the height at which lateral branches are required. Apply at 7- to 10-day intervals.
To increase fruit set after frost	Perlan or Promalin	16 to 32 fl oz	—	Apply within 24 hours after a frost event when the majority of the crop is between early bloom and full bloom. Apply in 75 to 150 gallons of water per acre. Do not apply to frozen foliage, blossoms or developing fruit. Allow trees to completely thaw prior to application. Do not use a surfactant. This is a rescue treatment and should only be used if significant crop loss is anticipated. Parthenocarpic fruit have reduced storage potential and may be misshapen.
To increase the duration of floral receptivity and subsequent fruit set in the event of poor pollination conditions during bloom	<u>aminoethoxyvinylglycine</u> (ReTain)	Apply one 333g pouch (50 g a.i.)	7	Apply one pouch of ReTain per acre, as a single application from pink to full bloom. Applications made prior to pink or after full bloom will significantly reduce efficacy of the treatment. Do not apply after petal fall.
To decrease June drop on trees with light bloom	<u>prohexadione-calcium</u> (Apogee or Kudos 27.5 WDG)	10 to 12 oz	45	Apply 10 to 12 oz per 100 gallons when shoots are 1 to 3 inches long (i.e., during bloom). Do not tank mix Apogee with calcium nutrient sprays; but Apogee/Kudos can be tank mixed in pesticide cover sprays. Do not apply more than 99 ounces of Apogee/Kudos per acre per season. Addition of a nonionic surfactant can improve coverage. Use an acidifier if the pH of the spray water is greater than 7.0. If calcium is present in the spray water (i.e., hard water), it can deactivate prohexadione-calcium and a reduction in growth control may occur. In this case, add a water conditioner, such as ammonium sulfate. Do not mix with calcium or boron sprays.

Table 8-4. Growth-Regulating Chemicals for Apples

Purpose	Material	Amount of Formulation per 100 Gallons	Minimum Interval (Days) Between Application and Harvest	Remarks and Precautions
To suppress russet formation on Golden Delicious and other russet sensitive varieties	Novagib 10L or ProVide 10SG	20 to 33 fl oz 2.1 to 3.5 oz	—	Recommended application interval is at petal fall (PF), then 10, 20, and 30 days after petal fall. There is an 80 fluid ounces per acre limit per season for Novagib 10L. Apply as a fine mist. Do not apply until runoff. Make 2 to 4 applications. Always make the first ProVide application at the beginning of petal fall and continue at 7- to 10-day intervals. Direct 85% of the spray volume to the upper two-thirds of the tree.
To reduce the occurrence of Stayman fruit cracking	Novagib 10L or ProVide 10SG	32 to 64 fl oz 1.8 to 3.5 oz	—	Apply in 3 to 6 consecutive applications at 14- to 21-day intervals beginning 2 to 3 weeks before fruit cracking is expected to occur. Apply at 50% of Tree Row Volume. Do not treat for cracking suppression apples that have received ProVide 10SG applications to suppress russet during the same growing season. Always apply when conditions favor slow drying.
To bloom thin apples and promote annual bearing	liquid lime sulfur + oil	1.5 to 2 gal 1 to 2 gal	—	A specific formulation of liquid lime sulfur (LS) is labelled for blossom thinning in North Carolina [NovaSource™ Lime-Sulfur Solution (Tessenderlo-Kerley, Inc.)]. Spray oil should be added to LS to enhance its penetration and boost its efficacy. When mixed with oil, use LS at 1.5 to 2% (v/v). Oil options include fish oil at 2% (v/v), dormant petroleum oil at 1%, or summer oil at 1 to 1.5% v/v. Two LS applications during bloom are suggested if possible. For well-pruned dwarf and semi-dwarf trees, a spray volume of 80 to 100 gallons per acre via air-blast is typically used but may need to be adjusted based on tree size. Do not concentrate the chemicals when spraying at lower volume. Application timing can occur using a visual estimate of the number of open blossoms or by use of variety-specific pollen tube growth models (see Pollen Tube Growth Model at http://nwa.comell.edu). If using visual estimates, use two sprays: one at 20% to 30% bloom followed by a second spray at 80% to 100% bloom. LS can cause apple leaf burn and fruit russet. Avoid use of LS when high temperature will exceed 85°F within 24 hours. The potential for injury is greater under slow drying conditions (low light, high humidity). Do not tank mix other spray materials. Additional applications of either oil or LS immediately after LS thinning sprays is very likely to increase thinning response. To allow oil residues to weather, leave a two- to three-week interval between the last spray containing oil and the first captan spray. If there is high risk of severe frost or freeze damage during the bloom period, consider delaying or avoiding application of LS as a bloom thinner.
To thin Golden Delicious fruit on trees where a heavy fruit set has occurred and to aid in encouraging annual bearing	<u>naphthalene-acetic acid</u> Fruitone L, PoMaxa or Refine +/- nonionic surfactant (to increase thinning activity)	5 to 15 ppm 1 pt	2	Until experience is gained in your orchard, use all concentrations of all thinning chemicals only on a trial basis on a few trees. Optimum thinning with NAA is achieved when fruit diameter is 5 to 10 mm. Under optimum growing conditions, the best size for thinning usually occurs between 15 to 21 days after full bloom. Applying NAA too early may result in fruit persistence rather than removal. Applications are most effective at temperatures from 70°F to 75°F. Do not exceed 161 fluid ounces of Fruitone L, PoMaxa, or Refine per acre per season.
To thin heavily set non-spur Red Delicious and Rome and to aid in encouraging annual bearing	<u>carbaryl</u> Carbaryl 50WP or Carbaryl 4L/Sevin XLR	1 to 2 lb 1 to 2 pt	3	Apply at 8 to 12 mm average fruit diameter for optimum thinning. Applying carbaryl to Golden Delicious may cause russet.
To thin heavily set spur strains of Red Delicious and to aid in encouraging annual bearing	<u>carbaryl</u> Carbaryl 50WP or Carbaryl 4L/Sevin XLR + <u>naphthalene-acetic acid</u> (Fruitone L, PoMaxa, or Refine)	2 lb (1 lb a.i.) 2 pt (1 lb a.i.) + 5 ppm	— 3 2	Apply at 8 to 10 mm average fruit diameter. Application of NAA at larger fruit size to Red Delicious may cause small fruit (i.e., pygmies, nubbins, or mummies) to persist on the tree through harvest. Apply as a dilute spray to runoff. Do not use NAA to thin Fuji, since this cultivar is prone to pygmy fruit formation.
	<u>carbaryl</u> Carbaryl 50WP or Carbaryl 4L/Sevin XLR + <u>ethephon</u> (Ethrel, Ethephon 2, Motivate, etc.)	2 lb (1 lb a.i.) 2 pt (1 lb a.i.) + 1.5 pt	3 7	Apply at 12 to 15 mm average fruit diameter. Apply only as a dilute spray to runoff (for use only on spur strains of Delicious). Applying ethephon when daily maximum temperatures exceed 80°F may result in excessive thinning. Do not apply ethephon if daily maximum temperature exceeds 90°F.
	<u>naphthalene-acetic acid</u> (Fruitone L, PoMaxa, or Refine) + <u>carbaryl</u> Carbaryl 50WP or Carbaryl 4L/Sevin XLR + <u>ethephon</u> (Ethrel, Ethephon 2, Motivate, etc.)	2 to 4 fl oz (5 to 10 ppm) + 2 lb (1 lb a.i.) 2 pt (1 lb a.i.) + 2 pt	2 3 7	Apply dilute at 8 to 10 mm average fruit diameter. Caution: This will temporarily suppress vegetative growth.
To defruit trees too young or too small to begin bearing or where fruit load needs to be eliminated (all varieties)	<u>N-(phenylmethyl)-1H-purine-6-amine</u> Exilis 9.5 SC or MaxCel	19.2 fl oz 96 fl oz	86 86	Apply between 8 to 12 mm average fruit diameter. Best results are observed when applied during periods of carbon stress (warm, cloudy days). Daytime high temperature must be greater than 70°F for this treatment to be effective. While some fruit may persist after treatment, this combination will not suppress vegetative growth.
	Carbaryl 50 WP or Carbaryl 4L/Sevin XLR + non-ionic surfactant	2 lb (1 lb a.i.) 2 pt (1 lb a.i.) 1 qt	3	

Table 8-4. Growth-Regulating Chemicals for Apples

Purpose	Material	Amount of Formulation per 100 Gallons	Minimum Interval (Days) Between Application and Harvest	Remarks and Precautions
Post-bloom thinning agent for cultivars such as Gala, Fuji, Spur Red Delicious	<u>N-(phenylmethyl)-1H-purine-6-amine</u> Exilis 9.5 SC	9.6 to 25.6 fl oz	86	Make 1 to 2 applications of 75 to 200 ppm when king fruit are 5 to 10 mm in diameter. Do not apply more than 296 fluid ounces of Exilis 9.5 SC per acre per season. Do not apply Exilis 9.5 SC if the temperature is below 60°F. Make 1 to 2 applications of 75 to 200 ppm when king fruit are 5 to 15 mm in diameter. Applications will be most effective when the maximum temperature is above 65°F on the day of application, and the following 2 to 3 days. Do not apply more than 308 fluid ounces of MaxCel per acre per season.
	or MaxCel	48 to 128 fl oz	86	
	+ <u>carbaryl</u> Carbaryl 50 WP	2 lb (1 lb a.i.)	3	
	or Carbaryl 4L/Sevin XLR	2 pt (1 lb a.i.)	3	
To thin Stayman, Rome, McIntosh, Jonathan, or Gala	<u>carbaryl</u> Carbaryl 50WP	2 lb (1 lb a.i.)	3	Apply as a dilute spray when fruit are 9 to 11 mm average fruit diameter. Do not use NAA to thin Fuji since this cultivar is prone to pygmy fruit formation.
	or Carbaryl 4L/Sevin XLR	2 pt (1 lb a.i.)	3	
	+ <u>naphthalene-acetic acid</u> (Fruitone L, PoMaxa, or Refine)	5 to 10 ppm	2	
	or <u>carbaryl</u> Carbaryl 50 WP	1 to 2 lb (0.5 to 1 lb a.i.)	3	
	or Carbaryl 4L/Sevin XLR	1 to 2 pt (0.5 to 1 lb a.i.)	3	
To thin small orchard plantings with mixed cultivars	+ <u>naphthalene-acetic acid</u> (Fruitone L, PoMaxa, or Refine)	1 to 2 pt (0.5 to 1 lb a.i.)	2	Apply when fruit size is 6 mm to 22 mm diameter; though most consistent responses occur at 8 to 14 mm. Optimal application conditions are when maximum daily temperatures are from 70 to 86 °F and rain does not occur for at least 8 hours after application. Delay application if heavy cloud cover occurs for a 2 to 3 day period, as over-thinning may occur on easy-to-thin cultivars. Do not apply during the bloom period, as this product is toxic to pollinators. Where carbaryl is used for chemical thinning at petal fall (~6 mm fruit diameter), only a liquid formulation should be used because it is safer around bees than the wettable powder formulations. Late use of carbaryl for thinning purposes may be detrimental to an integrated mite management program and should be avoided, especially on Red Delicious. Addition of a non-ionic surfactant can increase thinning responses.
		2.5 to 5 ppm	2	
To thin large fruit (>18 to 22 mm fruit diameter) on easy-to-thin cultivars	<u>carbaryl</u> Carbaryl 50WP	1 to 2 pt (0.5 to 1 lb a.i.)	3	Late thinning (rescue thinning) is only considered if previous thinner applications were ineffective or have not occurred due to inclement weather. Apply as a dilute spray when fruit are 18 to 22 mm average fruit diameter. Fruit are relatively insensitive to chemical thinners at > 24 mm diameter.
	or Carbaryl 4L/Sevin XLR +/- non-ionic surfactant	16 fl oz	3	
To thin large fruit (15 to 24 mm fruit diameter) on moderate- or difficult-to-thin cultivars	<u>ethephon</u> (Ethrel, Ethephon 2, Motivate, etc.)	0.5 to 1.5 pt	7	Rates of ethephon and ACC are cultivar dependent. Late thinning (rescue thinning) is only considered if previous thinner applications were ineffective or have not occurred due to inclement weather. Ethephon can cause excessive thinning if temperatures are high. If maximum temperatures are between 75°F and 80°F then reduce the rate of ethephon by one-third. If maximum temperatures are >80°F then reduce the rate of ethephon by two-thirds. Do not apply ethephon if temperatures are >90°F. The thinning effect of ethephon is localized; thus, for applications to be effective, excellent spray coverage is required. ACC is as temperature sensitive as ethephon, though rates should be reduced if temperatures >86°F applications should not occur if temperatures exceed >90°F on the day of application. An ethephon and carbaryl tank mix for chemical thinning is recommended only as a dilute application (1X) using a water volume accurately calculated with the "tree row volume" formula. Concentrate applications are generally stronger and very erratic in thinning response. ACC should be applied dilute at 100 gallons of water per acre. The spray delivery pattern should be adjusted on an airblast sprayer to deliver 80% of the spray volume to the top third of the tree canopy. Because rainfall and cloudy weather can have an effect on thinner activity, ethephon and carbaryl applications should not be made less than 48 hours before an imminent cloud and rain event. Persistent cloudiness after application may increase thinning activity; a hard rain within 8 hours may reduce thinner activity by washoff.
	+/-			
	<u>carbaryl</u> Carbaryl 50WP	1 to 2 pt (0.5 to 1 lb a.i.)	3	
	or Carbaryl 4L/Sevin XLR +/- non-ionic surfactant	16 fl oz	3	
	or <u>1-aminocyclopropanecarboxylic acid</u> (ACC; Accede SG) + non-ionic surfactant	6.7 to 13.4 oz	—	
		16 fl oz	—	

Table 8-4. Growth-Regulating Chemicals for Apples

Purpose	Material	Amount of Formulation per 100 Gallons	Minimum Interval (Days) Between Application and Harvest	Remarks and Precautions
To increase return bloom for the following season, especially on heavily cropped trees	<u>naphthalene-acetic acid</u> (Fruitone L, PoMaxa, or Refine) + non-ionic surfactant <u>ethephon</u> (Ethrel, Ethepon 2, Motivate, etc.)	5 to 20 ppm or 2.5 to 10 ppm + 1 pt surfactant 16 to 72 fl oz per acre	2	After the chemical fruit thinning activity window is past (typically 6 to 8 weeks after petal fall) use biweekly applications of naphthalene-acetic acid (NAA) in the next 3 to 4 cover sprays. (Typically, two applications in June and two applications in July for Southeastern U.S. apple-growing areas). These NAA applications may be tank mixed with routine pesticide cover sprays. Even when used at low rates, reduced fruit quality such as early ripening or water core or leaf drop can result on sensitive varieties such as Early McIntosh or other early summer varieties. Use 16 to 72 fl oz per acre depending on cultivar, crop load and history of biennial bearing. Use 16 to 24 fl oz per acre on Gala, Rome, and Red Delicious; 24 to 48 fl oz acre on Golden Delicious; 48 to 72 fl oz/acre on Fuji and Cameo. Make a single application five to six weeks after bloom. Consider a second application two to three weeks later if the crop load is excessive. Delay application if daily maximum temperature exceeds 86°F or if rain is likely within 8 hours of application. Do not use ethephon for increasing return bloom on Honeycrisp due to concerns related to fruit softening.
To reduce vegetative growth and to reduce later season tree canopy volume and density for improving pesticide efficiency	<u>prohexadione-calcium</u> (Apogee or Kudos 27.5 WDG)	3 to 6 oz biweekly or 8 to 12 oz monthly	45	Apply as a sequential application every other week beginning when new shoots are 1 inch long using 3 to 6 ounces in 100 gallons per acre or apply as a sequential monthly application beginning when new shoots are 1 inch long using 8 to 12 ounces in 100 gallons. Do not tank mix Apogee with calcium nutrient sprays; but Apogee/Kudos can be tank mixed in pesticide cover sprays. Do not apply more than 99 ounces of Apogee/Kudos per acre per season. Addition of a nonionic surfactant can improve coverage. Use an acidifier if the pH of the spray water is greater than 7.0. If calcium is present in the spray water (i.e., hard water), it can deactivate prohexadione-calcium and a reduction in growth control may occur. In this case, add a water conditioner, such as ammonium sulfate. Do not mix with calcium or boron sprays.
To aid in preventing preharvest fruit drop	<u>naphthalene-acetic acid</u> (Fruitone L, PoMaxa, or Refine)	4 to 8 fl oz per acre	2	Apply 10 to 20 ppm NAA at anticipated start of fruit drop. One application will normally prevent fruit drop for 7 to 10 days. If necessary, repeat applications can be made at weekly intervals. Apply only when temperature is 70°F or higher for maximum effectiveness. Higher application rates (>10 ppm NAA) may cause fruit softening at temperatures above 85°F. Use sufficient water to ensure adequate coverage of fruit.
To aid in delaying the onset of preharvest fruit drop before loosening begins	<u>naphthalene-acetic acid</u> (Fruitone L, PoMaxa, or Refine)	5 ppm applied as weekly sprays beginning 4 weeks before anticipated harvest	2	Preloading with the low rate of NAA is a more effective drop control program than waiting to use a higher rate as the fruit begins to loosen. Preloading may also increase return bloom of Golden Delicious and Red Delicious.
To delay preharvest fruit drop and fruit maturity to allow time for added fruit size increase	<u>aminoethoxyvinylglycine</u> or AVG (ReTain)	Apply one to two 333-g pouches (50 to 100 g a.i.) per acre for most cultivars	7	Apply 28 days before anticipated harvest in most years. This is the most effective stop-drop control program; however, fruit maturity and harvest date will be significantly delayed. Do not apply ReTain to plants under stress. Avoid ReTain application during the heat of the day. Maintain solution pH between 6 and 8. Do not apply ReTain if rain is expected within 8 hours of application. Delay ReTain application until 2 to 3 weeks before normal harvest in hot years. For optimal response, use ReTain with a 100% organosilicone surfactant at a final surfactant concentration of 0.05 to 0.1% (v/v) in the spray tank. To prevent possible spotting, use the 0.05% (v/v) concentration when high temperature (in excess of 86°F) weather conditions prevail or are anticipated. On sensitive cultivars such as Gala, the amount per acre can be reduced to 25 g a.i. (1/2 pouch of formulated product) to obtain a response similar to that of 50 g (1 pouch) on less sensitive varieties. To further delay preharvest drop and delay the onset of maturity, up to 2 pouches of ReTain can be applied per acre. Very good drop control and maintenance of fruit firmness on the tree is achieved by combining ReTain with 10 to 20 ppm NAA (4 to 8 fluid ounces Fruitone L or PoMaxa per 100 gallons) applied 2 weeks before harvest. Higher application rates of NAA may cause fruit softening at temperatures above 85°F.
To aid in controlling scald on stored apples	<u>diphenylamine</u> (DPA)	1,000 ppm; amount per 100 gallons depends on the a.i. in the formulated product. Consult the product label.	—	Apply as a dip or spray to harvested fruit. For maximum effect, uncooled fruit should be sprayed or dipped as soon after harvest as possible. The longer treatment is delayed after harvest, the less its effectiveness. Fruit should be thoroughly covered; however, fruit should not be dipped for longer than 30 seconds to prevent excess residue. Best control is obtained when both the fruit and the solution are at room temperature.
To maintain apple flesh firmness, reduce scald, and maintain fruit acidity.	<u>1-methylcyclopropene</u> (1-MCP)	Sufficient to achieve a final concentration of 1 ppm of the a.i.	—	1-MCP is a postharvest treatment that is introduced into the atmosphere of an airtight facility or container in which the fruit is held for 24 hours. Fruit must be treated within 3 to 5 days of harvest. The amount of product used depends upon the volume (cubic feet) of the treatment container. After treatment, the fruit is held in regular cold storage.

Growth Regulators for Floricultural Crops in Greenhouses

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This table lists labeled rates of plant growth regulators (PGR) for greenhouse crops. These rates are guidelines based on labeled recommendations, research at North Carolina State University, and recommendations by suppliers. Read the label for a complete listing of precautions. The degree of control can vary by a number of factors, including plant type, cultivar, stage of development, fertilization program, growing temperatures, and crop spacing. When using a PGR for the first time, it is good to test the rate on a few plants prior to spraying the entire crop. Keep accurate records and adjust rates for your location.

General Recommendations: Plug culture and flat culture have different recommended rates. The rates in this table include recommendations for both plug (lower rates) and flat culture (higher rates). Apply ALL foliar sprays of plant growth regulators using 0.5 gallons per 100 square feet of bench area. This work was supported in part by Hatch Project 02672.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
ABUTILON	To control plant growth	Citadel / Altercel	750 to 1,500 ppm spray	
		Dazide / B-Nine	2,500 ppm spray	Rate for use on plugs.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 ppm spray	Can be applied once plant fills the pot, 2 to 3 weeks after transplanting.
	To increase branching	Florel / Collate	250 to 500 ppm spray	Applied 2 weeks after transplanting. Follow with a pinch if needed.
ACHILLEA	To control plant growth	Dazide / B-Nine	2,500 ppm spray	One or 2 sprays may be needed to keep plants more compact.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.5 to 1 ppm drench	Apply to moderately moist substrate.
ACHMELLA OLERAEEA	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 ppm spray	Apply 2 weeks after transplant. Repeat a week later or a week after pinch if needed.
AGASTACHE	To control plant growth	Citadel+Dazide / Altercel+B-Nine	3,000 ppm + 1,500 ppm spray	Rates for compact genetics needing slight growth control.
AGASTACHE Purple Haze (Hyssop)	Induce branching of plugs	Configure	300 ppm	Foliar spray applied ~27 days after sticking (plants moderately rooted) increased lateral branching but not basal branching. Multiple applications or higher rates decreased root surface area.
AGERATUM	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	One or 2 sprays may be needed to keep plants more compact.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 45 ppm spray	High rates of Piccolo 10 XC may delay flowering. Late applications and overdosing may cause slow growth on transplantation. This can be avoided by using multiple applications of 25% to 50% of the specified rate and monitoring plant growth.
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	2 to 30 ppm spray	Cultivar response rates vary. Use lower rates to hold plants.
		Topflor	20 to 60 ppm spray	Based on NC State University trials. Adjust rates for other locations.
AGERATUM, Plugs	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
ALCEA ROSEA	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 to 50 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.12 to 0.24 mg a.i. (1 to 2 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
ALTERNANTHERA (Joseph's coat)	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) for a 6-in. pot (1 to 2 fl oz / gal of drench solution: apply 4 fl oz / 6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Citadel / Chlormequat E-Pro / Altercel	Spray	Apply only if needed. Not recommended on some cultivars due to potential phytotoxicity.
		Dazide / B-Nine	5,000 ppm spray	
		Florel / Collate	500 ppm spray	To keep plants more compact. Based on Texas A&M University trials.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 to 45 ppm spray	Rate for <i>Alternanthera dentata</i> .
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	4 ppm drench	To keep plants more compact. Apply to moderately moist substrate

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
ALYSSUM	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	40 to 60 ppm spray	
		Concise / Sumagic	5 to 25 ppm spray	
		Dazide / B-Nine	2,500 ppm spray	
ALYSSUM, Plugs	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	10 to 20 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
AMARYLLIS	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	23.66 mg a.i. (200 ppm) drench for a 6-in. pot (6.4 fl oz / gal. of drench solution; apply 4 fl oz / 6-in. pot)	Drench volumes and mg a.i. vary with pot size.
			100 ppm bulb soak	
ANAGALLIS	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.5 ppm drench	To keep plants more compact. Apply to moderately moist substrate.
ANEMONE	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	2 ppm drench	Rates for Mona Lisa series. Apply about 6 weeks after transplant when the foliage has covered the pot and the first visible flower bud is showing. Rates up to 4 ppm can be used after conducting your own trial. Apply one week earlier during warm weather if needed.
ANGELONIA	To control plant growth	Citadel + Dazide / Altercel + B-Nine	1,500 to 3,000 ppm Dazide / B-Nine + 750 to 1,000 ppm Citadel / Altercel applied as a tank-mix spray	At planting, soft pinch to promote lateral shoot development.
		Citadel / Altercel	1,500 ppm spray	
		Concise / Sumagic	10 to 20 ppm spray	Based on NC State University trials.
		Dazide / B-Nine	3,000 ppm spray	
		Florel / Collate	Spray	Not recommended.
		Topflor	45 to 60 ppm spray	Based on NC State University trials.
ANTHURIUM	Induce lateral or basal branching	Configure	250 ppm	10 ml drench applied at the plant base. 250 ppm recommended.
			1000 ppm	Single foliar spray. 1000 ppm recommended.
AQUILEGIA	To control plant growth	Dazide / B-Nine	3,000 to 5,000 ppm spray	
ARGYRANTHEMUM	To control plant growth	Citadel / Altercel	750 to 1,500 ppm spray	
		Citadel+Dazide / Altercel+B-Nine	750 to 1,000 ppm + 1,000 to 2000 ppm spray	Rates for compact genetics needing slight growth control.
		Concise / Sumagic	3 to 40 ppm spray	Based on NC State University trials conducted during late spring. Trial rates of 3 to 5 ppm for compact genetics.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Rates for compact genetics needing slight growth control.
			1 to 5 ppm drench	Rates for compact genetics needing slight growth control.
		Dazide / B-Nine	1,500 to 2,500 ppm spray	
		Topflor	50 to 75 ppm spray	Based on NC State University trials conducted during late spring. Slight phytotoxicity occurred with rates greater than 40 ppm, but damage was quickly hidden by new leaf growth.
ASCLEPIAS TUBEROSA (Butterfly Weed)	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 to 60 ppm spray	
	Induce lateral or basal branching	Configure	600 ppm	Not responsive to a single foliar spray.
ASTER NOVI-BELGII (Perennial)	To control plant growth	Concise / Sumagic	80 to 160 ppm spray	
		Dazide / B-Nine	1,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	160 ppm spray	Use lower rates of 5 to 10 ppm later in the season.
			12 to 16 ppm drench	
ASTER, Bedding Plant (Callistephus chinensis)	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
ASTER, Cut (<i>Callistephus chinensis</i>)	To promote stem elongation and break dormancy	Florgib / ProGibb T&O	50 to 100 ppm spray	Make one to three applications during the early vegetative period at 2- to 3-week intervals. Apply when plants are 2 to 6 in. tall.
ASTERISCUS MARITIMUS (Compact Gold Coin)	To control plant growth	Dazide / B-Nine	750 to 1,500 ppm spray	
		Citadel / Altercel	800 to 1,500 ppm spray	
		None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
ASTILBE	To control plant growth	Concise / Sumagic	25 ppm drench	Apply just prior to flower stem elongation.
		Dazide / B-Nine	5,000 ppm spray	1 or 2 sprays can be used to keep plants more compact. Begin once flower stalks show color. 1 to 2 week delay in flowering possible.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 ppm drench	Apply just prior to flower stem elongation.
AZALEA	To control plant growth	Abide / A-Rest	26 ppm spray	
		Concise	5 to 15 ppm spray	Apply as a uniform spray at a volume of 1.5 qt. per 100 sq ft of bench area approximately 4 to 6 weeks after the final pinch. Shorter-growing cultivars (Gloria, Solitaire): use 10 ppm. If a second application is required 2 to 3 weeks later, use 5 to 10 ppm. Taller-growing cultivars (Prize): use 10 ppm. If a second application is required 2 to 3 weeks later, use 10 to 15 ppm.
	To promote flower initiation	Dazide / B-Nine	1,500 to 2,500 ppm spray	Apply solution when new growth from final pinch is 1 to 2 in. long.
		Citadel / Chlormequat E-Pro / Altercel	1,000 to 4,000 ppm spray	Optimum rates are generally between 1,000 and 2,000 ppm. Two to six multiple sprays may be needed. Make first application when new growth is approximately 2 in. long.
	To prevent flower bud initiation during vegetative growth	GibGro	130 to 850 ppm spray	Apply two to three sprays at 2- to 3-week intervals.
		Florgib / ProGibb T&O	100 to 750 ppm spray	Apply a first application beginning 2 to 3 weeks after pinching. Weekly applications can continue for 1 to 2 additional weeks, for a maximum of three total applications.
	For partial or full substitution of cold treatment	GibGro	265 to 1,055 ppm spray	Spray timing, concentration and number of applications vary with cultivar, as well as intended degree of cold substitution. Consult label for exact recommendations. Not labeled for California.
		Florgib / ProGibb T&O	250 to 500 ppm spray	Spray timing, concentration and number of applications vary with cultivar, as well as intended degree of cold substitution. Consult label for exact recommendations.
	To promote lateral shoot growth on vegetative plants	Off-Shoot-O	Use a 3 to 5% solution in greenhouses; use a 5 to 7% solution outdoors. Apply as a foliar spray.	Efficacy is related to relative humidity and temperature. Spray a few plants to check activity prior to treating the entire crop; effect should be visible in about 1 hr. Be certain chemical covers shoot tip. Ineffective if microscopic flower buds are present.
	To increase lateral branching	Augeo/Atrimmec	3,125 to 6,250 ppm spray	
		Florel / Collate	2,500 to 5,000 ppm spray	
	To control plant growth, reduce bypass shoot elongation and promote flower bud initiation	Piccolo / Piccolo 10 XC / Bonzi / Pac O	100 to 200 ppm spray	To control plant growth and promote flower bud initiation, apply after final shaping when new growth is 1.5 to 2 in. long. To reduce bypass shoot development, apply after bud set when bypass shoots are barely visible, or about 5 to 7 weeks prior to cooling.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.59 to 1.77 mg a.i. (5 to 15 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot)	Drench volumes mg a.i. vary with pot size.
	To control plant growth	Concise / Sumagic	10 to 15 ppm spray	Apply at 1.5 qt per 100 sq ft of bench area.
BACOPA (SUTERA)	To control plant growth	Dazide / B-Nine	750 to 1,500 ppm spray	At planting, soft pinch to promote lateral shoot development. Initially try with lower rate.
		Piccolo	4 to 8 ppm liner root soak	Irrigation of the liners occurred within 24 hours prior to application, which results in a moderately dry substrate (the stage the plants would be watered but not wilted). Soak for a minimum of 30 to 60 seconds. Transplant after 3-hour waiting period. Rates based on Michigan State University trials.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	1 to 2 ppm drench	
		Florel / Collate	150 to 200 ppm spray	Early spray will increase branching and reduce early flowering.
	To increase lateral branching	Florel / Collate	150 to 200 ppm spray	
BANKSIA ASHBYI	Flower enhancer/ Dormancy interruption/ Branching inducer	Configure	100 to 500 ppm	BA overcame winter quiescence of buds and breaks apical dominance. The effects are long lasting. Plants have many more branches. 400 ppm BA sprayed on the overwintering inflorescences hastened spring flowering by 1 to 2 months.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
BEDDING PLANTS (Not specifically listed in this table)	To control plant growth	Abide / A-Rest	6 to 66 ppm spray; use 15 ppm spray as a base rate and adjust as needed	
			0.06 to 0.12 mg a.i. drench for a 4-in. pot; apply 2 fl oz / 4-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Citadel + Dazide / Altercel + B-Nine	800 to 5,000 ppm + 1,000 to 1,500 ppm Altercel applied as a tank-mix spray	Use the highest rate of Citadel that doesn't cause excessive leaf yellowing, and then adjust the Dazide / B-Nine rate up and down within the labeled range to attain the desired level of height control.
		Piccolo / Bonzi / Pac O	5 to 90 ppm spray. Use 30 ppm spray as a base rate and adjust as needed.	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control. Not recommended for use on fibrous begonia or vinca.
		Piccolo / Bonzi / Pac O / Downsize	0.118 mg a.i. drench for a 6-in. pot; apply 4 fl oz / 6-in. pot)	Drench applications are recommended only for bedding plants in 6-in. or larger containers. Not recommended for use on fibrous begonia or vinca.
		Citadel / Altercel	800 to 1,500 ppm spray	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control.
		Concise / Sumagic	1 to 50 ppm spray	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control. Apply spray as elongation begins (plant height about 2 to 4 in.).
			0.1 to 2 ppm drench	
		Piccolo 10 XC	15 to 30 ppm spray	General starting point for conducting trials for plants not specifically on the label. Use lowest rate in the Northern Belt Region and the upper rate in the Sunbelt Region.
			1 ppm drench	General starting point for conducting trials for plants not specifically on the label.
	To promote plant growth and overcome over-application of gibberellin-inhibiting PGRs	Florgib / ProGibb T&O	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results were not evident, reapplication or an increase in rate may be warranted. Consult the label for additional precautions.
		Fresco / Fascination	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results were not evident, reapplication or an increase in rate may be warranted. The most common rates for use are 3 to 5 ppm. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.
BEDDING PLANT PLUGS (Not specifically listed in this table)	To control plant growth	Abide / A-Rest	3 to 35 ppm spray	
			Drench plug flats with a 0.5 to 1 ppm solution	For uniform application, use a subirrigation delivery system. Plug trays should not be excessively dry prior to the subirrigation treatment. Plants should develop one to two true leaves prior to first application.
		Dazide / B-Nine	1,500 to 2,500 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and duration of height control. Can be used at the beginning of the true first leaf stage through the finishing stage.
		Citadel + Dazide / Altercel + B-Nine	800 to 5,000 ppm Dazide / B-Nine + 1,000 to 1,500 ppm Citadel / Altercel applied as a tank-mix spray	Use the highest rate of Citadel / Altercel that doesn't cause excessive leaf yellowing and then adjust the Dazide / B-Nine rate up and down within the labeled range to attain desired level of height control.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	1 to 20 ppm spray. Use 5 ppm spray as a base rate and adjust as needed.	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and duration of height control. Plants should develop one to two true leaves prior to first application.
		Citadel / Altercel	400 to 1,500 ppm spray	Conduct trials on a small number of plants. Start with lower rates and adjust the rates as needed for desired final plant height and duration of height control.
		Concise / Sumagic	0.5 to 10 ppm spray	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control. Plugs can be especially sensitive to Concise / Sumagic.
	To induce lateral or basal branching	Configure	50 to 500 ppm spray	The supplemental label allows legal use on greenhouse-grown plants not specifically listed on the original label. See label for trialing suggestions and precautions.
	BEGONIA, Hiemalis (Elatior)	Citadel / Altercel	500 to 1,000 ppm spray	Applied 1 week after short days begin in summer or when short days begin in winter. Late applications can result in insufficient flower stalk elongation.
		Augeo/Atrimmec	781 to 1,562 ppm spray	

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
BEGONIA, Seed (Wax)	To control plant growth	Abide / A-Rest	3 to 15 ppm spray	Use lower half of rate range for plugs and upper range for finishing plants.
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Florel / Collate	500 ppm spray	Apply to increase lateral branching, prevent flower initiation and development, and inhibit internode elongation.
		Concise / Sumagic	Sprays	Not registered for use. Can result in excessive control.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	Sprays	Not registered for use. Can result in excessive control.
		Topflor	Sprays	Not registered for use. Can result in excessive control.
		Citadel / Altercel	500 ppm spray	
		Citadel + Dazide / Altercel + B-Nine	1,000 to 1,250 ppm Dazide / B-Nine +800 to 1,250 ppm Citadel / Altercel applied as a tank-mix spray	
BEGONIA, Tuberous	To control plant growth	Citadel / Altercel	250 to 500 ppm spray	Rate can be used on Stage 4 plugs or beginning 2 weeks after transplanting.
		Citadel / Altercel	1,000 ppm spray	Rate for actively growing plants.
		Dazide / B-Nine	2,500 ppm spray	Rate for actively growing plants.
BEGONIA, Vegetative	To control plant growth	Citadel / Altercel	750 to 1,000 ppm spray	
BEGONIA, Vegetative (Dragon Wing)	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	3 to 5 ppm spray	For 4-in. pots, apply a weekly 3 ppm spray starting 2 weeks after transplanting for 3 weeks. For 6-in. pots, use 5 ppm starting 2 weeks after transplant. A second and third application may be useful.
	Induce lateral or basal branching	Configure	20 to 160 ppm	Foliar spray. Slight increase in branching but no decrease in height. Flowers emerged slightly earlier.
BELLIS	To control plant growth	Dazide / B-Nine	2,500 ppm spray	If needed.
		Concise / Sumagic	5 ppm spray	If needed.
BIDENS	To control plant growth	Dazide / B-Nine	1,500 to 2,500 ppm spray	At planting, soft pinch to promote lateral shoot development.
		Concise / Sumagic	1 to 5 ppm spray	Rates for genetics needing slight growth control.
			0.25 ppm drench	Rates for genetics needing slight growth control.
	To increase lateral branching	Florel / Collate	300 to 500 ppm spray	
BLETILLA STRIATA (Hardy Orchid)	Increase the sprouting of pseudobulbs	Configure	50 and 100 ppm	Soak pseudobulbs in solution for 30 min – 1 hr. 50 ppm increased growth rate but only under low temperatures. 100 ppm inhibited sprouting.
BORONIA HETEROPHYLLA (Red Boronia)	Induce lateral or basal branching	Configure	100 ppm foliar spray every 3 days for 18 days on mature plants in mid-fall; or 10 to 150 ppm foliar spray every 2 days for 4 to 8 days on rooted cuttings in mid-fall	100 ppm on mature plants vastly increased branching over pinching. Transient phytotoxicity noted. 50 ppm, 4 applications increased branching over pinching in rooted cuttings. Higher rates and more applications caused phytotoxicity and reduced flowering.
BORONIA METASTIGMA (Brown Boronia)	Induce lateral branching and additional cuttings	Configure	100 ppm	Foliar spray 3 times, 1 week apart – 2 months prior to taking cuttings. BA increased branching but subsequent cuttings rooted very poorly compared to control.
BOSTON FERN (Nephrolepis exaltata)	Induce lateral branching	Configure	50 to 150 ppm	Single foliar spray 4 weeks after planting. BA controlled frond length but did not stimulate more fronds.
BOUGAINVILLEA	To control plant growth	Abide / A-Rest	50 ppm drench	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	25 to 100 ppm drench	
	To increase lateral branching	Augeo/Atrimmec	400 to 1,600 ppm spray	Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing.
			1,600 ppm drench	Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing.
BRACHYSCOME	To control plant growth	Florel / Collate	500 to 1,000 ppm spray	To keep plants more compact. Based on Texas A&M University trials.
		Dazide / B-Nine	2,500 to 5,000 ppm spray	

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
BRACEANTHA, BRACEATA	To control plant growth	Dazide / B-Nine	2,500 ppm spray	
		Piccolo / Bonzi / Pac O	20 to 30 ppm spray	
			1 ppm drench	
		Concise / Sumagic	10 to 20 ppm spray	
	To increase lateral branching	Flore! / Collate	300 to 500 ppm	
BROMELIAD (Fosterella penduliflora)	To promote flower initiation	Flore! / Collate	2,471 ppm spray	Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing.
	Branching agent/ Enhance cutting numbers	Configure	200 to 800 ppm	Foliar spray on 9 month old plants 4 times at two week intervals. BA 800 ppm increased lateral shoot production by 50% and is better than pinching. New shoots were shorter and not as thick.
BROWALLIA	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
BULB CROPS (Not specifically listed in this table)	To control plant growth	Abide / A-Rest	25 to 50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	100 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and duration of height control.
			1.183 mg a.i. (10 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot)	Drench volumes and mg a.i. vary with pot size.
			20 ppm bulb soak	Soak for 15 min. Conduct trials on a small number of bulbs, adjusting the rate and soaking period (up to 1 hour) as needed for desired final plant height.
		Concise / Sumagic	2.5 to 20 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
			1 to 3 ppm drench	Drench volumes and mg a.i. vary with pot size. Application should be made when newly emerged shoots are 1 to 2 in. tall.
			1 to 10 ppm bulb soak	Soak for 1 to 5 min. Conduct trials on a small number of bulbs, adjusting the rate and soaking period as needed for desired final plant height.
	To promote plant growth and overcome over-application of gibberellin-inhibiting PGRs.	Fresco	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm, unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results were not evident, reapplication or an increase in rate may be warranted. The most common rates for use are 3 to 5 ppm. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.
CALADIUM	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Bonzi / Pac O / Downsize	100 to 200 ppm spray (3.2 to 6.4 fl oz / gal)	Make first spray application when plants are 2 to 4 in. tall.
			0.24 to 1.77 mg a.i. (5 to 15 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot)	Make first application when plants are 1 to 2 in. tall. Drench volumes and mg a.i. vary with pot size.
		Piccolo / Bonzi / Pac O	60 ppm tuber soak	Soak tubers for 30 min. prior to planting.
		Piccolo 10 XC	100 to 200 ppm spray	Spray applications of Piccolo 10 XC are the least desirable method for controlling bulb plant height and must be applied sequentially to maximize uniformity of the crop. Begin spray applications when plants reach a height of 2 to 4 in.
			2 to 16 ppm drench	Drench volume varies with pot size. Begin drench applications when plants reach a height of 1 to 2 in.
		Topflor	0.5 to 2 mg a.i. drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations. Use lower rates for less vigorous cultivars.
	Branching agent and de-eying agent	Configure	250 to 4000 ppm	Pre-plant bulb soak for 1hour. Shoot emergence delayed, shorter plants, and fewer shoots than non-de-eyed controls.
CALCEOLARIA	To control plant growth	Citadel / Altercel	400 to 800 ppm spray	Used to control internode length. Apply 400 ppm when flower buds are 1-in. in diameter. Repeat 2 weeks later if needed.
		Dazide / B-Nine	1,000 to 1,500 ppm spray	Used to control internode length.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
CALENDULA	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	Can be used when the visible flower bud is pea sized. Rates of 3,500 ppm be used 4 to 5 weeks after germination (when 3 to 4 mature leaves formed).
			2,500 to 5,000 ppm spray	Plugs: Use 2,500 ppm with Stage 1 and 5,000 ppm with Stages 2 or 3.
		Concise / Sumagic	1 ppm spray	Plugs: Use at Stages 2 or 3.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	4 ppm spray	Plugs: Use at Stages 2 or 3.
CALIBRACHOA	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	At planting, soft pinch to promote lateral shoot development. Multiple applications may be required.
		Citadel + Dazide / Altercel + B-Nine	2,500 ppm Dazide + 500 to 1,500 ppm Citadel applied as a tank-mix spray	
		Concise / Sumagic	10 to 25 ppm spray	Try lower rate initially. Apply 2 weeks after transplanting.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	3 to 50 ppm spray	Use rates of 3 to 5 ppm for compact genetics needing slight growth control.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	3 to 8 ppm drench	Rates for compact genetics needing slight growth control. Begin with 1 to 2 ppm to determine suitable rates.
		Florel / Collate	300 to 500 ppm spray	Early spray will increase branching and reduce early flowering.
		Topflor	5 to 10 ppm spray	
CALLA LILY (<i>Zantedeschia aethiopica</i>)	To control plant growth	Configure	150 to 300 ppm	Rates of 150 to 300 ppm improved branching of the cultivars 'Callie Bright Red' and 'Deep Yellow'.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.59 to 1.77 mg a.i. (5 to 15 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Make first application when plants are 1 to 2 in. tall. Drench volumes and mg a.i. vary with pot size.
		Piccolo / Bonzi / Pac O	20 ppm rhizome / tuber soak	Soak the rhizomes / tubers for 15 min. prior to planting.
		Concise / Sumagic	1 to 2 mg a.i. drench (8.45 to 16.9 ppm); apply 4 fl oz / 6-in. pot	Optimal rate based on NC State University trials. Adjust rate for plant vigor. Drench volumes and mg a.i. vary with pot size.
		Topflor	1 to 2.25 mg a.i. drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations.
	To promote flowering	Florigib / ProGibb T&O	500 ppm rhizome / tuber soak	Soak the rhizomes or tubers for 10 min. prior to planting. See label for details.
CAMPANULA	To control plant growth	Configure	250 to 350 ppm	Pre-plant rhizome dip for 20 minutes. BA 350 ppm increased total flowers produced. BA caused some flower abnormalities. Increasing flower production in one year reduces future production from the rhizome.
		Configure	250 to 350 ppm	
	Flower enhancer	Configure	250 to 350 ppm	
CANNA LILY	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	Use at visible bud.
		Topflor	10 to 30 ppm spray	Use at visible bud.
CANNA LILY	To control plant growth	Topflor	50 to 80 ppm spray	
CASTOR BEAN (<i>Ricinus communis</i>)	Flower enhancer	Configure	50 to 75 ppm	Applied to buds 0 to 8 days after formation. BA 75 ppm at 4 to 8 days after bud formation causes the normally monocious flowers to become perfect.
CELOSIA	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 45 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	10 to 20 ppm spray	
		Topflor	10 to 40 ppm spray	Based on NC State University trials. Adjust rates for other locations.
CELOSIA, Plugs	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
CENTAUREA	To control plant growth	Abide / A-Rest	10 to 15 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
CENTRADENIA HYBRID	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
CHAMAECECEUS SILVESTRI (Succulent, Peanut Cactus)	Induce lateral branching	Configure	100 to 200 ppm	Single foliar spray. 200 ppm increased branching.
CHAMAECECEUS SILVESTRII F. VARIEGATA (Peanut Cactus)	Increase offset production	Configure	1000 to 5000 ppm	Application method not listed. 5000 ppm increased offset (tubercles) of sufficient size.
CHRISTMAS CACTUS (<i>Schlumbergera spp.</i>)	To increase branching under vegetative conditions	Configure	100 ppm spray	After planting when new vegetative growth begins, uniformly apply 1 to 2 quarts of finished spray solution to 100 sq ft of area.
	To increase the number of flower buds under reproductive conditions	Configure	100 to 200 ppm spray	Apply as a uniform foliar spray after the start of short days following leveling, or when flower buds become visible. See the label for specific guidelines based on lighted or natural-season growth plants.
	Flower enhancer	Configure	10 to 100 ppm	High temperatures and foliar sprays applied at beginning of short day or 10 to 20 days later. BA inhibits flower production if applied at beginning of short day. At temperatures above 20C it is best applied 10 to 20 days after start of short day.
			100 to 1000 ppm	Foliar sprays during long days as well as 5 to 10 days after start of short days. Under long days, 100 to 200 ppm was ideal for increasing phylloclade branching. From 5 to 10 days after start of short days, BA caused more flowers per phylloclade and flowering occurred 10 days sooner. BA also induced flowering on immature plants under short days when short days alone did not.
CHRYSANTHEMUM, Cut	To reduce "neck" stretching	Dazide / B-Nine	2,500 ppm spray	Spray upper foliage 5 weeks after start of short-day treatment.
	To elongate peduncles of pompom-type mums	Florgib / ProGibb T&O	25 to 60 ppm spray	Use a single application 4 to 5 weeks after initiation of short days. Direct spray solution towards the flower buds. See label for precautions.
CHRYSANTHEMUM, Perennial	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	50 to 200 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.12 to 0.48 mg a.i. (1 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
CHRYSANTHEMUM, Potted	To control plant growth	Abide / A-Rest	25 to 50 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Apply when plants are 2 to 6 in. in height (about 2 weeks after pinch). Drench rates and application volumes vary with pot size.
		Dazide / B-Nine	1,000 ppm preplant foliar dip	Rooted cuttings can be dipped in solution to thoroughly wet leaves and stems and then potted. Allow foliage to dry before watering in. For unrooted cuttings, dip stems in solution, remove to flat, cover to prevent dehydration and hold overnight under cool conditions. Stick the next day.
			2,500 to 5,000 ppm spray	Spray when new growth from pinch is 1 to 2 in. long. Some varieties may require another application 3 weeks later.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	50 to 200 ppm spray	Applications should begin when axillary shoots are 2 to 3 in. long. Sprays can be applied earlier to vigorous cultivars if additional control is desired. Sequential applications of lower rates generally provide more uniformly shaped plants than single-spray applications. Uniform application of both sprays and drenches is critical for uniform crop development.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.118 to 0.473 mg a.i. (1 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size. Begin when the axillary shoots are to 2 to 3 in. long. Uniform application is required.
		Concise	5 to 10 ppm dip treatment on cuttings	Apply when the lateral shoots are 1.5 to 2.0 in. tall (about 7 to 14 days after pinching). Test for cultivar sensitivity. Multiple applications of the lower label rate may elicit a more satisfactory response and / or increasing the spray volume from 2 qts / 100 sq ft to 3 qts / 100 sq ft For Florida only: use a foliar spray concentration between 5 to 10 ppm (1.3 to 2.56 fl oz / gal). For medium to tall cultivars, increase the spray volume to 3 qts / 100 sq ft
			2.5 to 10 ppm spray	Apply as a dip treatment on unrooted cuttings followed by a foliar spray in the low-rate range. On rooted cuttings, use a solution of 2.5 ppm or less, followed by a foliar spray in the low-rate range.
		Concise / Sumagic	2.5 to 10 ppm spray	
		Topflor	7.5 to 25 ppm spray	Based on NC State University trials. Adjust rates for other locations. Use lower rates for less vigorous cultivars.
	Induce lateral branching	Configure	200 to 400 ppm	Single foliar spray 2 weeks before pinch, at pinch, or 2 weeks after pinch. 400 ppm applied at pinch increased branching and was better than spraying 2 weeks before or after pinch. No delay in flowering. Plants shorter.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
CHRYSANTHEMUM, Garden	To control plant growth	Concise	5 to 10 ppm dip treatment on cuttings	Apply when the lateral shoots are 1.5 to 2.0 in. tall (about 7 to 14 days after pinching). Test for cultivar sensitivity. Multiple applications of the lower label rate may elicit a more satisfactory response and / or increasing the spray volume from 2 qts / 100 sq ft to 3 qts / 100 sq ft. For Florida only: use a foliar spray concentration between 5 to 10 ppm. For medium to tall cultivars, increase the spray volume to 3 qts / 100 sq ft
		Concise / Sumagic	2.5 to 10 ppm spray	
		Dazide / B-Nine	1,000 to 5,000 ppm foliar spray	Normal starting point is 2,500 ppm. Multiple applications may be needed. Trial rates for cultivar response. Do not apply after bud set to avoid flower delay and/or discoloration.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 to 50 ppm spray	Trial rates for cultivar response. Do not apply after bud set to avoid flower delay and/or discoloration.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.5 to 2 ppm drench	Trial rates for cultivar response. Start trials at the lower rate range. Multiple applications may be needed if using low concentration drenches for the entire season growth control program. In grower trials late season drenches have been reported to help maintain plant finish size and avoid stretching. In addition, flowering delay has not been reported with late season applications at lower rates.
	To increase lateral branching	Florel / Collate	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
	Flower enhancer	Configure	0.1 to 10 ppm	Three foliar sprays (planting day, at 5 open leaves or 10 open leaves) in the early summer on field grown plants. 0.1 to 1.0 ppm resulted in slightly earlier flowering (up to 3.9 days) and stem lengths were unchanged. 10 ppm delayed flowering, stem lengths were shorter, leaves were larger and there was slight phytotoxicity.
CHRYSOCEPHALUM APICULATUM	To control plant growth	Dazide / B-Nine	2,500 ppm spray	Plants pinched and grown with good light and optimal growing conditions generally do not need PGRs.
CLARKIA (Godetia)	To control plant growth	Concise / Sumagic	15 to 25 ppm drench	Trial rates for cultivar response. Rates based on older cultivars.
		Dazide / B-Nine	3,000 ppm foliar spray	Trial rates for cultivar response. Rates based on older cultivars.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	20 to 30 ppm drench	Trial rates for cultivar response. Rates based on older cultivars.
CLEMATIS	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	Drench volumes and mg a.i. vary with pot size.
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
CLEOME	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Dazide / B-Nine	4,000 to 5,000 ppm spray	Multiple applications may be required. Make them at 7- to 10-day intervals.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	20 to 30 ppm spray	Multiple applications may be required. Make them at 7- to 10-day intervals.
CLERODENDRUM	To control plant growth	Abide / A-Rest	50 ppm spray	
			0.9 mg a.i. drench	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	100 ppm drench	
			0.5 mg a.i. drench	
	To increase lateral branching	Augeo/Atrimmec	1,042 to 2,083 ppm spray	
COLEUS PLUGS, Seed	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
COLEUS, Seed	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 30 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	400 to 3,000 ppm spray	
		Concise / Sumagic	10 to 20 ppm spray	
		Topflor	20 to 40 ppm spray	Based on NC State University trials. Adjust rates for other locations.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
COLEUS, Vegetative	To control plant growth	Citadel + Dazide / Altercel + B-Nine	2,500 to 4,000 ppm Dazide + 1,000 to 1,500 ppm Citadel applied as a tank-mix spray	See General Recommendations. Scheduling the crop to avoid excessive stretch is the most effective means of controlling growth.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 30 ppm spray	
			1 to 2 ppm drench	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	5 to 20 ppm spray	Use rates of 5 to 10 ppm for compact genetics needing slight growth control.
		Collate / Florel	500 ppm spray	
	Induce lateral or basal branching	Configure	400 to 1200 ppm	Foliar spray. 800 ppm BA increased branching and height of pinched and unpinched coleus.
			100 to 3200 ppm	Single foliar spray applied 2 weeks after potting. BA controlled plant growth in one of 2 cultivars tested.
COLUMBINE	To control plant growth	Abide / A-Rest	65 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
CONEFLOWER (Echinacea spp.)	To control plant growth	Concise / Sumagic	30 to 40 ppm spray	
	To increase branching	Configure	300 to 900 ppm spray	Apply after plant establishment and resumption of growth (i.e., approximately 2 weeks after potting). Apply in a uniform spray volume of 2 qts / 100 sq ft of area. Application timing and rate may vary with cultivar.
CONSOLIDA (Larkspur)	To control plant growth	Abide / A-Rest	35 to 132 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot (1 to 2 fl oz / gal of drench solution; apply 4 fl oz / 6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Concise / Sumagic	5 ppm drench	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 to 60 ppm spray	
CONSOLIDA, Cut (Larkspur)	To promote growth and stem elongation	Florgib / ProGibb T&O	50 to 100 ppm spray	Apply when plants are 4- to 8-in. tall. Apply at 2- to 3-week intervals. See label for precautions.
CORDYLINE	Induce lateral or basal branching	Configure	250 ppm	8 foliar sprays applied weekly. 250 ppm recommended.
COREOPSIS	To control plant growth	Concise / Sumagic	2 to 4 ppm spray	Rates for compact genetics needing slight growth control.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	3 to 100 ppm spray	Use rates of 3 to 6 ppm for compact genetics needing slight growth control.
			0.59 to 1.18 mg a.i. (5 to 10 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Rates for vigorous genetics needing moderate growth control.
		Topflor	2 to 4 ppm spray	Rates for compact genetics needing slight growth control.
	Induce lateral or basal branching on plugs	Configure	300 to 500 ppm	Rates of 300 to 500 ppm improved branching of the cultivars 'American Dreams', 'Moonbeam', 'Zagreb', and 'Rum Punch'.
COREOPSIS GRANDIFLORA (Tickseed)	Induce lateral branching	Configure	50 to 1600 ppm	No effect
COREOPSIS VERTICILLATA	Induce lateral branching	Configure	250 to 2000 ppm	Single foliar spray or crown drench. 500 ppm increased branching and also delayed flowering. Higher rates caused phytotoxicity.
CORNFLOWER (Centaurea)	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
COSMOS	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
CROSSANDRA	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	Apply after pinch when new growth is 2-in. long.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	50 ppm spray	Apply 2 weeks after pinch.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
CUPHEA	To control plant growth	Dazide / B-Nine	1,500 to 2,500 ppm spray	PGRs not required on compact cultivars.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	1 to 5 ppm spray	Initially, test on a few plants to determine rate for optimum control. Cuphea is sensitive to excessive rates.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.25 to 2 ppm drench	Use rates of 0.25 to 0.5 ppm for compact genetics needing slight growth control. Use 2 ppm for vigorous cultivars grown in the south.
CYCLAMEN PERSICUM	Flower enhancer and promote early flowering	Configure	50 to 100 ppm	Foliar spray applications. Flowering was advanced, especially at low temperatures. Flower malformations at high temperatures and when BA was applied with high levels of nitrogen. A foliar spray of 50 to 100 ppm applied after early October (cooler temperatures) is recommended.
DAFFODIL	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	2.37 to 4.73 mg a.i. (20 to 40 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	See CALADIUM.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	80 ppm bulb soak	Soak bulbs for 1 hr. prior to planting. Ten minute soaks of 400 ppm provided excellent results in NC State University trials.
		Florel / Collate	2,000 ppm spray	Controls plant height and stem topple. Apply when shoots are 3 to 4 in. tall. See label for cultivar differences in rates.
DAHLIA, Bedding Plant	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Citadel + Dazide / Altercel + B-Nine	2,500 to 4,000 ppm Dazide + 1,000 to 1,500 ppm Citadel applied as a tank-mix spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 45 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	10 to 20 ppm spray	
DAHLIA PLUGS, Bedding Plant	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
DAHLIA, Tuberous	To control plant growth	Abide / A-Rest	0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	1.18 to 4.73 mg a.i. (10 to 40 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	Greater than 40 ppm tuber soak	Soak tubers for 20 min. prior to planting.
		Concise / Sumagic	0.25 to 0.5 mg a.i. drench (2.1 to 4.2 ppm); apply 4 fl oz / 6-in. pot	Optimal rate based on NC State University trials. Adjust rate for plant vigor. Drench volumes and mg a.i. vary with pot size.
		Topflor	0.25 to 2 mg a.i. (2.1 to 16.9 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations. Use lower rates for less vigorous cultivars.
	Induce lateral or basal branching	Configure	20 to 40 ppm	3 foliar sprays made one week apart in summer. Lateral branching increased.
DELPHINIUM	To control plant growth	Abide / A-Rest	35 to 132 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot (1 to 2 fl oz / gal of drench solution; apply 4 fl oz / 6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Concise / Sumagic	5 ppm drench	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 to 60 ppm spray	
DELPHINIUM, Cut	To promote plant growth and stem elongation	Florgib / ProGibb T&O	50 to 100 ppm spray	Apply when plants are 4 to 8 in. tall. More than one application is possible at 2- to 3-week intervals. See label for precautions.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
DIANTHUS, Bedding Plant	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 60 ppm spray	Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing. Some series recommend the use of 5 to 8 ppm sprays.
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	3 to 5 ppm spray	
DIANTHUS CARYOPHYLLUS (Carnation)	Induce basal branching and cutting number	Configure	25 to 800 ppm	Single foliar spray onto stock plants. 400 ppm increased the cutting number by 35% without inhibiting subsequent rooting.
DIANTHUS PLUGS, Bedding plant	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	10 to 20 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
DIANTHUS, Cut	To promote plant growth and stem elongation	Florgib / ProGibb T&O	50 to 100 ppm spray	Apply when plants are 4 to 8 in. tall. More than one application is possible at 2- to 3-week intervals. See label for precautions.
	Induce lateral or basal branching	Configure	100 ppm	Single foliar spray at various times. BA increased branching but the timing of the spray was very important. Plants sprayed at the 5 open leaf stage of development branched the most.
DIANTHUS, Pot	To control plant growth	Concise / Sumagic	15 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 ppm spray	
DIASCIA Hybrid	To control plant growth	Dazide / B-Nine	1,250 to 5,000 ppm	At planting, soft pinch to promote lateral shoot development. Use higher rates on vigorous cultivars.
		Concise / Sumagic	5 to 15 ppm spray	Use lower rates to ensure taller flower spikes.
		Florel / Collate	200 to 500 ppm spray	Use 2 weeks after pinch.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 ppm spray	
			1 to 2 ppm drench	
DIASCIA, Seed	To control plant growth	Abide / A-Rest	20 ppm spray	Start application 7 to 10 days after transplant. Repeat 7 days later.
		Concise / Sumagic	5 to 10 ppm spray	To hold plants under warm conditions. Use caution, plants very responsive.
		Dazide / B-Nine	3,000 to 5,000 ppm spray	Start application 7 to 10 days after transplant.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	10 to 20 ppm spray	To hold plants under warm conditions. Use caution, plants very responsive.
DICENTRA SPECTABILIS (Bleeding Heart)	To control plant growth	Abide / A-Rest	65 to 132 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot; apply 4 fl oz / 6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Dazide / B-Nine	2,500 to 5,000 ppm spray	Apply as new sprouts emerge from the pot. Repeat if needed due to non-uniform emergence.
DICHONDRA ARGENTEA	To control plant growth	Citadel+Dazide / Altercel+B-Nine	1,000 ppm + 5,000 ppm spray	Also increases branching and improves silver color.
		Dazide / B-Nine	5,000 ppm spray	Also increases branching and improves silver color. Apply 2 weeks after transplanting.
DIEFFENBACHIA	Induce lateral or basal branching	Configure	500 to 2000 ppm	Single foliar spray 500 to 1000 ppm was the optimal. 2000 ppm caused phytotoxicity.
			750 ppm	Apply foliar sprays on 3 consecutive days.
DIGITALIS	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	80 to 160 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.24 to 0.48 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
DORITAENOPSIS (Orchid)	Flower enhancer	Configure	100 to 400 ppm	3 Foliar sprays on days 0, 7, 14 from the time they were moved into a floral inductive environment, or a single spray from -1 to +6 weeks after moving to an inductive environment. 200 to 400 ppm sprayed 3 times resulted in 3 to 9 days earlier flowering and produced 3 to 8 additional flowers per plant than the untreated plants. Spraying 1 week after the transfer to inductive conditions increased flowering the most.
DOROTHEANTHUS BELLIDIFORMIS	To control plant growth	None	None	Plants pinched and grown with good light and optimal growing conditions generally do not need PGRs.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
DRACAENA	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	Drench volumes and mg a.i. vary with pot size.
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
DUSTY MILLER (<i>Senecio cineraria</i>)	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Concise / Sumagic	30 ppm spray	
	Induce lateral or basal branching	Configure	50 to 400 ppm	Foliar spray or drench applied at 2 weeks after potting (WAP), 2+3 WAP or 2+3+4 WAP. BA decreased the size of the plants.
EASTER LILY (See Lily, Easter)				
ECHEVERIA spp	To induce offsets and induce flower development	Configure	100 to 400 ppm spray	Based on NC State University trials when applied 2 weeks after potting. A slight increase in offsets occurred along with the induction of flowering.
ECHINACEA HYBRIDS Fragrant Angel, Merlot, Tiki Torch (Hybrid Coneflower)	Induce lateral or basal branching	Configure	600 ppm	Single foliar application increased basal branching. This rate was our screening rate. Lower rates may be effective.
ECHINACEA PURPUREA	Induce lateral or basal branching on plugs	Configure	300 ppm	Single foliar application increased basal branching on plugs.
ECHINACEA PURPUREA Doubledecker, Magnus, Ruby Star, White Swan (Purple Coneflower)	Induce lateral or basal branching	Configure	300 ppm	Single foliar spray increased basal branching. No significant effect on plant height.
EGGPLANT	To control plant growth	Sumagic	2 to 10 ppm spray	See label for application suggestions and precautions. Make initial foliar applications when 2 to 4 true leaves are present. Apply uniformly as a foliar spray using 2 qt / 100 sq ft. Sequential applications at lower recommended rates will generally provide more growth control than a single high rate application. First-time users should apply the lowest recommended rate in order to determine optimal rate for individual cultivars under local environmental conditions. If additional growth control is required, a sequential spray application at the lowest recommended rate should be made 7 to 14 days after the initial application. If multiple applications are made to the transplants, the total amount of Sumagic applied may not exceed that from a single application of a 10 ppm spray. The final application may not occur later than 14 days after the 2 to 4 true leaf stage.
EPIPREMNUM AUREUM (syn <i>Rhaphidophora aurea</i>) (Golden Pothos)	Induce lateral or basal branching	Configure	50 to 200 ppm	Foliar spray 3 times every two weeks starting 2 weeks after potting. 200 ppm increased branching.
ERYSIMUM	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
EUPATORIUM	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	>240 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.96 to 1.18 mg a.i. (8 to 10 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
EUPHORBIA DULCIS Chameleon (Purple spurge)	Induce lateral or basal branching	Configure	600 ppm	Single foliar spray increased lateral branching but not basal branching. Lower rates may be effective.
EUPHORBIA HYPERICIFOLIA HYBRID	To control plant growth	Dazide / B-Nine	2,500 ppm spray	Plant growth slow early on. Apply PGRs if control is needed.
		Citadel+Dazide / Altercel+B-Nine	750 ppm + 2,500 ppm spray	
		Florel / Collate	Spray	Not recommended.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	0.5 to 2 ppm drench	Can be applied 3 to 4 weeks before finish, using the lower rate in the North and higher rate in the South.
EVOLVULUS	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
EXACUM (Persian Violet)	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	75 ppm spray	
			0.25 to 0.75 mg a.i. drench for a 6-in. pot	
		Topflor	25 to 50 ppm spray	Based on NC State University trials. Adjust rates for other locations.
			0.01 to 0.03 mg a.i. (0.08 to 0.25 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations. Exacum is very responsive to Topflor drenches, so start trials with lower rates.
	Induce lateral or basal branching	Configure	50 to 400 ppm	Foliar spray applied twice at weekly interval. No effect on growth. Phytotoxicity at all rates. Severely delayed flowering. Applications to exacum is NOT recommended.
FATSHEDERA	To control plant growth	Abide / A-Rest	65 to 132 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
FELICIA	To control plant growth	Citadel+Dazide / Altercel+B-Nine	1,000 to 1,500 ppm + 2,500 to 4,000 ppm spray	Pinch plant as needed to improve shape.
		Citadel / Altercel	1,500 ppm spray	Applied to pinched plants.
FLOWERING/ FOLIAGE PLANTS, Herbaceous Species (Not specifically listed in this table)	To control plant growth	Abide / A-Rest	20 to 50 ppm spray	Recommended starting rate for an Abide / A-Rest spray on a new herbaceous flowering or foliage species is 33 ppm (16 fl oz / gal).
			0.125 to 0.25 mg a.i. (1 to 2 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 ppm spray	Conduct trials on a small number of plants, adjust-ing the rate as needed for desired final plant height and length of height control.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.118 mg a.i. (1 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size. Conduct trials on a small number of plants.
		Citadel / Altercel	800 to 3,000 ppm spray	Optimum rate depends on species, desired amount of height control and environmental conditions. The suggested initial rate for small-scale trials is 1,250 ppm. Example: herbaceous species known to respond to Altercel are—Achimenes, Aster, Astilbe, Begonia (hiemalis), Begonia (tuberosus), Calceolaria, Carnation, Chrysanthemum, Columbine, Easter lily, <i>Gynura aurantiaca</i> , Ivy, Kalanchoe, <i>Lilium spp.</i> , Morning glory, Pachystachys, <i>Pilea spp.</i> , Pentas, <i>Salvia spp.</i> , Schefflera, <i>Sedum spp.</i> and Sunflower.
			2,000 to 4,000 ppm drench	Drench volumes vary with pot size. See label for recommended volumes. Herbaceous species known to respond to Altercel are listed above.
		Concise / Sumagic	5 to 40 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
			0.1 to 1 ppm drench	Drench volumes and mg a.i. vary with pot size.
	To promote plant growth and overcome over-applications of gibberellin-inhibiting PGRs	Florgib / ProGibb T&O	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm, unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results are not evident, reapplication or an increase in rates may be warranted. Consult the label for additional precautions.
		Fresco / Fascination	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm, unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results were not evident, reapplication or an increase in rate may be warranted. The most common rates for use are 3 to 5 ppm. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.
	To induce lateral or basal branching	Configure	50 to 500 ppm spray	The supplemental label allows legal use on greenhouse grown plants not specifically listed on the original label. See label for trialing suggestions and precautions.
FLOWERING / FOLIAGE PLANTS, Woody Species (Not specifically listed in this table)	To control plant growth	Abide / A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Dazide / B-Nine	2,500 to 7,500 ppm spray	Two or more applications may be necessary if new growth begins to stretch or for enhanced coloration.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	50 ppm spray	Conduct trials on a small number of plants, adjust-ing the rate as needed for desired final plant height and length of height control.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.237 mg a.i. drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
FLOWERING / FOLIAGE PLANTS, Woody Species (Not specifically listed in this table) (continued)		Citadel / Altercel	800 to 3,000 ppm spray	Optimum rate depends on species, desired amount of height control and environmental conditions. The suggested initial rate for small-scale trials is 1,250 ppm. Example: woody species known to respond to Citadel are—Barleria cristata, Bougainvillea, Camellia, Gardenia, Fuchsia, Hollies, Hydrangea, Lantana, Pseuderanthemum lactifolia, Rhododendron and Roses (potted).
			2,000 to 4,000 ppm drench	Drench volumes vary with pot size. See label for recommended volumes. Woody species known to respond to Citadel are listed above.
		Concise / Sumagic	20 to 50 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
			0.5 to 2 ppm drench	Drench volumes and mg a.i. vary with pot size.
FREESIA	To control plant growth	Abide / A-Rest	100 to 200 ppm corm soak	Soak corms in the solution for 1 hour before planting. Cultivar response varies, so conduct your own trials.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.22 to 0.48 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	To increase lateral branching.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	50 to 200 ppm corm soak	Soak corms in the solution for 1 hour before planting. Cultivar response varies, so conduct your own trials.
FUCHSIA	To control plant growth	Abide / A-Rest	25 to 75 ppm spray	May also increase flowering.
		Dazide / B-Nine	1,250 to 2,500 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Make applications prior to visible bud to avoid delay.
		Concise / Sumagic	2 to 5 ppm spray	Make applications prior to visible bud to avoid delay.
	To increase lateral branching	Augeo/Atrimmec	781 to 2,343 ppm spray	
		Florel / Collate	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
	To promote stem elongation for topiary	Florgib / ProGibb T&O	200 to 400 ppm spray	For use on upright growing cultivars used for topiary. Weekly sprays can be used, maximum 3 applications.
GAILLARDIA ARISTA Dazzler (Common gaillardia)	Induce lateral or basal branching	Configure	600 ppm	A single foliar spray caused excessive branching. Use much lower rates for this crop.
GAILLARDIA X GRANDIFLORA Gallo Yellow, Orange Lemon	Induce lateral or basal branching on plugs	Configure	300 ppm	Single foliar spray increased lateral branching.
GARDENIA	To control plant growth	Abide / A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Dazide / B-Nine	5,000 ppm spray	Spray when plants are at two-thirds final market size.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	12 ppm drench	Flower delay possible. Apply prior to floral initiation (short days) or 6 weeks after pinching.
		Topflor	100 to 200 ppm spray	Apply prior to floral initiation (short days) or 6 weeks after pinching.
	To increase lateral branching	Augeo/Atrimmec	2,343 to 4,687 ppm spray	
GAURA GAURA Siskiyou Pink	To control plant growth	Dazide / B-Nine	3,000 to 4,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 to 50 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	3.54 mg a.i. (30 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
		Concise / Sumagic	10 to 30 ppm spray	
	Induce branching on plugs	Configure	300 ppm	Single or multiple foliar sprays applied ~27 days after sticking (plants moderately rooted) increased lateral and basal branching with no adverse effects on rooting.
	Induce lateral or basal branching/ enhance flower numbers	Configure	600 ppm	A single foliar spray resulted in increased lateral and basal branching. Increased number of flower stalks. This was our screening rate. Lower rates may be effective.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
GAZANIA	To control plant growth	Citadel / Chlormequat E-Pro / Altercel	1,500 ppm spray	Make applications prior to visible bud to avoid delay.
		Dazide / B-Nine	2,500 ppm spray	Make applications prior to visible bud to avoid delay.
GERANIUM (<i>Pelargonum x hortorum</i>)	To control plant growth	Abide / A-Rest	26 to 66 ppm spray	See AGERATUM.
		Piccolo / Bonzi / Pac O	5 to 30 ppm spray	Apply to zonal geraniums when new growth is 1.5 to 2 in. long. Apply to seed geraniums approximately 2 to 4 weeks after transplanting.
		Concise	3 to 8 ppm spray	Use lower rates for less vigorous plants and higher rates for more vigorous growing plants. Flower delay on some cultivars can occur when using rates >6 ppm.
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	Make first application 2 to 4 weeks after planting plugs or rooted cuttings (after stems have started elongating). Multiple applications may be needed.
		Piccolo 10 XC	10 to 30 ppm spray	See Piccolo remarks for GERANIUM. Early applications may require lower rates to avoid overdosing. Piccolo 10 XC will reduce late stretch when applied as the flower stems begins to elongate.
		Concise / Sumagic	3 to 6 ppm spray for cutting geraniums and 2 to 4 ppm spray for seed geraniums	
		Topflor	15 to 25 ppm spray	Apply to zonal geraniums when new growth is 1.5 to 2 in. long.
	To promote earlier flowering in seed geraniums	Citadel / Chlormequat E-Pro / Altercel	1,500 ppm spray	Make two applications at 35 and 42 days after seeding. Treated plants should flower earlier and be more compact and more well-branched than untreated plants.
		Florgib / ProGibb	5 to 15 ppm spray (0.02 to 0.06 fl oz / gal)	Make a single foliar application when first flower bud set is noted. Spray the entire plant until runoff. See label for precautions.
	To increase flower number and size in cutting geranium	Florgib / ProGibb T&O	1 to 5 ppm spray	Make a single foliar application when first flower bud set is noted. Spray the entire plant until runoff. See label for precautions.
	Induce lateral or basal branching	Florel / Collate	300 to 500 ppm spray	Labeled for zonal and ivy geraniums. Use the lower concentration for ivy geraniums. Florel and Collate will also provide some growth retardant effect and delay flowering. Read the label for restrictions on timing of applications.
			1000 ppm	Single foliar sprays applied 2 weeks before, during, or 2 weeks after a soft pinch. BA applied at pinch increased branching of geranium. BA applied at pinch delayed flowering 2 to 5 days.
		Configure	50 to 200 ppm	Rates of 50 to 200 ppm improved branching of the cultivars 'Melody', 'Candy Lavender', and 'Patriot Bright Red'. Some cultivars may be sensitive to Configure , and small trials should be conducted to evaluate the potential for phytotoxicity.
GERANIUM, IVY (<i>Pelargonum x peltatum</i>)	To control plant growth	Citadel / Chlormequat E-Pro / Altercel	750 to 1,500 ppm spray	
	To increase branching	Augeo/Atrimmec	1,562 ppm spray	Labeled for ivy geraniums only.
		Florel / Collate	200 to 300 ppm spray	
	Induce lateral or basal branching	Configure	50 to 200 ppm	Rates of 50 to 200 ppm improved branching of the cultivars 'Caliente Rose', 'Caliente Lavender', and 'Caliente Dark Red'. Some cultivars may be sensitive to Configure , and small trials should be conducted to evaluate the potential for phytotoxicity.
GERANIUM, REGAL (<i>Pelargonum grandiflorum</i>)	To control plant growth	Citadel / Chlormequat E-Pro / Altercel	1,500 to 3,000 ppm spray	Multiple applications may be needed. Trial rates for cultivar response. Do not apply after bud set to avoid flower delay and/or discoloration.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Multiple applications may be needed. Trial rates for cultivar response. Do not apply after bud set/flower coloration to avoid flower delay and/or discoloration.
	Induce lateral or basal branching	Configure	150 ppm	Single foliar increased lateral branching and reduced plant height
GERANIUM, Seed	To promote earlier flowering	Citadel	1,500 ppm spray	See label. Make two spray applications at 35 and 42 days after seeding. Plants flower quicker, are compact and have increased lateral breaks.
	To control plant growth	Concise	2 to 4 ppm spray	Apply when plant height is approximately 4 in. tall.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
GERBERA DAISY (<i>Gerbera jamesonii</i>)	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	Do not apply when flower stems are visible.
			0.25 to 0.5 mg a.i. drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size. Do not apply when flower stems are visible.
		Dazide / B-Nine	1,200 to 5,000 ppm spray	Do not apply when flower stems are visible. Apply lower rate at 10 to 14 interval if needed.
	Branching agent/ Enhance cutting numbers	Configure	100 to 400 ppm	Plants defoliated and sprayed twice 6 weeks apart to induce new shoots. 2 sprays of 200 ppm BA promoted more sprouting shoots harvested for cuttings. Large cultivar differences.
	Flower enhancer	Configure	25 or 50 ppm	Single foliar spray. No effect on height, branching, flower number or timing, or fasciation.
GLADIOLUS	To control plant growth	Abide / A-Rest	1.5 mg drench per 0.5 gal. pot	For container-grown plants.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	2.5 to 5.0 mg drench per 0.5 gal. pot	For container-grown plants.
	Increase corm and cormel yield	Configure	25 ppm	Corm or cormel preplant soak for 24 to 30 hours just after harvesting in April. BA decreased time to sprouting from 90 days to 10 days and increased the number of corms and slightly increased the number of cormels produced one year later.
			25 to 100 ppm	Pre-plant bulb soak for 24 hours. 25 ppm BA decreased the number days to sprouting by 10 days as well as increasing sprouting percentage. BA increased corm diameter and weight and cormel number and weight.
GLOXINIA (<i>Sinningia speciosa</i>)	To control peduncle length	Dazide / B-Nine	1,250 ppm spray	PGRs may not be required on compact cultivars. Make first application when the leaves reach the side of the pot. A repeat application can be made 7 to 10 days later if needed. Flower streaking can develop if PGR applied when the buds show color. Phytotoxicity may occur at rates >1,250 ppm.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 ppm spray	Can be applied when buds grow above the foliage.
			4 to 8 ppm drenches	For elongation control late in the season (10 weeks after transplant).
GOMPHRENA	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
GOODENIA	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
GRAPE IVY	To increase lateral branching	Augeo/Atrimmec	781 to 1,562 ppm spray	
GROUNDCHERRY	To control plant growth	Concise / Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
GYPSOPHILA	To accelerate plant growth, increase stem and flower number and increase flower uniformity	Florgib / ProGibb T&O	150 to 500 ppm spray	Make 3 to 4 foliar applications after 4 weeks of new growth has occurred after pinching. Use 2-week intervals between sprays. See label for precautions.
HEDERA CANARIENSIS (Algerian Ivy)	Induce lateral or basal branching	Configure	50 to 200 ppm	Foliar spray 3 times every two weeks starting 2 weeks after potting. 200 ppm increased branching
HELENIUM AMARUM	To control plant growth	Dazide / B-Nine	5,000 ppm spray	Apply after plant established (2 weeks after transplant).
HELENIUM (Sneezeweed)	Induce lateral/ Flowering enhancer	Configure	20 to 40 ppm	Foliar sprays 3 times, one week apart in summer. Increased lateral branching but did not affect height. Delayed flowering but increased flower number.
HELENIUM AUTUMNALE Coppelia (Sneezeweed)	Induce lateral or basal branching	Configure	600 ppm	Not responsive to a single foliar spray at this screening rate. Multiple sprays may be effective.
HELICHRYSUM PETIOLARE/ H. ITALICUM (Licorice plant)	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	1 ppm drench	Plants grown with good light and optimal growing conditions generally do not need PGRs.
	To increase lateral branching	Florel / Collate	300 to 500 ppm spray	Make first application after 2 weeks. Repeat in 2 weeks if needed (with larger pots).
HELICONIA	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 30 ppm spray	Apply when axillary shoots are 4 to 6-in. high after removal of primary shoot (2 to 3 months after planting). Cultivar variation possible, so conduct your own trials to determine optimal rates.
			0.375 mg a.i. drench / 6-in. pot	Apply when axillary shoots are 4 to 6-in. high after removal of primary shoot (2 to 3 months after planting). Cultivar variation possible, so conduct your own trials to determine optimal rates.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
HELIOTROPIUM ARBORESCENS	To control plant growth	Citadel / Chlormequat E-Pro / Altercel	500 ppm spray	Rate for compact genetics needing slight growth control.
		Citadel+Dazide / Altercel+B-Nine	750 to 1,000 ppm + 1,500 to 3,000 ppm spray	Rate for compact genetics needing slight growth control.
HELLEBORUS X HYBRIDUS (Lenten Rose)	Induce lateral or basal branching	Configure	50 to 800 ppm	Foliar spray or drench applied every 2 weeks for 12 weeks during the summer. Some increase in branching. No phytotoxicity but leaves were feathered.
HEMEROCALLIS (Daylily)	Induce lateral or basal branching	Configure	2500 or 5000 ppm	Foliar spray for 1, 2, 3, 4, or 5 consecutive weeks. BA increased offset formation. Higher rates and more applications were generally optimal.
			1250, 2500, 3750 ppm	Foliar sprays applied twice in the summer. BA at 2500 ppm increased divisions by 20%.
HEMEROCALLIS Strutters Ball (Daylily)	Induce lateral or basal branching	Configure	600 ppm	Not responsive to a single foliar spray. Multiple applications may improve response.
HEUCHERA Raspberry Ice, Silver Lode (Coral bells)	Induce lateral or basal branching	Configure	600 ppm	A single foliar spray increased basal branching. Lower rates may be effective.
HIBISCUS MOSCHEUTOS	To control plant growth	Citadel / Altercel	1000 ppm foliar spray	Multiple applications may be required.
		Concise / Sumagic	15 ppm foliar spray	
HIBISCUS ROSA-SINENSIS	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 150 ppm spray	Application should be made when laterals are 1 to 4 in. long. Single applications control lateral growth for 3 to 6 weeks.
		Concise	10 ppm spray	Apply within 7 days after pruning. Make additional applications as necessary to obtain desired results. Florida only: Use a foliar spray concentration between 5 to 10 ppm and apply a uniform spray volume of 3 qts / 100 sq ft
		Citadel / Altercel	200 to 600 ppm spray	Multiple applications starting prior to first pinch are recommended. See label for additional precautions. Avoid applications after flower buds are visible.
		Concise / Sumagic	0.025 to 0.2 mg a.i. drench per pot	
HOLLY	To control plant growth	Abide / A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
HOLLYHOCK	To control plant growth	Piccolo / Bonzi / Pac O	30 to 50 ppm spray	
		Concise / Sumagic	5 to 40 ppm spray	
HOSTA	To promote lateral growth on finished plants	Configure	1,000 to 3,000 ppm spray	Apply in a uniform spray volume. Application is most effective when plants are fully established prior to application (i.e. at least 3 to 4 weeks after potting), when there is evidence of surface root development but before flower initiation.
	To increase production of offsets for propagation	Configure	1,000 to 3,000 ppm spray	Apply in a uniform spray volume to fully established, actively growing stock plants. Repeat the application at 30-day intervals during the growing season. Offsets may be harvested at any time. Treatment effects may vary by Hosta cultivar and may respond differently to a given rate. Multiple applications at 30-day intervals using lower rates may be more effective than a single application at a higher rate. Conduct trials on a small number of plants under actual use conditions to establish the proper use rates and timings.
	Induce lateral or basal branching	Configure	1250 to 3750 ppm	Single foliar sprays in summer onto plants with 0, 1, 2, or 3 pre-existing offsets. The optimal rate was 3750 ppm onto plants with 0 initial offsets.
			3000 ppm	1 to 4 foliar sprays at 30 day intervals. 4 applications yielded the highest number of offsets.
			1250 to 3750 ppm	Single foliar spray. Optimal rate varied by cultivar. 10 cultivars trialed. BA improves offset number on all cultivars. No phytotoxicity was observed.
			3000 ppm	Foliar spray, crown spray, crown + foliar spray, crown drench, root immersion, or crown + root immersion. Foliar sprays were the least effective. Crown and crown + root immersions were the most effective.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
HYACINTH	To reduce stem topple	Florel / Collate	1,000 ppm spray	To reduce stem topple at time of full flower, apply foliar spray before florets have opened.
	To control plant growth	Piccolo / Bonzi / Pac O	100 ppm bulb soak	Ten minute soaks provided excellent results in NC State University trials. Cultivar response varied.
		Concise / Sumagic	20 to 40 ppm bulb soak	Two to ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
		Topflor	0.5 to 1 mg a.i. (4.2 to 8.45 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations.
			10 to 25 ppm bulb soak	Two to ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
HYACINTH, GRAPE (<i>Muscari armeniacum</i> <i>M. comosum</i>)	Propagation/ Increase bulblet production	Configure	1000 to 5000 ppm	BA mixed with lanolin paste and applied to basal plate of 6 to 7 cm bulbs. All rates increased bulblet formation 30x over controls in <i>M. armeniacum</i> and 3x over controls in <i>M. comosum</i> .
HYBRID LILY (See Lily, Hybrid)				
HYDRANGEA	To control plant growth	Abide / A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Dazide / B-Nine	1,250 to 7,500 ppm spray	Use lower rate in spring when 4 to 5 pairs of leaves are visible and new growth is starting to unfold, but not later than 4 weeks after initiation of forcing. Use higher rate for summer when regrowth after pinching is 1 to 2 in. long.
		Topflor	100 to 200 ppm spray	
HYLOCEREUS	Induce lateral or basal branching	Configure	25 to 100 ppm	24-hour soak of cuttings (apical tip only). 100 ppm caused more lateral shoots to break, providing more shoots for propagation.
HYPOCALYMMMA ANGUSTIFOLIA (White myrtle)	Induce lateral or basal branching	Configure	100 ppm	Foliar spray 3 times, 1 week apart – 2 months prior to taking cuttings. BA increased branching but subsequent cuttings rooted very poorly compared to control.
HYPOESTES	To control plant growth	Chlormequat E-Pro	800 to 1,500 ppm spray	Initially apply after second set of leaves have developed. If needed, reapply 2 weeks later.
		Citadel / Altercel	400 to 1,500 ppm spray	Initially apply after second set of leaves have developed. If needed, reapply 2 weeks later.
		Dazide / B-Nine	1,000 ppm spray	Initially apply after second set of leaves have developed. If needed, reapply 2 weeks later.
IMPATIENS, Seed	To control plant growth	Abide / A-Rest	10 to 44 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	10 to 45 ppm spray	
		Concise / Sumagic	5 to 10 ppm spray	
		Topflor	20 to 60 ppm spray	Based on NC State University trials. Adjust rates for other locations.
	To increase branching	Florel / Collate	100 to 300 ppm spray	Use if better branching needed.
IMPATIENS PLUGS, Seed	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	0.5 to 10 ppm spray (0.015 to 0.32 fl oz / gal)	Timing of application should normally begin at the 1 to 2 true leaf stage.
IMPATIENS, Vegetative	To control plant growth	Piccolo / Bonzi / Pac O	2 to 15 ppm spray	Cultivars' response to PGRs varies, so test a few plants to determine rate for optimum control.
			0.5 to 1 ppm drench	Drench volumes and mg a.i. vary with pot size. See label for recommended volumes.
		Florel / Collate	100 to 300 ppm spray	Will improve branching.
IMPATIENS, Seashell-type	To control plant growth	Piccolo / Bonzi / Pac O	5 to 8 ppm spray	Apply when plants have reached 75% of finished height. Don't apply to plants under stress. Recommendations based on Michigan trials.
IOCHROMA	To control plant growth	Dazide / B-Nine	5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	2 ppm spray	

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
IPOMOEA (<i>Ipomoea batatas</i> ; Ornamental Sweet Potato)	To control plant growth	Concise / Sumagic	10 to 25 ppm spray	Not needed if optimal scheduling is used. If needed, apply when plants have reached 75% of finished growth. Recommendations based on NC State University trials.
		Dazide / B-Nine	2,500 ppm spray	Apply as needed.
		Florel / Collate	500 to 1,000 ppm spray	Will improve branching and control growth.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	8 ppm drench	Applied to plugs prior to transplanting.
	Induce lateral or basal branching	Configure	12.5 to 1600 ppm	Two foliar sprays applied 30 days apart during winter production. No effect with rates used.
IRISINE HYBRID (Blood Leaf)	To control plant growth	Citadel+Dazide / Altercel+B-Nine	1,000 to 1,500 ppm + 2,500 to 4,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	
		Piccolo / Piccolo10XC / Bonzi / Pac O / Downsize	1 to 3 ppm drench	
	Induce lateral or basal branching	Configure	50 to 800 ppm	Single foliar spray applied 2 weeks after potting. No effect on growth. Some phytotoxicity at the highest rates.
IRIS GERMANICA (Tall bearded Iris)	Induce lateral/ Flowering enhancer	Configure	100 to 200 ppm	Single foliar spray. 100 ppm slightly increased lateral branching on one cultivar. This resulted in more bloom stalks the following year.
JACOBINIA (Pink)	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.06 to 0.12 mg a.i. (0.5 to 1 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
JERUSALEM CHERRY (<i>Solanum pseudocapsicum</i>)	To control plant growth	Citadel / Chlormequat E-Pro	800 to 1,500 ppm spray	
		Citadel / Altercel	400 to 1,500 ppm spray	
	To promote stem elongation for topiary	Florgib / ProGibb T&O	250 ppm spray	For plants grown in 6-in. pots and with 4- to 6-in. of growth, apply 2 foliar sprays 10 days apart to promote stem elongation for topiary plants. Stake plants to support stem.
JOVIBARBA HIRTA (Hens and Chicks)	Induce lateral or basal branching	Configure	50 to 1600 ppm	Single foliar spray. 1600 ppm increased offsetting the most.
KALANCHOE	To control plant growth	Abide / A-Rest	50 ppm spray	Apply when axillary growth begins and repeat 20 to 30 days after short days begin. Trial to determine optimal rates and timing for your location.
		Dazide / B-Nine	2,500 to 5,000 ppm spray	Rates and timing vary with the season and cultivar. Applications typically begin 2 weeks after pinching. Apply sprays every 7 days in the summer, 10 to 15 days in the spring and fall, and 14 to 21 days in the winter. Trial to determine optimal rates and timing for your location.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	2 to 4 ppm spray	Trial to determine optimal rates and timing for your location.
	To increase lateral branching	Augeo/Atrimmec	1,042 to 2,343 ppm spray	
	To control peduncle length	Dazide / B-Nine	1,200 to 5,000 ppm spray	Phytotoxicity possible if B-Nine / Dazide accumulates in cupped areas of certain cupped-leaved varieties.
	Induce lateral branching/ Pinching replacement	Configure	10 to 50 ppm	Single foliar spray. 50 ppm increased branching above that of hand pinching.
LACHENALIA sp.	To control plant growth	Concise / Sumagic	20 ppm corm soaks	Rates based on trials at Cornell University.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	100 to 200 ppm spray	Rates based on trials at Cornell University.
			1 to 2 mg a.i. / pot drench	Rates based on trials at Cornell University.
LAMIUM	To control plant growth	Concise / Sumagic	5 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 ppm spray	
			1 ppm drench	
	To increase lateral branching	Collate / Florel	500 ppm spray	Improves branching and produces compact growth.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
LANTANA	To control plant growth	Citadel + Dazide / Altercel + B-Nine	2,500 to 5,000 ppm Dazide + 1,000 to 1,500 ppm Citadel applied as a tank-mix spray	Cultivar response varies.
		Piccolo / Bonzi / Pac O	20 to 40 ppm spray	
		Concise / Sumagic	10 to 20 ppm spray	
	To increase lateral branching	Augeo/Atrimmec	781 to 1,562 ppm spray	
		Florel / Collate	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
	Induce lateral or basal branching	Configure	800 to 1200 ppm	Weekly foliar sprays for 3 weeks. BA increased branching.
LAVANDULA X INTERMEDIA Provence (Lavandin)	Induce branching on plugs	Configure	300 ppm	Two foliar sprays applied, first at ~34 days after sticking (plants moderately rooted) and again 2 weeks later; increased lateral and basal branching but reduced root surface area and root volume of plugs.; no reduction in establishment of plants. Apply after plugs are well rooted.
LAURENTIA AXILLARIS	To control plant growth	Abide / A-Rest	2 to 4 ppm spray	
		Dazide / B-Nine	2,500 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	1 to 2 ppm drench	
LEUCANTHEMUM X SUPERBUM Alaska, Becky (Shasta Daisy)	Induce basal branching/ enhance flower number	Configure	600 ppm	A single foliar spray increased basal branching on both cultivars but effect was short term on 'Alaska'. Multiple applications may improve branching. This treatment doubled the number of flowers on 'Alaska'.
LEUCANTHEMUM X SUPERBUM Snowcap (Shasta daisy)	Induce branching on plugs	Configure	300 ppm	Single or multiple foliar sprays applied ~27 days after sticking (plants moderately rooted) increased basal branching but reduced root surface area and root volume. Apply after plugs are well rooted.
LEUCOSPERMUM (Pincushion)	Flower enhancer	Configure	50 to 300 ppm	Foliar spray (50 to 300 ppm) applied once or 200 ppm applied 1 to 4 times in late summer to fall. 200 ppm applied once in late summer increased the number of florets and increased flower stem diameter.
LIATRIS	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
LILIUM X FORMOLONGI (Lily)	Propagation/ Seed Germination	Configure	100 ppm	24 pre-plant seed soak. 100 ppm increased germination by 20%, and reduced germination time by 3 days.
LILY, Easter	To control plant growth	Abide / A-Rest	30 to 132 ppm spray. Use 50 ppm spray as a base rate and adjust as needed.	Apply when newly developing shoots are 2 to 3 in. long; a second application when shoots average 6 in. long may be needed.
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Single drench should be applied when shoots average 3 to 5 in. long. Drench volumes and mg a.i. vary with pot size.
		Concise	3 to 15 ppm spray	Apply when shoots average 3 in. tall. It is best to make only one foliar application per crop.
			0.03 to 0.06 mg a.i. (0.23 to 0.5 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Apply when shoots average 3 in. tall. Use lower rates on cultivars such as Nellie White and higher rates for Ace. For Florida only: use a solution concentration of between 0.05 to 0.12 mg a.i. (0.4 to 1.0 ppm) drench for a 6-in. pot (0.11 to 0.26 fl oz / gal of drench solution, apply 4 fl oz / 6-in. pot).
		Concise / Sumagic	3 to 15 ppm spray	Apply when shoots average 3 in. tall.
			0.03 to 0.06 mg a.i. (0.25 to 0.5 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
	To prevent leaf yellowing	Fresco / Fascination	5 to 10 ppm spray	Apply early season (7 to 10 days PRIOR to visible bud stage) and mid-season (7 to 10 days AFTER visible bud stage). Apply spray only to lower leaves to minimize stem elongation. See label.
	To prevent leaf yellowing and prolong flowering	Fresco / Fascination	100 ppm spray	Apply late season (when first bud reaches at least 3 in. in length) and no more than 14 days prior to placement in a cooler or shipping. Apply to foliar and flower buds. See label.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
LILY, Hybrid	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	200 to 500 ppm spray	See CALADIUM.
		Piccolo / Bonzi / Pac O	5 to 30 ppm bulb soak	Soak bulbs in the solution for 15 min. prior to planting.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.25 to 0.5 mg a.i. (4 to 30 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Single drench should be applied when shoots average 3 to 5 in. long. Drench volumes and mg a.i. vary with pot size and cultivar.
		Concise	2.5 to 20 ppm spray	Conduct a trial to determine optimal rates for each cultivar and adjust the rate as needed. Spray when shoots average 3 in. tall. If a second application is needed or a split application is made, it should be applied when the shoots average 6 in. tall. Usually two applications of foliar sprays at a lower rate are more effective than one application at a higher rate. Avoid applications after visible bud stage.
			1 to 3 ppm drench	Drench volume varies with pot size. Applications should be made when newly emerged shoots are 1 to 2 in. tall.
			1 to 10 ppm bulb soak	Treatment soak time should range from 1 to 5 minutes. Soak time will vary depending on bulb size, cultivar, and final desired height. Lower rates may require longer soak times (5 to 10 minutes) than higher rates (1 minute).
		Concise / Sumagic	3 to 15 ppm spray 0.03 to 0.06 mg a.i. (0.25 to 0.5 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Apply when shoots average 3 in. tall. Drench volumes and mg a.i. vary with pot size.
		Topflor	0.25 to 0.5 mg a.i. (2.1 to 4.2 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations and plant response.
	To prevent leaf yellowing	Fresco / Fascination	5 to 10 ppm spray	Apply early season (7 to 10 days PRIOR to visible bud stage) and mid-season (7 to 10 days AFTER visible bud stage). Apply spray only to lower leaves to minimize stem elongation. See label.
LILY, Oriental	To control plant growth	Fresco / Fascination	100 ppm spray	Apply late season (when first bud reaches at least 3 in. in length) and no more than 14 days prior to placement in a cooler or shipping. Apply to foliar and flower buds. See label.
		Piccolo / Bonzi / Pac O	100 to 200 ppm bulb soak	Ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
			2.5 to 10 ppm spray	See Concise label comments for Hybrid lilies.
		Concise	1 to 10 ppm bulb soak	See Concise label comments for Hybrid lilies.
			1 to 10 ppm bulb soak	See Concise label comments for Hybrid lilies. Ten minute preplant soaks of 5 ppm provided excellent results in NC State University trials. Cultivar response varied.
		Concise / Sumagic	1 to 10 ppm bulb soak	See Concise label comments for Hybrid lilies. Ten minute preplant soaks of 5 ppm provided excellent results in NC State University trials. Cultivar response varied.
		Piccolo 10 XC	200 to 500 ppm spray	Begin spray applications when plants reach a height of 2 to 4 inches.
			4 to 30 ppm drench	Drench volume varies with pot size. Begin drench applications when plants reach a height of 1 to 2 inches.
		Topflor	0.5 mg a.i. drench (4.2 ppm); apply 4 fl oz / 6-in. pot	Optimal rate based on NC State University trials. Adjust rate for plant vigor. Drench volumes and mg a.i. vary with pot size.
			25 ppm bulb soak	Ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
LINARIA HYBRIDA (Baby snapdragon)	To control plant growth	Fresco / Fascination	100 ppm spray	Apply early season (7 to 10 days PRIOR or AFTER visible bud stage). Apply spray only to lower leaves to minimize stem elongation. See label.
		Fresco / Fascination	100 ppm spray	Apply late season (no more than 14 days prior to placement in a cooler or shipping). Apply to foliar and flower buds. See label.
	To control plant growth	Dazide + Citadel / B-Nine + Altercel	2,500 ppm Dazide / B-Nine + 300 to 500 ppm Citadel / Altercel applied as a tank-mix spray	Controlled plant growth, but didn't strengthen stems, as well as paclobutrazol sprays.
LINARIA HYBRIDA (Baby snapdragon)	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	10 to 30 ppm spray	Use 10 ppm 1 week after transplant. Make a second application of 20 to 30 ppm once the secondary shoots are 2-in. long. Strengthened stems and improved flower coloration.
		Piccolo	0.5 to 8 ppm preplant liner dip	See label: for detailed recommendations for chemical application techniques, adjusting rates for northern or southern locations, and the specific rates for achieving the desired level of activity.
LIPSTICK VINE	To increase lateral branching	Augeo/Atrimmec	521 to 1,042 ppm spray	

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
LISIANTHUS (<i>Eustoma</i>)	To control plant growth	Abide / A-Rest	0.5 mg a.i. drench	Cultivar response varies.
		Concise / Sumagic	5 to 10 ppm spray	Cultivar response varies.
		Dazide / B-Nine	2,500 to 5,000 ppm spray	Cultivar response varies.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	4 to 16 ppm drench	Cultivar response varies.
LOBELIA	To control plant growth	Dazide / B-Nine	1,500 to 2,500 ppm spray	
		Concise / Sumagic	1 to 10 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	4 ppm spray	
			1 ppm drench	Can be used 3 to 5 weeks before sale to control stretch.
LOBELIA CARDINALIS (Cardinal flower)	Induce basal branching	Configure	600 ppm	A single foliar spray increased basal branching. Lower rates may be effective.
LOBELIA X SPECIOSA Fan Deep Rose (Hybrid Lobelia)	Induce basal or lateral branching	Configure	600 ppm	A single foliar spray increased number of shoots not branches. Moderate response. This rate was our screening rate. Multiple applications may be more effective.
LOBULARIA	To control plant growth	Piccolo	4 to 8 ppm liner root soak	See BACOPA. Rate based on North Carolina State University trials with Snow Princess.
			75 to 100 ppm spray	Sprays less effective than preplant liner soaks or substrate drenches. Rate based on North Carolina State University trials with Snow Princess.
			2 to 4 ppm drench	Drench volume varies with pot size. Rate based on North Carolina State University trials with Snow Princess.
		Concise	0.5 to 1 ppm liner root soak	See BACOPA. Rate based on North Carolina State University trials with Snow Princess.
			20 to 25 ppm spray	Sprays less effective than preplant liner soaks or substrate drenches. Rate based on North Carolina State University trials with Snow Princess.
			1 to 2 ppm drench	Drench volume varies with pot size. Rate based on North Carolina State University trials with Snow Princess.
		Topflor	10 ppm spray	
LOPHSOPERMUM (LOFUS)	To control plant growth and improve branching	Collate/Florel	250 to 500 ppm spray	Cultural requirements vary with the cultivar grown. Many cultivars only require high light, optimal growing conditions and regular pinching to control growth. Use a PGR if needed. Multiple applications may be needed in warmer climates. Avoid applications within 8 weeks of sale to ensure flowering is not delayed.
LUPINE (<i>Lupinus angustifolius</i>)	Enhance seed set	Configure	450 ppm	Painted onto flowers daily until senescence with a paint brush. BA increased the number of seed pods set, but reduced the number of seeds per pod. Overall seed production increased 11%.
LYCHNIS X ARKWRIGHTII Vesuvius (Arkwright's Champion)	Induce basal or lateral branching	Configure	600 ppm	A single foliar spray increased lateral branching. Lower rates may be effective.
MAMMILLARIA ELONGATA (Succulent)	Induce lateral branching	Configure	100 to 200 ppm	Single foliar spray. 200 ppm increased branching (linearly with rate).
MANDEVILLA SANDERI (<i>Dipladenia</i>)	To control plant growth	None	None	Cultural requirements vary with the cultivar grown. Many cultivars only require high light, optimal growing conditions, and regular pinching to control growth.
		Dazide/B-Nine	2,500 to 3,500 ppm spray	Use a PGR if needed. Multiple applications may be needed in warmer climates.
		Dazide/B-Nine + Citadel/Altercel	1,000 to 1,500 ppm Dazide/B-Nine + 750 ppm Citadel/Altercel spray	Use a PGR if needed. Multiple applications may be needed in warmer climates.
MARIGOLD	To control plant growth	Abide / A-Rest	13 to 33 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 60 ppm spray	See remarks for AGERATUM. Use 15 to 30 ppm for French type and 30 to 60 ppm for African type (apply at an early stage of plant growth for African type with good stem coverage, especially for vigorous varieties).
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	10 to 20 ppm spray	
		Topflor	20 to 60 ppm spray	Based on NC State University trials. Adjust rates for other locations.

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
MARIGOLD, Plugs	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 20 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage. Use 5 to 10 ppm for French types and 10 to 20 ppm for African types.
MATTHIOLA, Bedding Plant (Stock)	To control plant growth	Dazide + Citadel / B-Nine + Altercel	800 to 5,000 ppm Dazide / B-Nine + 1,000 to 1,500 ppm Citadel / Altercel applied as a tank-mix spray	
MATTHIOLA, Cut (Stock)	To promote growth and stem elongation	Florgib / ProGibb T&O	50 to 100 ppm spray	Apply when plants are 4 to 8 in. tall. Apply at 2- to 3- week intervals. See label for precautions.
MELAMPODIUM	To control plant growth	Dazide / B-Nine	2,500 ppm spray	Use when plants reach 75% of marketable size to tone.
MIMULUS	To control plant growth	Dazide / B-Nine	2,500 ppm spray	Use if needed. Delay in flowering possible with multiple applications.
MONARDA	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	60 to 160 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	>0.48 mg a.i. (>4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
		Concise / Sumagic	15 to 30 ppm spray	
MONSTERA	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
MONTBRETIA	To control plant growth	Piccolo / Bonzi / Pac O	20 to 30 ppm corm soak	Soak corms in the solution for 15 min. prior to planting.
NARSISSUS	To control plant growth	Florel / Collate	500 to 2,000 ppm spray	For types requiring a vernalization period (<i>Narcissus hybrids</i>), apply when new leaves reach 3 to 4 in. of height. For paperwhite narcissus (<i>Narcissus tazetta</i>), apply 2,000 ppm when the new leaves are 3- to 4-in. tall. Cultivar response varies, so conduct your own trial to determine suitable concentrations. Results based on Cornell University trials.
NASTURTIUM	To control plant growth	Citadel / Altercel	800 to 1,500 ppm spray	Use only on non-food plants.
NEMESIA	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	Use on compact varieties to tone and hold crop.
		Piccolo / Bonzi / Pac O	10 to 20 ppm spray	Based on NC State University trials.
		Collate / Florel	250 to 500 ppm spray	Make final application 4 to 6 weeks before sale.
		Concise / Sumagic	3 to 30 ppm spray	In NC State University trials, 5 ppm worked well on Vanilla Sachet.
		Topflor	2.5 to 5 ppm spray	Recommendation based on NC State University trials with Vanilla Sachet.
NEPHTHYTIS, Green and Green Gold	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
NEW GUINEA IMPATIENS	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	0.25 to 15 ppm spray	Apply 2 to 4 weeks after transplanting. Cultivars' response to PGRs varies greatly. Test a few plants to determine rate for optimal control.
		Piccolo / Bonzi / Pac O	0.25 to 2 ppm drench	Drench volumes vary with pot size. See label for recommendations. Cultivars response to PGRs varies greatly. Test a few plants to determine rate for optimal control.
		Florel / Collate	100 to 300 ppm spray	To increase lateral branching and reduce premature flowering, don't apply within 8 weeks of desired flower date.
		Topflor	5 to 15 ppm spray	Apply 2 to 4 weeks after transplanting. Cultivars' response to PGRs varies greatly. Test a few plants to determine rate for optimal control.
NEW GUINEA IMPATIENS, Plugs	To control plant growth	Piccolo 10 XC	0.25 to 5 ppm spray	See Piccolo remarks for AGERATUM, Plugs.
NICOTIANA	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	Higher initial rates can be used after the plant becomes established. Use lower rate with multiple applications at 3-week interval.
NOLANA PARADOXA	To control plant growth	Florel / Collate	500 ppm spray	To keep plants more compact. Based on Texas A&M University trials.
OENOTHERA	To control plant growth	Concise / Sumagic	5 to 10 ppm spray	Apply if needed.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
ORNAMENTAL CABBAGE and KALE (Non-food)	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	Use the higher rates for more vigorous types / cultivars. Multiple applications may be needed. Recommendation based on North Carolina conditions.
		Concise / Sumagic	2.5 to 8 ppm spray	Use higher rates for more vigorous cultivars. Cultivar response can vary. Recommendation based on North Carolina conditions.
ORNAMENTAL PEPPERS (Capsicum) (Non-food)	To control plant growth	Piccolo / Bonzi / Pac O	20 ppm foliar spray	Recommendation based on North Carolina conditions for a moderately vigorous cultivar.
		Concise / Sumagic	5 to 15 ppm spray	
ORNAMENTAL VEGETABLES (Non-food)	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	Use the higher rates for more vigorous types / cultivars like kale Red Bor. Multiple applications may be needed. Recommendation based on North Carolina conditions.
		Concise / Sumagic	10 to 25 ppm spray	Use higher rates for more vigorous cultivars. Recommendation based on North Carolina conditions.
ORNITHOGALUM	To increase stem length	Florgib / ProGibb T&O	100 ppm dip	Soak the bulbs for 20 minutes prior to potting.
OSTEOSPERMUM	To control plant growth	Citadel / Altercel	750 to 1,500 ppm spray	Two applications may be required. Two applications of 1,500 ppm (with the first applied at the start and the second at the end of the vernalization period) provided excellent results in NC State University trials.
			1,500 to 3,000 ppm drench	Drench volumes vary with pot size. See label for recommended volumes.
		Concise / Sumagic	8 ppm spray	Recommendation based on European trials on a cultivar with prostrate growth. Rates less than 24 ppm were not effective in NC State University trials.
			0.25 to 2 ppm drench; apply 3 fl oz / 5-in pot	One application of 1 to 2 ppm (at the start of vernalization) or two applications of 1 ppm (at the start of vernalization) and 0.5 ppm (at the end of the vernalization period) provided excellent results in NC State University trials for 4.5-in. production.
		Dazide / B-Nine	2,500 to 4,000 ppm spray	Can be applied 3 or 4 times (weekly) after pinch.
		Dazide + Citadel / B-Nine + Altercel	1,500 to 3,000 ppm Dazide / B-Nine + 1,000 to 1,500 ppm Citadel / Altercel applied as a tank-mix spray	Multiple sprays required. Stop applications after visible bud to avoid flower delay and smaller flowers. Not effective in NC State University trials.
		Piccolo	4 to 8 ppm liner root soak	See BACOPA. Rate based on Michigan State University trials.
		Piccolo / Bonzi / Pac O	27 to 54 ppm drench (8 to 16 mg a.i.) during production	Drench volumes vary with pot size. See label for recommended volumes. (based on NC State University trials)
			2 to 3 ppm drench (0.236 to 0.35 mg a.i.) for holding plants	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 30 ppm spray	
		Topflor	20 to 60 ppm spray	
			1 to 2 ppm drench; apply 3 fl oz / 5-in pot	One application of 1 to 2 ppm (at the start of vernalization) or two applications of 1 ppm (at the start of vernalization) and 0.5 ppm (at the end of the vernalization period) provided excellent results in NC State University trials for 4.5-in. production.
OSTEOSPERMUM Astra Yellow, Voltage Yellow	Induce lateral or basal branching	Configure	150 to 200 ppm	Single foliar spray increased lateral branching and reduced plant height
OTACANTHUS	To control plant growth	Dazide / B-Nine	2,500 ppm spray	Make first application when new growth appears after pinching. A second application may be used if a second pinch is planned.
OTOMERIA	To control plant growth	Dazide / B-Nine	1,700 ppm spray	Apply 1 to 3 times if needed to tone the plant.
OXALLIS	To control plant growth	Abide / A-Rest	33 ppm spray	To limit petiole stretch.
		Concise / Sumagic	0.1 mg a.i. / 4.5-in. pot drench	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	1 to 4 ppm sprays	Rates for <i>O. regnellii</i> .
			1 to 10 ppm preplant dip	Dip for 5 minutes. Rates for <i>O. regnellii</i> .

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
PANSY (<i>Viola x wittrockiana</i>)	To control plant growth	Abide / A-Rest	3 to 15 ppm spray	See AGERATUM.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 15 ppm spray	Apply when plants are 2 in. in diameter. Use higher rates for higher temperatures and more vigorous cultivars. Late applications may delay flowering.
		Concise / Sumagic	1 to 6 ppm spray	Apply when plants are 3 to 4 in. tall. Use higher rates for higher temperatures and more vigorous cultivars. Late applications may delay flowering.
		Topflor	2.5 to 7.5 ppm spray	Based on NC State University trials. Adjust rates for other locations. Pansies are very responsive to Topflor, so start trials with lower rates.
	Induce lateral or basal branching	Configure	50 to 800 ppm	Single foliar spray. Limited plant height control and small increase in branching. There were cultivar differences with violas being more tolerant than pansies. Flowering was delayed. Phytotoxicity occurred above 100 ppm.
PANSY PLUGS	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	1 to 5 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage. Pansies are sensitive as plugs, so determine optimal rates.
PENNISETUM GLAUCUM	To control plant growth	Collate / Florel	500 ppm spray	Apply first application 4 weeks after sowing or 1 week after transplant. If needed, a second application can be made 10 to 14 days later. Promotes side shoot production more than providing height control.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	6 to 8 ppm drench	For direct-sown seed, apply paclobutrazol 4 weeks after sowing. A second application possible 10 days later, if needed.
			3 to 5 ppm drench	For plugs, apply 1 week after transplant.
PENNISETUM SETACEUM 'Rubrum'	To control plant growth	Concise / Sumagic	5 ppm spray	First application can be made 21 days after transplanting. Repeat if needed 14 days later.
PENSTEMON DIGITALIS Husker Red (Smooth White Penstemon)	Induce basal branching	Configure	600 ppm	A single foliar spray induced a small increase in number of laterals but increased pot fill. Slight delay in plant development resulted in reduced plant height.
PENSTEMON HARTWEGII	To control plant growth	Citadel+Dazide / Altercel+B-Nine	1,000 ppm + 2,500 ppm spray	Rates for moderately vigorous cultivars. Up to 2 sprays may be needed.
		Concise / Sumagic	5 to 10 ppm spray	Rates for moderately vigorous cultivars. Up to 2 sprays may be needed.
		Dazide / B-Nine	2,500 ppm spray	Rates for moderately vigorous cultivars. Up to 2 sprays may be needed.
		Florel / Collate	Spray	Not recommended because of flower delay.
PENTAS	To control plant growth	Abide / A-Rest	2 to 4 ppm spray	
		Citadel / Altercel	1,000 to 1,500 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	2 to 3 ppm spray	
PEONY (<i>Paeonia</i>)	Induce lateral branching	Configure	100 to 1600 ppm	5 minute pre-plant bulb soaks in the fall. BA caused buds to sprout earlier and closer together. Without BA, bud emergence occurred over a longer period of time. With BA, bud emergence was more synchronized and overall, the bud emergence dates per plant were about 20 days earlier.
PEPEROMIA	Induce lateral or basal branching	Configure	250 to 1000 ppm	Single foliar spray applied at planting. 500 ppm recommended. 1000 ppm BA resulted in more than double the number of lateral branches and a reduction in plant height and internode length. No phytotoxicity noted. Custom solution of BA used, not commercial mix. Effects lasted about 12 weeks.
PEPINO	To control plant growth	Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
PEPPER	To control plant growth	Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
PERENNIALS (Not specifically listed in this table)	To induce lateral or basal branching	Configure	50 to 500 ppm spray	The supplemental label allows legal use on greenhouse grown plants not specifically listed on the original label. See label for trialing suggestions and precautions.
PERICALLIS (Cineraria)	To control plant growth	Dazide / B-Nine	2,000 ppm spray	Apply every 14 days, if needed.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
PERILLA	To control plant growth	Concise / Sumagic	3 to 5 ppm spray	Apply if needed.
		Dazide / B-Nine	2,000 to 4,000 ppm spray	Apply 1 to 3 times as needed.
		Dazide + Citadel / B-Nine + Altercel	2,500 to 4,000 ppm Dazide + 1,000 to 1,500 ppm Citadel applied as a tank-mix spray	
		Piccolo / Bonzi / Pac O	10 to 20 ppm spray	
PETUNIA, Seed	To control plant growth	Abide / A-Rest	10 to 26 ppm spray	See AGERATUM.
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 45 ppm spray	
		Concise / Sumagic	25 to 50 ppm spray	
		Topflor	20 to 60 ppm spray	Based on NC State University trials. Adjust rates for other locations.
PETUNIA PLUGS, Seed	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
PETUNIA, Vegetative	To control plant growth	Abide / A-Rest	10 to 26 ppm spray	Multiple applications may be required.
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Dazide / B-Nine + Bonzi / Piccolo / Pac O	2,500 ppm spray + 40 ppm Bonzi / Piccolo / Pac O applied as a tank-mix spray	Recommendation based on NC State University trials.
		Dazide / B-Nine + Topflor	2,500 ppm spray + 15 to 30 ppm Topflor applied as a tank-mix spray	Recommendation based on NC State University trials.
		Piccolo / Bonzi / Pac O	5 to 45 ppm spray	An application at 2 to 4 ppm can be made 1 to 2 weeks after transplanting, followed by a 20 to 30 ppm spray 2 to 3 weeks later. Cultivars' responses to PGRs vary. Test a few plants to determine rate for optimal control. Finished plants can be maintained and have prolonged shelf life when 5 to 10 ppm sprays are applied on full-grown, mature plants. Recommendations based on Michigan conditions.
		Concise / Sumagic	20 to 50 ppm spray	20 ppm worked well in NC State University trials.
		Piccolo	12 ppm liner root soak	See BACOPA. Rate based on Michigan State University trials with petunia multiflora prostrate Wave Purple.
		Topflor	15 to 60 ppm spray	Recommendation based on NC State University trials.
	To increase lateral branching	Florel / Collate	300 to 500 ppm spray	
	Induce lateral or basal branching	Configure	20 to 160 ppm	Foliar spray 1 to 2 times. 80 ppm applied twice was optimal at increasing branching, improving shape, increasing flowering. Transient phytotoxicity noted at 160 ppm.
PHALAENOPSIS Orchids	To increase flower number and earlier flowering	Configure	200 to 400 ppm spray	Apply Configure 1 week after the start of forcing (cooling). Cultivar response varies. Some cultivars are sensitive to Configure and distorted flower stalks may form, so conduct your own trials to determine suitability. Recommendation based on Michigan State University trials.
	To control inflorescence length	Concise / Sumagic	100 to 200 ppm spray	Apply when the flower spike length is 1 in. (3 cm).
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	250 ppm spray	Apply when the flower spike length is 1 in. (3 cm).
PHILODENDRON	To control plant growth / vine control		25 to 132 ppm spray	
		Abide / A-Rest	0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Citadel / Altercel	3,000 ppm spray	
		Dazide / B-Nine	2,500 to 7,500 ppm spray	
PHLOX DRUMMONDII	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
PHLOX MACULATA, (Hybrid)	To control plant growth	Concise / Sumagic	5 to 10 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Topflor	10 to 15 ppm spray	

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CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
PHLOX PANICULATA David (Garden Phlox)	Induce lateral or basal branching	Configure	600 ppm	Not responsive to a single foliar spray. Multiple applications may be effective.
PHLOX PANICULATA Franz Schubert (Garden Phlox)	Induce lateral or basal branching	Configure	600 ppm	A single foliar spray increased the number of shoots. No effect on height.
PILEA	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	Drench volumes and mg a.i. vary with pot size.
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
PLATYCODON	To control plant growth	Abide / A-Rest	100 ppm spray	PGRs usually not required.
		Dazide / B-Nine	1,500 to 5,000 ppm spray	PGRs usually not required. High rates have been reported to cause edge burn.
	Induce lateral or basal branching	Configure	300 ppm	Single foliar spray resulted in significant phytotoxicity.
PLECTRANTHUS	To control plant growth	Dazide + Citadel / B-Nine + Altercel	1,500 to 2,500 ppm Dazide + 750 to 1,000 ppm Citadel applied as a tank-mix spray	Cultivars' responses to PGRs vary. Test a few plants to determine rate for optimal control. See label.
		Piccolo / Bonzi / Pac O	5 to 20 ppm spray	Cultivars' responses to PGRs vary.
PLUMBAGO AURICULATA	To control plant growth	Collate / Florel	1,000 ppm spray	Pinching plants help improve the overall form. In addition, to further enhance secondary shoots, apply PGR 1 week before pinch.
POINSETTIA	To control plant growth	Abide / A-Rest	0.06 to 0.25 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volume and mg a.i. vary with pot size. Start with lower rates.
		Dazide / B-Nine	2,000 to 3,000 ppm spray	Not effective in NC State University studies.
		Dazide + Citadel / B-Nine + Altercel	800 to 2,500 ppm Dazide + 1,000 to 1,500 ppm Citadel applied as a tank-mix spray	Use the higher rates of this tank-mix spray on stock plants and for finishing crops in very warm regions. Outside of very warm areas, use the lower rates. Late applications can delay flowering and reduce bract size.
		Piccolo / Bonzi / Pac O	10 to 30 ppm spray	Use higher rates of 15 to 45 ppm in southern Florida. Applications to slower-growing cultivars in cool climates should begin when axillary shoots are 2 to 3 in. long. For vigorous growing cultivars in warm climates, applications should begin when axillary shoots are 1.5 to 3 in. long. See label for other precautions.
		Piccolo / Bonzi / Pac O / Downsize	0.237 to 0.473 mg a.i. (0.25 to 3 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drenches generally have less of an effect on bract size than sprays. Drench volume and mg a.i. vary with pot size. Start with lower rates.
		Concise / Sumagic	2.5 to 10 ppm spray	Apply when the lateral shoots are 1.5 to 2.5 in. tall (about 10 to 14 days after pinching). Test for cultivar sensitivity. Multiple applications of the lower label rate may elicit short days. For Florida only: use a foliar spray concentration between 10 to 15 ppm (2.5 to 3.8 fl oz / gal) and do not apply after October 25.
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	For natural season crops in NC, don't apply Citadel after mid-October to November 1. Late applications can reduce bract size and delay flowering.
			3,000 to 4,000 ppm drench	Drench volume varies with pot size. Consult the label for recommended volumes.
	To promote plant growth	Topflor	2.5 to 80 ppm spray	Use lower rates for less vigorous cultivars. SEE LABEL FOR ADDITIONAL RATE RECOMMENDATIONS.
			0.03 to 0.5 mg a.i. (0.25 to 4.2 ppm) drench for a 6-in. pot	
		Fascination	3 ppm spray	Use an early-season application during vegetative growth prior to the start of short days and flower initiation if promoting vegetative growth. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.
	Growth enhancer/ Rooting enhancer	Configure	1250 ppm	Single drench when IBA treated cuttings were stuck in the mist bed. Increased the number of roots per cutting and the root fresh weight.
	Branching agent/ Enhance cutting numbers	Configure	62.5 to 500 ppm	Foliar spray 2 times at 20 day intervals. BA 125 ppm worked optimally at maximizing the number of cuttings produced on stock plants. Rooting percentage was not affected by this rate. 500 ppm BA delayed rooting in the cuttings.
POINSETTIA, Tree	To control plant growth	Concise	2 to 3 ppm drench for a 6-in. pot	For use in Florida only: Apply when the lateral shoots are 1.5 to 2.5 in. tall (about 10 to 14 days after pinching). Test for cultivar sensitivity. Do not apply after October 25.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
PORPHYROCOMA POHLIANA (Brazilian Fireworks)	To improve foliage color and for earlier flowering	Piccolo / Piccolo 10 XC / Bonzi / Pac O	3 to 5 ppm spray	Height control generally not needed and rates above 5 ppm can cause leaf puckering.
PORTULACA GRANDIFLORA (Moss rose)	Induce lateral or basal branching	Configure	62.5 to 250 ppm	Single foliar spray. 250 ppm BA reduced shoot length by 25%, increased branching by 143%, and caused a more prostrate habit.
PORTULACA OLERACEA (Moss rose)	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Concise / Sumagic	15 to 30 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 ppm drench	Apply 7 days after transplant. May replace the need to pinch.
		Topflor	30 ppm spray	Apply 7 days after transplant. Repeat 2 weeks later, if needed.
	To increase lateral branching	Citadel / Altercel	5,000 ppm spray	Apply 5 to 6 days after pinching to improve branching of cuttings.
		Collate / Florel	300 to 500 ppm spray	Recommendations based on Michigan conditions. Defoliation can occur with rates greater than 300 ppm.
	Induce lateral or basal branching	Configure	50 to 400 ppm	Single foliar spray. BA increases branching of one of two cultivars tested.
POTHOS	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Dazide / B-Nine	2,500 to 7,500 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	4 to 6 mg a.i. drench for an 8-in. pot; apply 10 fl oz / 8-in. pot	
PRIMULA ACAULIS	To control plant growth	Dazide / B-Nine	1,000 to 2,500 ppm spray	PGRs usually not required.
PRIMULA OBCONICA	To control plant growth	Dazide / B-Nine	5,000 ppm spray	PGRs usually not required.
PURPLE CONEFLOWER	To control plant growth	Concise / Sumagic	30 to 40 ppm spray	
PURPLE PASSION	To control plant growth	Abide / A-Rest	26 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
RANUNCULUS	To control peduncle length	Dazide / B-Nine	2,500 to 5,000 ppm spray	Make first application after 4 weeks. Repeat at lower rate every 2 weeks if needed. 3 to 4 applications may be needed. Conduct trials to determine optimal concentrations and timing.
REBUTIA VIOLACIFLORA (Cactus)	Flower enhancer	Configure	10 to 100 ppm	Applied 1 to 3 times. 100 ppm sprayed 3 times induces more flower buds but many of these buds aborted. Rhipsalidopsis gaertneri
ROSE, Bush	Induce lateral or basal branching	Configure	100 ppm	Foliar spray 2 to 3 times. Slight increase in branching and increase in the length of the side branches. Subsequent flowering was increased too. Effect was better than pinching.
ROSE, Pot	To control plant growth	Concise / Sumagic	0.1 to 0.2 mg a.i. / pot drenches	Usually only a single application is made.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	16 to 25 ppm sprays	Begin applications after the final pinch. Make the first one in 14 to 21 days. Repeat weekly if needed. Discontinue applications after visible bud.
	Senescence inhibitor	Configure	45 to 180 ppm	Single foliar spray followed by simulated shipping. At 180 ppm inhibit flower senescence and leaf abscission in simulated shipping and was nearly equal to silver thiosulfate (STS).
RUDBECKIA HIRTA (syn. <i>R. bicolor</i>) (Blackeyed susan)	Induce lateral or basal branching	Configure	50 to 1600 ppm	Single foliar spray applied 2 weeks after potting. Height controlled. 1600 ppm caused phytotoxicity.
RUDBECKIA Goldstrum	Induce lateral or basal branching on plugs	Configure	300 ppm	Single foliar spray increased basal branching with significant early phytotoxicity.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
SALVIA, Annual (<i>Salvia splendens</i> ; Scarlet sage)	To control plant growth	Abide / A-Rest	10 to 26 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	20 to 60 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	5 to 10 ppm spray	
		Topflor	20 to 80 ppm spray	Based on NC State University trials. Adjust rates for other locations.
	Induce lateral or basal branching	Configure	50 to 800 ppm	Single foliar spray applied 2 weeks after potting. Growth index decreased with increasing rates.
SALVIA PLUGS, Annual	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
SALVIA FARINACEA (Mealy sage)	To control plant growth	Citadel+Dazide / Altercel+B-Nine	1,000 ppm + 2,500 ppm spray	Apply if growth control is needed.
		Florel / Collate	Spray	Not recommended because of flower delay.
	Induce lateral or basal branching	Configure	250 ppm	Single foliar spray. Controlled height and increased branching on par with Florel sprayed at 500 ppm.
SALVIA GUARANITICA	To control plant growth	Citadel+Dazide / Altercel+B-Nine	1,000 to 1,500 ppm + 2,000 to 3,500 ppm spray	
SALVIA HYBRID	To control plant growth	Dazide / B-Nine	1,500 to 2,500 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.5 to 1 ppm drench	
SALVIA LONGISPICATA x FARINACEA	To control plant growth	Dazide / B-Nine	2,500 to 3,000 ppm spray	
SALVIA NEMOROSA May Night (Meadow sage)	Induce lateral or basal branching	Configure	50 to 800 ppm	Single foliar spray applied 2 weeks after potting. Branching increased and flowering delayed with increasing rates. 400 ppm was optimal.
	Induce branching on plugs	Configure	300 ppm	Single or multiple foliar sprays applied ~34 days after sticking (plants moderately rooted) increased basal branching but reduced root surface area and root volume moderately. Apply after plugs are well rooted.
SALVIA PATENS	To control plant growth	Citadel+Dazide / Altercel+B-Nine	1,000 ppm + 2,500 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	1 ppm drench	Trial rate before use.
SALVIA, Perennial	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	40 to 60 ppm spray	
SALVIA, Vegetative	To control plant growth	Dazide / B-Nine	1,000 to 2,000 ppm spray	Multiple applications may be needed to tone crop.
		Dazide + Citadel / B-Nine + Altercel	2,000 to 3,500 ppm Dazide + 1,000 to 1,500 ppm Citadel applied as a tank-mix spray	
SANVITALIA	To control plant growth	Dazide / B-Nine	1,200 to 5,000 ppm spray	Use to tone plants. Cultivars' response to PGRs varies. Test a few plants to determine rate for optimal control.
SCABIOSA CAUCASICA (Pincushion flower)	Induce lateral or basal branching	Configure	50 to 800 ppm	Single foliar spray applied 2 weeks after potting. No effect.
SCAEVOLA AEMULA	To control plant growth	Concise / Sumagic	30 ppm spray	Based on NC State University trials, 30 ppm worked well. Adjust rates to other locations; test on a few plants to determine rate for optimal control.
			0.125 ppm drench (0.011 mg a.i.) for a 5-in. pot; apply 3 fl oz / 5-in. pot	Drench volumes vary with pot size. See label for recommended volumes. Scaevola is very responsive to Concise / Sumagic drenches. Test on a few plants to determine rate for optimal control. Recommendations based on NC State University trials.
		Dazide / B-Nine	2,500 ppm spray	
		Piccolo / Bonzi / Pac O	20 to 40 ppm spray	
			1 to 3 ppm drench (0.12 to 0.35 mg a.i.)	Drench volumes vary with pot size. See label for recommended volumes. Cultivars' response to PGRs varies. Start with lowest rate in your trials. Scaevolans are very responsive to paclobutrazol.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
SCAEVOLA AEMULA (continued)	To control plant growth (continued)	Topflor	45 to 60 ppm spray	Recommendations based on NC State University trials.
			0.79 to 2.25 ppm drench (0.075 to 0.2 mg a.i.)	Drench volumes will vary with pot size. See label for recommended volumes. Scaevola is very responsive to Topflor. Test the lower rates on a few plants. Recommendations based on NC State University trials.
			2 to 4 ppm liner dip	Scaevola is very responsive to Topflor. Test the lower rates on a few plants. Recommendations based on NC State University trials.
	To increase lateral branching	Florel / Collate	300 to 500 ppm spray	Apply early, typically 2 to 3 weeks after pinching. Late applications can delay flowering.
SCHEFFLERA	To control plant growth	Abide / A-Rest	25 to 132 ppm spray	Drench volumes and mg a.i. may vary with pot size.
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
		Dazide / B-Nine	2,500 to 7,500 ppm spray	
	To increase lateral branching	Augeo/Atrimmec	3,125 ppm spray	Labeled for Schefflera arboricola only.
SCHIZANTHUS	To control plant growth	Abide / A-Rest	1 to 2 ppm spray	
		Dazide / B-Nine	1,500 to 3,000 ppm spray	
SCOPARIA	To control plant growth	Dazide / B-Nine	1,000 to 2,500 ppm spray	Use to tone plants if needed.
SCUTELLARIA JAVANICA (Skullcap)	To control plant growth	Dazide + Citadel / B-Nine + Altercel	2,500 ppm Dazide/B-Nine + 1,000 ppm Citadel/Altercel tank mix spray	Begin applications 2 to 3 weeks after transplanting. Repeat as needed every 2 weeks.
SEMPERVIVUM spp.	To induce offsets	Configure	100 to 400 ppm spray	Based on NC State University trials when applied 2 weeks after potting. For retail sales, 400 ppm produced the most offsets. For stock plant production, 100 to 200 ppm provided a balance between an increase in offset number and a larger offset size.
SEMPERVIVUM CANTABRICUM X MONTANUM VAR STRIACUM (Hens and Chicks)	Offset enhancer	Configure	50 to 400 ppm	Single foliar spray. Rates between 200 and 400 ppm was optimal for increasing offsets. Rates up to 400 ppm did not affect subsequent rooting of offsets. Cultivars varied in the number of offsets produced.
SHASTA DAISY	To control plant growth	Concise / Sumagic	15 to 30 ppm spray	
SHRIMP PLANT	To control plant growth	Abide / A-Rest	25 to 50 ppm spray	Apply after plants established.
		Dazide / B-Nine	1,000 ppm	Apply after plants established.
	To increase lateral branching	Augeo/Atrimmec	781 to 1,562 ppm spray	
SNAPDRAGON, Seed (ANTIRRHINUM)	To control plant growth	Abide / A-Rest	10 to 26 ppm spray	
		Concise / Sumagic	25 to 50 ppm spray	
		Dazide + Citadel / B-Nine + Altercel	800 to 1,000 ppm Dazide / B-Nine + 800 to 1,000 ppm Citadel / Altercel applied as a tank-mix spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 to 90 ppm spray	Apply at an early stage of plant growth with good stem coverage, especially for vigorous varieties.
SNAPDRAGON PLUGS, Seed (ANTIRRHINUM)	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	10 to 20 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
SNAPDRAGON, Vegetative (ANTIRRHINUM)	To control plant growth	Piccolo / Bonzi / Pac O	30 to 60 ppm spray	
		Concise / Sumagic	20 to 45 ppm spray	
	To control plant growth and peduncle stretch	Dazide / B-Nine	1,500 ppm spray	Use during periods of high temperatures.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
SPATHIPHYLLUM (Peace lily)	To induce flowering	GibGro	265 ppm spray	Apply one full-coverage spray during non-seasonal bloom period (June through January). Some cultivars exhibit distorted blooms, increased petiole length and narrow leaves.
	To accelerate bloom and increase flower number	Florgib / ProGibb T&O	150 to 250 ppm spray	Use a single application approximately 9 to 12 weeks prior to expected sale date. Spray to the point of runoff and thoroughly wet all growing points.
	Induce lateral or basal branching	Configure	250 to 1000 ppm	Single foliar spray or 10 ml substrate drench. Drench rates of 500 ppm recommended. Drenches at 1000 ppm resulted in the greatest number of lateral shoots and reduced overall height. All drench rates were better than any foliar rate.
STATICE, Cut (Limonium)	To promote plant growth and stem elongation	Florgib / ProGibb T&O	50 to 100 ppm spray	Apply when plants are 4 to 8 in. tall. Other applications can be made at 2- to 3-week intervals. See label.
	For earlier flowering and increased flowering	Florgib / ProGibb T&O	400 to 500 ppm spray	Give each plant 0.33 fl oz (10 ml) of solution. Use when plants are 10 in. or more in diameter (approximately 90 to 100 days after sowing). See label.
STEPHANOTIS, Pot	To tone plant growth	Dazide + Citadel / B-Nine + Altercel	100 ppm + 100 ppm spray	Controls vine elongation and shortens days until flowering.
STOKESIA (<i>Stokesia laevis</i> ; Silver Moon Stoke's Aster)	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	40 to 80 ppm spray	
	Induce basal branching	Configure	600 ppm	Not responsive to a single foliar spray. Higher rates or multiple applications may be effective.
STREPTOCARPUS	To control plant growth	Abide / A-Rest	10 to 50 ppm spray	Rate based on Louisiana State University trial.
		Dazide / B-Nine	1,500 to 2,500 ppm spray	Supplier rate recommendation.
		Topflor	5 to 20 ppm spray	
	To delay premature bloom and promote additional plant growth	Collate	250 to 1000 ppm spray	Optimal rates varied significantly by cultivar. Conduct your own trials to determine optimal rates for each Streptocarpus series and specific cultivar. Results based on Iowa State University trial.
STROBILANTHES DYERIANUS (Persian Shield)	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	30 ppm spray	
SUNFLOWER (<i>Helianthus annuus</i>)	To control plant growth	Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Piccolo / Bonzi / Pac O	2 to 4 mg a.i. drench; apply 4 fl oz / 6-in. pot	Optimal rate based on NC State University trials. Adjust rate for plant vigor. Drench volumes and mg a.i. vary with pot size.
		Concise / Sumagic	16 to 32 ppm sprays	Optimal rate based on NC State University trials. Adjust rate for plant vigor.
		Topflor	30 to 50 ppm spray	
	Enhance seed set	Configure	1 to 2 mg a.i. (8.45 to 16.9 ppm) drench for a 6-in. pot	
			150 to 250 ppm	Single foliar spray 20 to 60 days after planting to field grown plants. 150 ppm applied on day 40 was optimal and increased seed set and yield by 25%.
SYNGONIUM PODOPHYLLUM (Arrowhead vine)	Induce lateral or basal branching	Configure	250 to 2000 ppm	Single foliar spray onto rooted cuttings at the 3 or 5 leaf stage. BA at the 3 to 5 leaf stage resulted in earlier development of lateral shoots and shorter bushier plants.
TALINUM PANICULATUM	To control plant growth	Dazide / B-Nine	2,500 to 3,500 ppm spray	For toning the crop. Apply once after transplanting.
TECOMA STANS	To control plant growth	Dazide + Citadel / B-Nine + Altercel	2,500 ppm Dazide/B-Nine + 1,000 ppm Citadel/Altercel tank mix spray	Begin applications 2 to 3 weeks after transplanting. Repeat as needed every 2 weeks.
TECOMA STANS (Texas star)	Induce lateral or basal branching	Configure	125 to 500 ppm	4 foliar sprays at 2 week intervals following a hard pinch. BA increased the number of cuttings but reduced rooting percentage.
THANKSGIVING CACTUS (<i>Rhipsalidopsis gaertneri</i>)	Branching agent/ Flower enhancer	Configure	10 to 200 ppm	Single foliar spray 3 or 6 months after planting. 200 ppm on older plants increases branching and improves appearance.
THANKSGIVING CACTUS (<i>Schlumbergera truncata</i>)	Flower enhancer	Configure	100 to 800 ppm	Single foliar spray applied 5 to 10 days after start of short days. BA hastens time to flower and increases number of flowers. BA 100 to 200 ppm was optimal.
	Phylloclade enhancer/Flower enhancer	Configure	100 ppm	Single foliar spray 2 weeks after start of short days or during long days. Applications at 2 weeks after beginning of short day increased number of flower buds by 40%. Applications during long day increased phylloclade numbers by 150%.

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
THUNBERGIA ALATA	To control stem elongation/plant growth	Dazide + Citadel / B-Nine + Altercel	2,500 ppm Dazide/B-Nine + 1,000 ppm Citadel/Altercel tank mix spray	Apply to cuttings in propagation.
TIBOUCHINA	To control plant growth	Dazide / B-Nine	2,500 ppm spray	
TILLANDSIA BUTZII T. aeranthos T. cacticola (Succulent/ Bromeliad)	Induce lateral or basal branching	Configure	1 to 50 ppm	Applied 2 to 3 times per week for 2 to 10 weeks as a foliar spray, or cuttings dipped 1 to 3 times for 1 to 24 hours. 25 to 50 ppm sprays and 1 hour dips greatly increased offsets.
TOMATILLO	To control plant growth	Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
TOMATO	To control plant growth	Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
TORENIA FOURNIERI	To control plant growth	Concise / Sumagic	5 to 15 ppm spray	Apply if growth control is needed.
		Dazide / B-Nine	1,500 to 2,500 ppm spray	Apply if growth control is needed.
TORENIA spp.	To control plant growth	Dazide / B-Nine	1,500 ppm spray	Apply if growth control is needed
		Florel / Collate	Avoid use	Florel and Collate significantly delay flowering.
TROPICAL PLANTS (Not specifically listed in this table)	To induce lateral or basal branching	Configure	50 to 500 ppm spray	The supplemental label allows legal use on greenhouse-grown plants not specifically listed on the original label. See label for trialing suggestions and precautions.
TULIP	To control plant growth	Abide / A-Rest	0.125 to 0.5 mg a.i. (1 to 4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.591 to 4.732 mg a.i. (5 to 40 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size. Apply drenches 1 to 5 days after forcing begins.
		Piccolo / Bonzi / Pac O	2 to 5 ppm bulb soak	Soak bulbs for 1 hr. prior to planting. Ten-minute soaks of 50 ppm (1.6 oz / gal.) provided excellent results in NC State University trials. Cultivar response varied.
		Concise / Sumagic	10 ppm bulb soak	Ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
		Topflor	0.5 to 1 mg a.i. (4.2 to 8.45 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations.
			80 to 100 ppm spray	
			10 to 40 ppm bulb soak	Ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
	Senescence inhibitor	Configure	1 to 100 ppm	Applied via injecting bulbs or buds with 0.5 ml or 100 ppm solution, single foliar spray, or single soil drench. BA reduced bud blasting with 10 ppm being better than 1 ppm and the same as 100 ppm. BA reduced the time to flowering, increased the flower size, reduced the bulblet size, and hastened the exhaustion of the mother bulb.
VERBENA, Annual	To control plant growth	Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 30 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	Begin applications 7 days after pinching. Repeat as needed every 2 weeks.
		Concise / Sumagic	15 to 30 ppm spray	
	To increase lateral branching	Augeo/Atrimmec	521 to 1,042 ppm spray	
		Florel / Collate	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
VERBENA CANADENSIS (Clump verbena)	Induce lateral or basal branching	Configure	250 to 1000 ppm	Single foliar sprays immediately after pinching. 1000 ppm controlled shoot elongation by 19%
VERBENA PLUGS, Annual	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
VERBENA, Perennial	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	120 to 160 ppm spray	
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	>0.36 mg a.i. (>3 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
VERBENA, Vegetative	To control plant growth	Dazide + Citadel / B-Nine + Altercel	2,000 to 3,500 ppm Dazide / B-Nine + 750 to 1,000 ppm Citadel / Altercel applied as a tank-mix spray	See General Recommendations.
		Piccolo	8 to 12 ppm liner root soak	See BACOPA. Rate based on Michigan State University trials.
		Citadel / Chlormequat E-Pro / Altercel	1,500 to 2,000 ppm spray	
		Concise / Sumagic	5 to 10 ppm spray	Apply as needed.
		Dazide / B-Nine	1,500 to 2,500 ppm spray	Do not apply within 2 weeks of a Florel or Collate application.
		Florel / Collate	250 to 300 ppm spray	Make last application 8 weeks before sale.
	Induce lateral or basal branching	Configure	150 to 300 ppm	Single foliar increased lateral branching.
VERBENA X HYBRIDA	Induce lateral or basal branching	Configure	30 to 300 ppm	Single foliar spray onto new cuttings. 30 ppm BA applied at cutting improved rooting after 12 days and improved branching after 24 days.
VERONICA	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	20 to 40 ppm spray	
		Concise / Sumagic	20 to 40 ppm spray	
VERONICA LONGIFOLIA Icicle (Speedwell)	Induce lateral or basal branching	Configure	600 ppm	A single foliar spray induced a short term increase in number of shoots and lateral branches. Multiple applications may improve response.
VINCA (Catharanthus)	To control plant growth	Abide / A-Rest	5 to 18 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	1 to 3 ppm spray	Apply after plants reach a height of 4 in.
		Topflor	2.5 to 7.5 ppm spray	Based on NC State University trials. Adjust rates for other locations. Vinca is very responsive to Topflor, so start trials with lower rates.
	Induce lateral branching	Configure	50 to 800 ppm	Foliar spray or drench applied at 2 weeks after potting (WAP), 2+3 WAP, or 2+3+4 WAP. BA increased branching.
VINCA VINE (<i>Vinca spp.</i>)	To increase lateral branching	Florel / Collate	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
	Induce lateral or basal branching	Configure	600 ppm	No response to a single foliar spray. Higher rates or multiple applications may improve response.
VIOLA	To control plant growth	Concise / Sumagic	1 to 5 ppm spray	
WANDERING JEW	To control plant growth	Abide / A-Rest	26 to 132 ppm spray	
WOODY LANDSCAPE PLANT (Not specifically listed in this table)	To control plant growth	Abide / A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	100 ppm spray	See BEDDING PLANTS.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O / Downsize	0.47 mg a.i. (4 ppm) drench for a 6-in. pot; apply 4 fl oz / 6-in. pot	
		Concise / Sumagic	10 to 50 ppm spray	
			1 to 2 ppm drench	

Table 8-5. Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE	PRECAUTIONS AND REMARKS
ZINNIA	To control plant growth	Abide / A-Rest	7 to 26 ppm spray	
		Citadel / Chlormequat E-Pro / Altercel	800 to 1,500 ppm spray	
		Concise / Sumagic	5 to 25 ppm spray	
		Dazide / B-Nine	2,500 to 5,000 ppm spray	Multiple applications may be required. Use higher rates for summer crops.
		Piccolo / Piccolo 10 XC / Bonzi / Pac O	15 to 45 ppm spray	
	Flower enhancer	Configure	100 to 200 ppm	Single foliar spray. 100 ppm reduced time from bud emergence to flowering by 7 days.
	Senescence inhibitor	Configure	90 to 225 ppm	Single foliar spray, followed by simulated shipping. No effect on senescence.
ZINNIA <i>Zinnia elegans</i>	Induce lateral or basal branching	Configure	20 to 800 ppm	1, 2, or 3 foliar sprays applied 1 week apart starting 1 week after potting seedlings. BA increased branching, decreased internode length.
ZINNIA PLUGS	To control plant growth	Piccolo / Piccolo 10 XC / Bonzi / Pac O	4 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.

Growth Regulators for Woody Ornamental Crops

A. V. LeBude, Horticultural Science Department (This table was not updated in 2024.)

Table 8-6. Growth Regulators for Woody Ornamental Crops

Crop	Purpose	Chemical	Rate	Precautions and Remarks
Azalea	To produce compact plants.	succinic acid (daminozide) (B-Nine) 85% WSP	9 oz/gal water	Spray foliage to runoff. Apply during early part of July. Follow label instructions.
Woody Ornamentals	To stimulate rooting of cuttings.	K-IAA (Rhizopon A Water Soluble Tablet) 0.0018 oz (50 mg) K-IAA	Variable	Concentration will depend on species and also on time of year rooting is to take place. Follow label instructions.
		IBA (C-mone) 1% to 2%	1% to 2%	
		K-IBA (Rhizopon AA Water Soluble Tablet) 0.0018 oz (50 mg) K-IBA	Variable	
		K-IBA (C-mone K) 1%	1%	
		K-IBA + K-NAA (C-mone K+) 1.5% L	1.5%	
		IBA + NAA (Dip 'N Grow) 1.5% L	1.5%	
		IBA (Hormex) 0.1% to 4.5% D	0.1% to 4.5%	
		IBA (Hormodin) 0.1% to 0.8% D	0.1% to 0.8%	
		IBA + thiram (Hormo-Root) 0.1% to 2% IBA + 15% thiram D	0.1% to 2% + thiram 15%	
		IBA (Rhizopon AA) 0.1% to 0.8% D	0.1 to 0.8%	
		K-NAA (Rhizopon B Water Soluble Tablet) 0.0009 oz (25 mg) K-NAA	Variable	
		NAM + thiram (Rootone) 4.24% D	4.24%	
		IBA + NAA (Wood's Rooting Compound) 1.54% L	1.54%	
	To promote lateral branching and produce compact plants in various species and suppress flowering and fruit formation in various species.	dikegulac sodium (Atrimmec) 20% L; (Augeo) (Pinscher) 18.5%	Depending on species, size, vigor of plants, and specific use	Amount used and concentration will vary depending on a number of factors. Follow label directions.
	To control height on a wide variety of woody landscape plants (container grown in greenhouses or shadehouses or in landscapes) using both spray or drench applications.	paclobutrazol (Bonzi) (Piccolo) 0.4% L; (Profile 2 SC) 21.8%;	variable	Amount used and concentration will vary depending on a number of factors. Follow label directions.
	To reduce or eliminate undesirable fruit development on many ornamental trees and shrubs such as apples, cottonwood, crabapples, elm, flowering pear, horse chestnut, maples, oaks, pines, sour orange, sweetgum, and sycamore.	ethephon (Florel) 3.9% L; (Ethephon 2 SL) 21.7%	1 qt/10 gal water (3 oz/gal)	Timing is extremely critical. Application must be made prior to fruit set; so apply at the full bloom stage in sufficient water to wet (do not spray to run off). Follow label directions.
	To retard regrowth of most trees (hickory, red oak, silver maple), shrubs (viburnum, glossy abelia), and vines (ajuga, periwinkle, English ivy).	chlorthalendiol (Maintain CF 125) 12.5% EC, A	0.33 pt to 8 pt/100 gal water	Concentration will depend on particular species. Apply after new flush of growth or after pruning and new leaves have fully expanded. Take care to confine the use of this material to the particular area treated.
	To promote lateral shoot growth on vegetative plants of azalea, cotoneaster, juniper, taxus.	methyl decanoate/octanoate (Off-Shoot-O) 45% EC	2 to 5 oz/qt water	Amount will vary with genera. Follow label for specific conditions.
	To retard regrowth of most trees, (sycamore, sweetgum, willow), shrubs (pyracantha, privet), and ivy.	maleic hydrazide (Royal Slo-Gro) 21.7% SOL	1.33 gal/100 gal water	Prune plant to desired height. After regrowth occurs (as new leaves expand), apply to drip point. Uniform coverage is important for desired results.
	To reduce terminal growth on shrubs (not trees) by shortening internode length. May increase quality of plants by darkening leaf color and thickening leaves and stems.	flurprimidol (Cutless) 0.33% G; (TopFlor) 0.17% G and 0.38%	Depending on height and mass of woody stems, foliage volume, species	Prune plants to desired height. Apply any time of year to top of soil or substrate and water thoroughly.

Sucker Control for Flue-Cured Tobacco

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Table 8-7. Sucker Control for Flue-Cured Tobacco

Type	Chemical and Formulation	Purpose	Amount of Formulation Per Acre	Precautions and Remarks
Contact Type	C ₈ -C ₁₀ fatty alcohol (various brands) 6.01 lb/gal	Normal sucker control	2 or 2.5 gal (4% or 5%)	Apply in 48 gallons of water per acre (4% solution) to plants in button stage with second application 3 to 5 days later at any time of day, except when plants are wet or temperature exceeds 90°F or plants are wilted. Use two TG-3 nozzle tips plus a TG-5 in the center or equivalents per row with approximately 20 psi operated from 12 to 16 inches above the top of the button or stalk at 2.5 to 3 mph. Rate of second application may be increased to 2.5 gallons in 47.5 gallons of water (5% solution) unless crop is tender. Will not control suckers more than 1-inch long. Excess nitrogen increases the chance of leaf drop.
	C ₁₀ fatty alcohol 5.72 lb/gal	Normal sucker control	1.5 gal (3%)	Apply in 48.5 gallons water per acre (3% solution) for both applications. Follow application instructions above for C ₈ -C ₁₀ alcohol.
	C ₈ -C ₁₀ fatty alcohol 6.01 lb/gal	Control of late-season sucker regrowth	2.5 gal (5%)	Apply 3 to 4 weeks after MH application if suckers begin to grow. Apply in 47.5 gallons of water (5% solution) per acre. Follow same directions as above. Will not control suckers more than 1-inch long. Do not make more than three applications of a contact per crop per season.
Systemic Type	Maleic hydrazide [MH] Liquids, various brands 1.5 lb/gal	Normal sucker control	1.5 gal (1 qt/1,000 plants)	Rate varies with plant population. 1.5 gallons of the 1.5 pounds per gallon material assumes 6,000 plants per acre. For plant populations other than 6,000, adjust rate accordingly. Apply to plants 5 to 7 days after the last contact application. Apply in the morning, using 30 to 50 gallons of water per acre, two to three cone nozzle tips per row, and 40 to 60 psi. Effectiveness will be reduced if applied to wet plants or those that are drought-stressed or wilted from too much rainfall or high temperatures. Do not make more than one application per season. Should wash-off occur within 6 hours, a single repeat application may be made. Do not apply at higher than suggested rates or within 7 days before harvest in order to minimize MH residues.
	2.25 lb/gal		1 gal (1 qt/1,500 plants)	
	60% Water-Soluble Products Fair 80 SP or Sucker Stuff 60 WS		3.75 lb	Rate for 6,000 plants per acre. Adjust rate accordingly for other plant populations.
	Royal MH-30 SG		4 to 5 lb	
Contact Local-Systemic Type	flumetralin (Prime +, Flupro or Drexalin Plus) 1.2 lb/gal	Normal sucker control, power sprayer	2 qt	Mix in 49 gallons of water per acre and apply like a contact at elongated button to early flower stage with three nozzles per row (TG-3, TG-5, TG-3) at 20 psi. Remove suckers longer than 1 inch within 24 hours before application and remove missed suckers as observed later. Excess spray to the point of rundown on the soil increases the risk of carryover residues, which may stunt early growth of next crop, including tobacco if a dinitroaniline herbicide is also used. Do not apply these products through any type of irrigation system and apply only once per season. Rainfall within 2 hours after application may reduce effectiveness. Follow WSP requirements and other precautions and restrictions listed on product labels.
	flumetralin (Prime +, Flupro or Drexalin Plus) 1.2 lb/gal	Hand application (dropline)	2 qt (1.28 oz/gal water)	Mix in desired amount of water at rates shown in parenthesis and apply mixture as a coarse spray or drench to top of stalk. Apply 0.5 to 1.0 ounces of mixture per plant after topping and removing suckers longer than 1 inch. Apply only enough solution to ensure that each leaf axil is filled without pooling at the base of the stalk. See remarks above for power sprayer application and follow precautions, restrictions, and WPS requirements shown on product labels.
	flumetralin (Prime +, Flupro or Drexalin Plus) 1.2 lb/gal	Control of late season sucker regrowth	2 qt	Apply only if control with MH is beginning to break down. Mix in 49 gallons water per acre and apply like a contact at 20 to 25 psi 3 to 4 weeks after MH application; will not control suckers longer than 1 inch. To reduce the risk of soil residue carryover, do not use for late-season control if used earlier in the season.
Systemic Type + Contact Local-Systemic Type	maleic hydrazide (MH) + flumetralin (Prime +, Flupro or Drexalin Plus)	Normal sucker control	Full rate MH + 2 qt	See precautions and remarks for MH to determine "full rate" of MH. Mix in sufficient water to total 50 gallons per acre and apply 5 to 7 days after the last contact or when MH alone is normally applied. Apply like a contact, using three nozzles (TG-3, TG-5, TG-3) per row at approximately 20 psi. Follow precautions and restrictions on labels. Do not apply at higher than suggested rates or within 7 days before harvest in order to minimize MH residues.
Contact-Systemic Type	C ₁₀ fatty alcohol + MH (FST-7 or Leven-38) 4 lb/gal	Normal sucker control	3 gal	Apply in 47 gallons water to plants in early flower stage (1 week after button) any time during the day except when plants are wet or temperatures exceed 90°F or plants are wilted. Use three nozzles per row with tips that deliver a coarse spray and desired rate when operated at 20 psi. Operate sprayer at a speed of 2.5 to 3 miles per hour and spray 50 gallons of diluted emulsion per acre. Use a semi-coarse spray covering the top 1/3 to 1/2 of the plant and allowing the liquid to run down the stalk to the bottom of each plant. Do not apply at higher than suggested rates or within 7 days before harvest in order to minimize MH residues. Effectiveness will be reduced if applied to plants that are drought-stressed or wilted from too much rainfall or high temperatures.
Contact + Contact-Local Systemic	C ₈ -C ₁₀ fatty alcohol + flumetralin (Plucker-Plus)	Normal Sucker Control	2.5 gal	Refer to the discussion above on C ₈ -C ₁₀ fatty alcohol and flumetralin. Apply in 47.5 gallons of water per acre at normal timing for flumetralin application. Remove suckers longer than 1 inch within 24 hours before application and remove missed suckers as observed later. Excess spray to the point of rundown on the soil increases the risk of carryover residues, which may stunt early growth of next crop, including tobacco if dinitroaniline herbicide is also used. Do not apply these products through any type of irrigation system. Rainfall within 2 hours after application may reduce effectiveness. Follow WPS requirements and other precautions and restrictions listed on product labels. Do not make more than two applications per season so as not to exceed maximum rate of flumetralin.

Yellowing Agents for Flue-Cured Tobacco

M. C. Vann, L. R. Fisher, M.M. James, D. S. Whitley, J.L. Machacek, and J. A. Cheek, Crop and Soil Sciences Department

Table 8-8. Yellowing Agents for Flue-Cured Tobacco

Purpose	Chemical	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
To Increase the Rate of Yellowing	ethephon (Prep), (Super Boll), (Mature XL), or (Ethephon 6)	1.33 to 2.67 pt	1 to 2 lb	Use after second or third priming when remaining leaves are physiologically mature. Determine if tobacco is ready to spray by treating several representative plants at several locations with test kit (or prepare test spray by mixing 1 teaspoon of product in 1 quart of water). If test leaves begin to yellow in 24 to 72 hours, apply product to tobacco in 40 to 60 gallons water per acre as a fine spray mist (40 to 60 psi). Effectiveness may be reduced by application on cool, cloudy days, poor spray coverage, or rain within 4 hours after application. Harvest leaves within 24 to 48 hours or when they reach the desired degree of yellowness; prolonged delay in harvest may result in yield and quality loss or leaf drop. Therefore, do not spray more acreage than can be harvested before major rain is anticipated. Do not use surfactants.
	(Osokie)	2.67 to 5.33 pt	1 to 2 lb	

Sucker Control for Burley Tobacco

M. C. Vann, L. R. Fisher, M.M. James, D. S. Whitley, J. L. Machacek, and J. A. Cheek, Crop and Soil Sciences Department

Table 8-9. Sucker Control for Burley Tobacco

Type	Chemicals and Formulations	Amount of Formulation Per Acre	Precautions and Remarks
Contact Type	C ₈ -C ₁₀ fatty alcohol (various brands) 6.01 lb/gal	1.5 to 2 gal ¹ (3% to 4%)	Apply in button to early flower stage as coarse, low pressure (approximately 20 psi) spray directed downward on plant tops. Leaf burn may occur with high application rates and pressure, especially on tender or wilted plants when temperature exceeds 90°F. High rates or reapplication may contribute to leaf drop. Application before dew dries will reduce effectiveness.
Systemic Type (maleic hydrazide [MH])	Liquids, various brands 1.5 lb/gal 2.25 lb/gal	1.5 to 2 gal 1 to 1.33 gal	For all systemic products, apply to upper 1/3 to 1/4 of plant in 20 to 50 gallons water per acre at approximately 20 psi after topping to 8-inch leaf. Effectiveness reduced when applied to drought-stressed or wilted plants, or before dew has dried. Apply a single repeat application only if wash-off occurs within 6 hours. For water-soluble products, see rate information below and read labels carefully for mixing instructions.
	60% Water-Soluble Products Fair 80 SP or Sucker Stuff 60 WS	3.75 lb	
	Royal MH-30 SG	4 to 5 lb	
Contact + Systemic Mixture	(FST-7 or Leven-38) C ₁₀ fatty alcohol + maleic hydrazide (MH)	9 qt ¹	Apply downward on plant tops as coarse, low-pressure (approximately 20 psi) spray after topping down to 8-inch leaf. Follow precautions given above and label restrictions for both contact- and systemic-type chemicals. High rates or reapplication after wash-off may contribute to leaf drop and increase MH residues on cured tobacco.
Contact, Local-Systemic Type	flumetralin (Prime +, Flupro or Drexalin Plus)	1 gal ¹	Apply downward on plant tops as coarse, low-pressure (approximately 20 psi) spray after topping down to 8-inch leaf. Suckers longer than 1 inch should be removed at application time and missed suckers removed when seen. Apply only once per plant per season. Excessive spray volume that causes downstalk runoff on soil increases the chance of soil residue carryover, which may stunt the growth of small grains and corn or cause early season stunting of the next tobacco crop when a dinitroaniline herbicide is also used. Rainfall within 2 hours may reduce effectiveness.
	butralin (Butralin)	3 to 4 qt ¹	
Systemic + Contact, Local-Systemic	maleic hydrazide (MH) + flumetralin (Prime +, Flupro or Drexalin Plus)	1/2 to full rate MH + 2 qt flumetralin ¹	Apply as tank mix downward on topped plants as coarse, low pressure (approximately 20 psi) spray at time recommended for MH application. Follow precautions given above and label restrictions for both systemic and contact, local-systemic-type chemicals. The 3/4 rate of MH (1.5 gallons for most products) tank mixed with Prime+ has given satisfactory sucker control on vigorous crops or those harvested more than 3 weeks after application.
	maleic hydrazide (MH) + butralin (Butralin)	Full rate MH +2 qt Butralin	
Contact + Contact-Local Systemic	C ₈ -C ₁₀ fatty alcohol + flumetralin (Plucker-Plus)	2.5 gal	Refer to the discussion above on C ₈ -C ₁₀ fatty alcohol and flumetralin. Apply in 47.5 gallons of water per acre at normal timing for flumetralin application. Remove suckers longer than 1 inch within 24 hours before application and remove missed suckers as observed later. Excess spray to the point of rundown on the soil increases the risk of carryover residues, which may stunt early growth of next crop, including tobacco if dinitroaniline herbicide is also used. Do not apply these products through any type of irrigation system. Rainfall within 2 hours after application may reduce effectiveness. Follow WPS requirements and other precautions and restrictions listed on product labels. Do not make more than two applications per season so as not to exceed maximum rate of flumetralin.

¹ Mix in sufficient water to total 50 gallons spray per acre.

Growth Regulators for Fruiting Vegetables

J. R. Schultheis, Horticultural Science Department (This table was not updated in 2024.)

Table 8-10. Growth Regulators for Fruiting Vegetables

Purpose	Crop	Chemical	Amount of Formulation	Precautions and Remarks
Ethephon 2 — To Stimulate Uniform Ripening for One Harvest	Processing Tomatoes Early and midseason crops or warm conditions	Ethephon 2 Ethephon 2 SL (Ethrel)	1.25 to 3.25 pt/A	Apply to cover foliage and fruit uniformly when 5% to 15% of the fruit is pink and red. Under warm temperatures (above 85°F) rates as low as 1.25 pints/acre can be effective. Thorough coverage is essential. Observe treated fields closely and harvest fruit at proper maturity.
	Processing Tomatoes Late season or coastal crops or cool conditions	Ethephon 2 Ethephon 2 SL (Ethrel)	3.25 to 6.5 pt/A	Apply to cover foliage and fruit uniformly when 5% to 15% of the fruit is pink and red. Use the higher rate when nighttime temperatures are cool (below 65°F) or vegetative growth is dense. Thorough coverage is essential. Observe treated fields closely and harvest fruit at proper maturity.
	Pepper	Ethephon 2 Ethephon 2 SL (Ethrel)	1.25 to 4 pt/A	Apply to bell peppers when 10% have red or chocolate coloration; chili and pimiento peppers when 10 to 30% have red to chocolate coloration. Application should not be made until enough fruit exists for sufficient yield. Product will not ripen immature, green fruit. Rates between 1.25 and 2 pints/acre should be applied in 20 gallons/acre and 3 to 4 pints/acre in 40 gallons/acre. Use of spray volumes less than 40 gallons/acre in hot, dry weather may result in foliage burn. Applications should not be made at temperatures of 100°F or greater. In addition, use the higher rate when nighttime temperatures are cool (below 65°F) or vegetative growth is dense. Thorough coverage is essential. Observe treated fields closely and harvest fruit at proper maturity. Maximum of 4 pints/acre per year.
Sumagic — For Commercial Greenhouse, Lathhouse, and Shadehouse Use Only	Eggplant Groundcherry Pepino Pepper Tomatillo Tomato	Sumagic (Uniconazole-P)	0.52 to 2.6 fl oz/Gal or 16 to 76 ML/Gal or 2 to 10 PPM	Apply uniformly as a foliar spray at a volume of 2 quarts/100 square feet. Initial foliar applications when 2 to 4 true leaves are present. Sequential applications of lower rates provide more growth control than a single high-rate application. First-time user should apply the lowest recommended rate in order to determine optimal rate for individual cultivars under local environmental conditions. If additional growth regulation is required, a sequential spray application at the lowest recommended rate should be made at 7 to 14 days after initial application. Total Uniconazole-P applied may not exceed that from a single application of a 10 ppm spray concentration at 2 quarts/100 feet. Final application may not occur later than 14 days after the 2 to 4 true leaf stage.

Growth Regulators for Peanuts

D. L. Jordan, Crop and Soil Sciences Department

Table 8-11. Growth Regulators for Peanuts

Purpose	Chemical and Formulation	Amount of Formulation per Acre	Remarks
To Suppress Excessive Vegetative Growth and Reduce Pod Shed	prohexadione calcium (Apogee) 27.5% WDG (Kudos) 27.5% WDG (Cryova PGR) 27.5% WDG	7.25 + 7.25 oz	Apply Apogee, Kudos, or Cryova when 50% of vines from adjacent rows are touching in middle. Follow with a repeat application 2 to 3 weeks later. Two applications are needed in most circumstances. However, do not make a second application if soil moisture is limited and no regrowth is apparent. In some cases, yield reductions have been noted when the second application is made under dry conditions. Although a third application may be made, it is generally discouraged because of expense and possible adverse impact on peanut. Do not exceed 21.75 ounces per acre per year. The preharvest interval is 25 days. Do not apply more than 2 applications of Apogee, Kudos, or Cryova within 6 weeks. Apply in a minimum of 20 GPA. Always apply Apogee, Kudos, or Cryova with a nitrogen source. Apply one pound of spray grade ammonium sulfate for every pound of Kudos. Apply one pound of spray grade ammonium sulfate per acre or one pint of UAN (28%, 30%, or 32% nitrogen solution) per acre with Apogee. Apply Apogee, Kudos, or Cryova with either nonionic surfactant or crop oil concentrate depending on product labels when mixing with other products.

For further information, see Extension publication *Peanut Information* (AG-331). Copies are available from your local Cooperative Extension center.

Growth Regulators for Turfgrasses

F. H. Yelverton, R. Cooper, and T. W. Gannon, Crop and Soil Sciences Department (This table was not updated in 2024.)

Table 8-12. Growth Regulators for Turfgrasses

Turfgrass	Brand	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Cool Season Grasses—Well-Maintained Turf: Seedhead and Foliar Suppression	mefluidide (Embark) 0.2	5 pt/15 to 150 gal water	0.125	See Embark 2-S for low-maintenance cool-season turf. Follow label directions and precautions.
	trinexapac-ethyl (Governor) 0.17 G	30 to 258 lb	0.05 to 0.44	Apply 30 to 41 pounds per acre to greens, 53 to 152 pounds per acre to fairways less than 0.5 inch cut, and 152 to 258 pounds per acre to residential and commercial turf. Do not exceed 2.5 pounds active ingredient per acre per year. These rates should provide 50% turf growth suppression for 4 weeks with minimal yellowing.
	(Primo Maxx) 1 MEC or (T-Nex) 1 AQ (Primo WSB) 25 WP	6 to 44 fl oz 2.75 to 21.8 oz	0.085 to 0.34 0.085 to 0.34	Application rate varies with turfgrass species and height of cut. Apply to actively growing, nonstressed turf. More growth suppression occurs at lower mowing heights. See label for specific rate and other directions and precautions. Repeat applications can be made, but do not exceed a total of 21.4 pints per acre per year of Primo Maxx or a total of 174 ounces per acre per year of Primo WSB. Do not exceed a total of 19 pints per acre per year of T-Nex. Refer to the respective Primo label for guidelines regarding mowing prior to and following application. Mix with 0.5 to 4 gallons of water per 1,000 sq ft (20 to 174 gallons per acre). Primo can be applied to putting greens. See label for instructions.
Cool Season Grasses—Well-Maintained Turf: Foliar Suppression	ethephon (Ethephon or Proxy) 2 SL	1.7 gal	3.4	May be applied to Kentucky bluegrass, perennial ryegrass, bentgrass, and tall and fine fescues. Apply in 22 to 174 gallons of water per acre. Do not use a surfactant. Plant growth regulator effect will not be seen until 7 to 10 days after application. May be reapplied to Kentucky bluegrass and perennial ryegrass at 7-week intervals. Repeat applications to bentgrass and tall and fine fescue may be made at 4-week intervals.
	flurprimidol (Cutless 50 W) 50 WP	0.75 to 3 lb/50 to 200 gal water	0.37 to 1.5	Rates depend upon grass species and cultivar. Apply to bentgrass, Kentucky bluegrass, and perennial ryegrass in late spring-early summer or late summer-early fall. Time the second application to occur at least 3 months before expected winter dormancy. Do not apply to putting greens. Do not exceed 1.5 pounds per acre per application on coarse-textured soils. Treated areas should receive 0.5 inch of irrigation within 24 hours after application. Resume mowing 3 to 5 days after application.
	flurprimidol + trinexapac-ethyl (Legacy) 1.51 SL	5 to 22 fl oz	0.059 to 0.26	Tolerant species include bentgrass greens and fairways, Kentucky bluegrass, and perennial ryegrass. Do not use on turf grown for sale or other commercial use as sod or seed production. Do not seed 3 weeks before or 3 weeks after application. Wait 6 to 8 weeks after sprigging or laying sod before applying. Use only 5 to 8 fluid ounces per acre on bentgrass greens. Repeat applications at 2- to 6-week intervals until 4 weeks before the onset of inactive growth.
	paclobutrazol (TGR Turf Enhancer 2 SC or Trimmit 2 SC) 2 SC	1 to 2 pt /43 to 200 gal water	0.25 to 0.5	Apply in spring after greenup and after turf has been mowed once or twice. Apply at least 1 month before onset of high temperatures. In late summer-early fall, apply at least 1 month before anticipated first killing frost. Apply with 0.5 to 0.9 pound nitrogen per 1000 sq ft of a nonburning fertilizer. Apply 0.25 inch of water within 24 hours after application to remove product from foliage and onto soil surface. See label for special rates and directions for applications to bentgrass, putting greens, and overseeded bermudagrass. Repeat applications within the same growing season may be made but refer to label for instructions. Do not apply more than three times annually. Do not use on areas containing greater than 70% <i>poa annua</i> . Do not seed within 6 weeks prior to or 2 weeks after applications.
	prohexadione calcium (Anuew) 27.5 WG	1.8 to 29.1 oz	0.031 to 0.5	Apply to golf course fairways, tees, greens and roughs and also athletic fields, residential and commercial lawns, sod farms, parks, cemeteries and roadsides. Apply 1.8 to 7.25 ounces per acre on bentgrass greens and tees at 1 to 2 wk intervals and 7.25 to 14.5 ounces per acre on bentgrass fairways and roughs at 2 to 4 wk intervals. Apply 14.5 to 21.8 ounces per acre on perennial bluegrass and 21.8 to 29.1 ounces per acre on perennial ryegrass at 2 to 4 wk intervals. For cool season grass sod production, apply 7.25 to 29.1 ounces per acre at 2 to 4 wk intervals. Use a spray volume of 1 to 2 gallons of water per 1000 sq ft. A nonionic surfactant may improve product performance. Do not irrigate for 4 hours after application or mow until 1 day after application.
	trinexapac-ethyl (Primo Maxx) 1 MEC or (T-Nex) 1 AQ (Primo WSB) 25 WP	6 to 22 fl oz 2.75 to 10.9 oz	0.085 to 0.17 0.085 to 0.17	Application rates are for mowing heights of less than or equal to 0.5 inch. Apply to actively growing, non-stressed turf. Rate varies with turfgrass species. See label for specific rate and other directions and precautions. Repeat applications can be made but do not exceed a total of 21.4 pints per acre per year of Primo Maxx or a total of 174 ounces per acre per year of Primo WSB. Do not exceed a total of 19 pints per acre per year of T-Nex. Refer to the respective Primo label for guidelines regarding mowing prior to and following applications. Mix with 0.5 to 4 gallons of water per 1,000 sq ft (20 to 174 gallons per acre). Primo can be applied to putting greens. See label for instructions.

Table 8-12. Growth Regulators for Turfgrasses

Turfgrass	Brand	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Cool Season Grasses—Low-Maintenance Turf: Seedhead and Foliar Suppression	chlorsulfuron (Telar DF) 75 DF + mefluidide (Embark 2-S) 2S	0.25 oz + 0.5 pt	0.012 + 0.125	For growth and seedhead suppression in fescue/bluegrass stands. Apply up until seedhead emergence. Do not apply Telar DF to turf less than 1 year old. Grass seed may be planted in treated areas 6 months after treatment, but cultivation is recommended. For broadcast applications, do not exceed 0.5 ounces Telar DF per acre within a 12-month period. Telar DF alone can also be used for weed control in bahiagrass, bermudagrass, fescue, and bluegrass.
	glyphosate (Touchdown Pro) 3 LC	4 to 8 fl oz/10 to 40 gal water	0.09375 to 0.1875	Touchdown Pro may be used on turf described in "GENERAL USE AREAS" section of the label. 4 to 5 ounces will suppress annual grasses, such as ryegrass, wild barley, and wild oats, growing in turf areas. 6 ounces will suppress Kentucky bluegrass and serve as a mowing substitute. 8 ounces will suppress fine fescue and tall fescue and serve as a mowing substitute. A nonionic surfactant containing at least 75% active ingredient at 0.25% v/v (1 quart per 100 gallons) or ammonium sulfate at 0.5% by weight (4.25 to 17 pounds per 100 gallons) may be added.
	imazethapyr + imazapyr (Event) 1.46 lb/gal	8 to 10 fl oz	0.09 to 0.11	Apply to tall fescue, perennial ryegrass, and bluegrass only. Apply after the turf is at 100% greenup and has at least 2 inches of vertical growth. The addition of a nonionic surfactant containing at least 80% active ingredient at 0.25% v/v of the spray (2 pints per 100 gallons of spray mixture) is required. Do not use on newly established stands less than 1 year old or on highly managed turf. Do not reseed before 3 months after application. See label for herbicide tank mix options. Follow label directions and precautions.
	maleic hydrazide (Retard) 2.25 lb/gal (Royal Slo-Gro) 1.5 lb/gal (Liquid Growth Retardant) 0.6 lb/gal	1.3 gal/50 gal water 2 gal/30 to 50 gal water 5 gal/45 gal water	3	Treat in the spring when the grass is actively growing but before seedhead appears. Applications made after seedhead appears will suppress subsequent seedheads. Do not apply to turf less than 3 years old, and do not reseed within 3 days after application. Treated turf may appear less dense and temporarily discolored. Optimum results may not be obtained if rainfall or overhead irrigation occurs within 12 hours following application. Remove excess grass clippings and fallen leaves before application. Do not add a surfactant. Follow label directions and precautions.
	mefluidide (Embark 2-S) 2 S	1.5 to 2 pt/15 to 150 gal water	0.38 to 0.5	Apply after uniform spring greenup until approximately 2 weeks before seedheads appear. Do not apply to turf within 4 growing months after seeding, and do not reseed within 3 days after application. Treated turf may appear less dense and temporarily discolored. Optimum results may not be obtained if rainfall or overhead irrigation occurs within 8 hours following application. Remove excess clippings and fallen leaves before application. Adding 1 to 2 quarts of nonionic surfactant per 100 gallons of spray solution may enhance suppression; however, discoloration may also be increased. Follow label directions and precautions.
	metsulfuron methyl (Escort XP) 60 DF	0.25 to 0.5 oz	0.009 to 0.018	Apply to well-established tall fescue and perennial bluegrass turf. Can tank mix with 0.125 to 0.25 pints per acre of Embark to improve pgr performance. Treat after 2 to 3 inches of new growth but before seed stalk formation. Temporary discoloration may occur. Do not use on stressed turf.
Warm Season Grasses— Well-Maintained Turf: Seedhead and Foliar Suppression	trinexapac-ethyl (Governor) 0.17 G	12 to 258 lb	0.02 to 0.44	Apply 12 to 41 pounds per acre to greens, 30 to 77 pounds per acre to fairways less than 0.5 inch cut, and 41 to 258 pounds per acre to residential and commercial turf. Do not exceed 2.5 pounds active ingredient per acre per year. These rates should provide 50% turf growth suppression for 4 weeks with minimal yellowing.
	(Primo Maxx) 1 MEC or (T-Nex) 1 AQ (Primo WSB) 25 WP	2.7 to 88 fl oz 1.35 to 43.6 oz	0.085 to 0.68 0.085 to 0.68	Application rate varies with turfgrass species and height of cut. Apply to actively growing, nonstressed turf. More growth suppression occurs at lower mowing heights. See label for specific rate and other directions and precautions. Repeat applications can be made but do not exceed a total of 21.4 pints per acre per year of Primo Maxx or 174 ounces per acre per year of Primo WSB. Do not exceed a total of 19 pints per acre per year of T-Nex. Refer to the respective Primo label for guidelines regarding mowing prior to and following application. Mix with 0.5 to 4 gallons of water per 1,000 sq ft (20 to 174 gallons per acre). Primo can be applied to putting greens. See label for directions.
	mefluidide (Embark) 0.2	10 pt/15 to 150 gal water	0.25	For St. Augustinegrass. See Embark 2-S for low-maintenance warm season turf. Follow label directions and precautions.

Table 8-12. Growth Regulators for Turfgrasses

Turfgrass	Brand	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Warm Season Grasses—Well-Maintained Turf: Foliar Suppression	flurprimidol (Cutless 50 W) 50 WP	0.75 to 3 lb/50 to 200 gal water	0.37 to 1.5	Rates depend upon grass species and cultivar. Apply to Tifway, Tifgreen, common bermudagrass, or zoysiagrass. Treated areas should receive 0.5 inch of irrigation within 24 hours of application. Resume mowing. Overseed 2 to 3 weeks after fall application with a desired perennial ryegrass.
	flurprimidol + trinexapac-ethyl (Legacy) 1.51 SL	8 to 15 fl oz	0.094 to 0.177	Tolerant species include Tifway and TifSport bermudagrass, zoysiagrass, and seashore paspalum. Do not use on turf grown for sale or other commercial use as sod or seed production. Do not seed 3 weeks before or 3 weeks after application. Wait 6 to 8 weeks after sprigging or laying sod before applying. Repeat applications at 2- to 6-week intervals until 4 weeks before winter dormancy.
	paclobutrazol (TGR Turf Enhancer 2 SC or Trimit 2 SC) 2 SC	2 to 3 pt/43 to 200 gal water	0.5 to 0.75	Use any time when established hybrid bermudagrass and St. Augustinegrass are green, are actively growing, and have recovered from dormancy (filled in fully following winter). Apply with 0.5 to 0.9 pound nitrogen per 1,000 sq ft of a nonburning fertilizer. Apply 0.25 inch of water within 24 hours after application to remove product from foliage and onto soil surface. A repeat application within the same growing season may be made, but not sooner than 8 weeks following initial application. Do not apply more than 3 times annually. Do not use on areas containing greater than 70% <i>poa annua</i> . Refer to label to determine bermudagrass and St. Augustine cultivar response relating to sensitivity, growth, and color response. Do not seed within 6 weeks prior to or 2 weeks after application.
	prohexadione calcium (Anuew) 27.5 WG	7.25 to 43.6 oz	0.125 to 0.75	Apply to golf course fairways, tees, greens and roughs and also athletic fields, residential and commercial lawns, sod farms, parks, cemeteries and roadsides. Apply 7.25 to 14.5 ounces per acre on hybrid bermudagrass greens and tees at 1 to 2 wk intervals and 29.1 to 43.6 ounces per acre on hybrid bermudagrass fairways and roughs at 2 to 4 wk intervals. For warm season grass sod production, apply 14.5 to 43.6 ounces per acre at 2 to 4 wk intervals. Use a spray volume of 1 to 2 gallons of water per 1000 sq ft. A nonionic surfactant may improve product performance. Do not irrigate for 4 hours after application or mow until 1 day after application.
	trinexapac-ethyl (Primo Maxx) 1 MEC or (T-Nex) 1 AQ (Primo WSB) 25 WP	2.7 to 13 fl oz 1.35 to 6.5 oz	0.042 to 0.085 0.042 to 0.085	Application rates are for mowing heights of less than or equal to 0.5 inch Apply to actively growing, non-stressed turf. Rate varies with turfgrass species. See label for specific rate and other directions and precautions. Repeat applications can be made but do not exceed a total of 21.4 pints per acre per year of Primo Maxx or a total of 174 ounces per acre per year of Primo WSB. Do not exceed a total of 19 pints per acre per year of T-Nex. Refer to the respective Primo label for guidelines regarding mowing prior to and following applications. Mix with 0.5 to 4 gallons of water per 1,000 sq ft (20 to 174 gallons per acre). Primo can be applied to putting greens. See label for directions.
Warm Season Grasses—Low-Maintenance Turf: Seedhead and Foliar Suppression	glyphosate (Roundup Pro) 4 lb/gal	6 fl oz/10 to 25 gal water	0.2	Apply to bahiagrass only. Apply after full greenup of the bahiagrass (about late May) and make only one application per year. Do not apply to turf less than 3 years old. Treated turf may appear less dense and temporarily discolored. Optimum results may not be obtained if rainfall or overhead irrigation occurs within 6 hours following application. This is a nonselective herbicide. If application exceeds the above recommended rates, it can result in permanent loss of turf.
	(Touchdown Pro) 3 LC	0.375 to 4 pt/10 to 40 gal water	0.14 to 1.5	Touchdown Pro may be used on dormant or actively growing bermudagrass and bahiagrass turf described in "GENERAL USE AREAS" section of label. May be tank mixed with 0.25 to 2 ounces of Oust for residual weed control. Check label for correct rates. Touchdown Pro will control winter annual weeds less than 6 inches tall and also 4-to 6-leaf tall fescue in dormant turf. Use only on well-established bermudagrass. Injury may occur, but regrowth will occur under moist conditions. Bahiagrass vegetative growth and seedheads may be suppressed approximately 45 days when applied 1 to 2 wk after spring greenup and before seedhead emergence. A second application at 45 days will extend suppression to approximately 120 days.
	imazapic (Plateau) 2 ASU	2 fl oz	0.031	Only government entities may buy Plateau. Used for bahiagrass seedhead suppression. Apply to bahiagrass in spring after full greenup but approximately 3 to 4 weeks prior to expected seedhead emergence or 7 to 10 days after mowing. Do not apply to wetlands. Add a surfactant according to label directions. Bahiagrass may appear less dense and discolored following application.
	imazapic (Panoramic) 2 SL	2 to 3 fl oz	0.031	May be used for seedhead suppression of bahiagrass or tall fescue turf areas including industrial turf, golf courses, and non-residential areas. Apply 2-3 ounces/A for tall fescue seedhead suppression prior to seedhead emergence. Apply 2 ounces/acre after bahiagrass greenup but prior to seedhead emergence. Temporary turf discoloration may occur.
	imazapic + glyphosate (Journey) 2.25 AS	11 to 32 fl oz	0.19 to 0.56	Use in noncrop areas. Temporary turf discoloration may occur. Apply 4 to 8 fluid ounces per acre on a small area first to determine rate needed for desired results. Do not use with methylated seed oil. Do not apply to drought-stressed turf. Apply after full turf greenup.
	imazethapyr + imazapyr (Event) 1.46 lb/gal	8 to 10 fl oz	0.09 to 0.11	Apply to bahiagrass only. Apply after the turf is at 100% greenup and has at least 2 inches of vertical growth. The addition of a nonionic surfactant containing at least 80% active ingredient at 0.25% v/v of the spray (2 pints per 100 gallons of spray mixture) is required. Do not use on newly established stands less than 1 year old or on highly managed turf. Do not reseed before 3 months after application. See label for herbicide tank mix options. Follow label directions and precautions.

Table 8-12. Growth Regulators for Turfgrasses

Turfgrass	Brand	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Warm Season Grasses—Low-Maintenance Turf: Seedhead and Foliar Suppression (continued)	maleic hydrazide (Retard) 2.5 lb/gal (Royal Slo-Gro) 1.5 lb/gal (Liquid Growth Retardant) 0.6 lb/gal	1.3 gal/50 gal water 2 gal/30 to 50 gal water 5 gal/45 gal water	3 3 3	Apply to bahiagrass only. Apply in late spring but before seedheads appear. Applications made after seedhead appearance will suppress subsequent seedheads. Do not apply to turf less than 3 years old and do not reseed within 3 days after application. Treated turf may appear less dense and temporarily discolored. Optimum results may not be obtained if rainfall or overhead irrigation occurs within 12 hours following application. Remove excess grass clippings and leaves before application. Do not add a surfactant. Follow label directions and precautions. A repeat application may be needed 6 weeks after initial application.
	mefluidide (Embark 2-S) 2 S	2 qt/15 to 150 gal water	1	Apply to bermudagrass only. Apply in late spring until about 2 weeks before seedhead appearance. Do not apply to turf within 4 growing months after seeding, and do not reseed within 3 days after application. Treated turf may appear less dense and temporarily discolored. Optimum results may not be obtained if rainfall or overhead irrigation occurs within 8 hours following application. Remove excess grass clippings and leaves before application. Adding 1 to 2 quarts of a nonionic surfactant per 100 gallons of spray solution may enhance suppression; however, discoloration may also be increased. Follow label directions and precautions.
	sulfometuron methyl (Oust) 75 DG	0.5 oz/30 to 50 gal water	0.02 lb	Apply to bahiagrass in late spring or early summer before seedheads appear. Do not apply to wetlands or where runoff water may flow onto agricultural lands or forests. Injury of desirable trees may result if applications are made near plants or where their roots extend or may be subjected to runoff from treated areas. Do not apply to turf less than 3 years old. Treated turf may appear less dense and temporarily discolored. Do not add a surfactant. Follow label directions and precautions.
	sulfometuron methyl + chlorsulfuron (Landmark MP) 50 + 25 DG (Landmark II MP) 56.25 + 18.75 DG	0.9 oz 1.0 oz	0.042 0.047	For established bermudagrass and centipede-improved turf. Temporarily suppresses foliar and seedhead growth while controlling many grass and broadleaf weeds. Apply 30 days after breaking dormancy or either late fall or early winter. Landmark MP may discolor or cause top kill of desired turf species. Do not apply to turf less than 1 year old. Annual retreatments may reduce turf vigor.
	sulfometuron methyl + metsulfuron methyl (Oust Extra) 56.25 + 15 DG	0.5 to 2 oz	0.022 to 0.088	For use on well-established, unimproved bermudagrass and centipedegrass. Apply 30 days after breaking dormancy. Can also be applied in late fall or early winter depending on weed presence. Oust Extra can be tank mixed with 3 to 4 pounds active ingredient per acre MSMA on bermudagrass during the summer. Do not add a surfactant.
Annual Bluegrass: Suppression	flurprimidol (Cutless 50 W) 50 WP	0.25 to 0.5 lb/50 to 100 gal water 1 to 1.5 lb/50 to 200 gal water	0.12 to 0.25 0.5 to 0.75	Apply to actively growing bentgrass putting greens in spring after third or fourth mowing or in the fall. Repeat, if necessary, at 3- to 6-week intervals, not to exceed 2 pounds per acre per growing season. Delay overseeding 2 weeks after application. Make final fall application 8 weeks before onset of winter dormancy. Apply to bentgrass, Kentucky bluegrass, and perennial ryegrass in late spring-early summer or late summer-early fall. Time the second application to occur at least 3 months before expected winter dormancy. Management practices that encourage vigorous growth of perennial turfgrass following application will enhance conversion. <i>Poa annua</i> discoloration will be visible 7 to 10 days after treatment and last for 3 to 6 weeks. Do not apply to putting greens. Treated areas should receive 0.5 inch of irrigation within 24 hours after application. Resume mowing 3 to 5 days after application.
	flurprimidol + trinexapac-ethyl (Legacy) 1.51 SL	5 to 30 fl oz	0.059 to 0.354	Use in cool season turfgrasses, such as bentgrass greens and fairways, Kentucky bluegrass, and perennial ryegrass. Repeat applications at 2- to 6-week intervals. Annual bluegrass suppression is gradual and could take several growing seasons. Start treatments in early spring and continue through early fall.
	maleic hydrazide (Retard) 2.25 lb/gal (Royal Slo-Gro) 1.5 lb/gal (Liquid Growth Retardant) 0.6 lb/gal	1 qt/30 to 40 gal water 2 qt/30 to 40 gal water 1.25 gal/30 to 40 gal water	0.56 0.75 0.75	Treat after two normal mowings but before seedhead appears. Applications made after seedhead appears will suppress subsequent seedheads. Do not apply to golf greens. Do not apply to turf less than 3 years old, and do not reseed within 3 days after application. Treated turf may appear less dense and temporarily discolored. Optimum results may not be obtained if rainfall or overhead irrigation occurs within 12 hours following application. Remove excess grass clippings and fallen leaves before application. Do not add a surfactant. Follow label directions and precautions for use on fairways.
	mefluidide (Embark 2-S) 2 S (Embark) 0.2	0.5 pt/15 to 150 gal water 2 to 5 pt/15 to 150 gal water	0.125 0.05 to 0.125	Apply after uniform greenup but before first appearance of seedheads. Do not apply to turf within 4 growing months after seeding, and do not reseed within 3 days after application. Treated turf may appear less dense and temporarily discolored. Optimum results may not be obtained if rainfall or overhead irrigation occurs within 8 hours following application. Remove excess grass clippings and leaves before application. Adding 1 to 2 quart of a nonionic surfactant per 100 gallons of spray solution enhances suppression; however, discoloration may also be increased. Follow label directions and precautions for use of fairways and tees.
	paclobutrazol (31-3-9 Fertilizer with TGR <i>Poa annua</i> Control 0.42%)	128 lb	0.5	Apply only to bentgrass, Kentucky bluegrass, perennial ryegrass fairways, or bentgrass greens with less than a 70% <i>poa annua</i> infestation. Follow label directions and precautions. Note: This product supplies 0.9 pound N per 1,000 sq ft.
	prohexadione calcium (Anuew) 27.5 WG	0.9 to 1.75 oz	0.015 to 0.03	Apply to overseeded hybrid bermudagrass during periods of active <i>poa annua</i> growth at 3 to 4 wk intervals.
	(15-0-29 High K Fertilizer with TGR <i>Poa annua</i> Control 0.34%)	98 lb to 146 lb	0.33 to 0.5	Apply only to bentgrass, zoysiagrass, Kentucky bluegrass, and Kentucky bluegrass/perennial ryegrass fairways, tees, and roughs, as well as bentgrass greens with less than 70% <i>poa annua</i> infestation. Note: This product supplies 0.5 pound N per 1,000 sq ft.

Table 8-12. Growth Regulators for Turfgrasses

Turfgrass	Brand	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Annual Bluegrass: Suppression (continued)	(TGR Turf Enhancer 2 SC or Trimit 2 SC) 2 SC	6.4 to 48 fl oz/43 to 200 gal water	0.1 to 0.75	Apply on hybrid bermudagrass, bentgrass, perennial ryegrass, and Kentucky bluegrass/perennial ryegrass fairways, tees, and roughs. Can also be applied to bentgrass putting greens. Apply in spring after greenup or regrowth has begun and after mowing once or twice. Apply with a nonburning fertilizer. Apply 0.25 inch of water within 24 hours after application to remove product from foliage and onto soil surface. See label for rates and other directions for applications to bentgrass putting greens and overseeded bermudagrass. Do not apply more than 3 times annually. Do not use on areas containing more than 70% <i>poa annua</i> . For bentgrass putting greens, do not apply more than 0.25 pound active ingredient per acre per application.
	ethephon (Proxy) 2 SL	1.7 gal	3.4	May be used to suppress annual bluegrass seedheads and growth of other cool season turfgrasses including golf course greens, fairways, tees, and roughs. Do not use an adjuvant. Do not apply to stressed turfgrass or where excessive thatch is present. Scalping may occur on bentgrass surfaces after application. Consult label for repeat application intervals.
Overseeded Bermudagrass Turf: Foliar Suppression	flurprimidol (Cutless 50 W) 50 WP	0.75 to 3 lb/50 to 200 gal water	0.37 to 1.5	Rates depend upon grass species and cultivar. Apply to zoysiagrass, Tifway, Tifgreen, and common bermudagrass in late spring-early summer or late summer-early fall. Time the second application to occur 8 to 10 weeks before expected winter dormancy. Do not apply to putting greens. Do not exceed 1.5 pound per acre per application on coarse-textured soils. Treated areas should receive 0.5 inch of irrigation within 24 hours after application. Resume mowing 3 to 5 days after application.
	flurprimidol + trinexapac-ethyl (Legacy) 1.51 SL	5 to 30 fl oz	0.059 to 0.354	Use in cool season turfgrasses, such as bentgrass greens and fairways, Kentucky bluegrass, and perennial ryegrass. Repeat applications at 2- to 6-week intervals. Annual bluegrass suppression is gradual and could take several growing seasons. Start treatments in early spring and continue through early fall.
	maleic hydrazide (Royal Slo-Gro) 1.5 lb/gal (Liquid Growth Retardant) 0.6 lb/gal	1.5 gal/50 gal water 3.3 gal/50 gal water	2.25	Apply in late September or early October to inhibit bermudagrass growth and allow winter overseeding to establish. Overseed no sooner than 48 hours after application. Follow label directions and precautions for use on greens and fairways.
	paclobutrazol (TGR Turf Enhancer 2 SC or Trimit 2 SC) 2 SC	6.4 to 16 fl oz/43 to 200 gal water	0.1 to 0.25	Apply any time after overseeded turf has successfully established itself. Do not apply after March 15 to avoid delay in bermudagrass green-up. Apply with 0.25 to 0.5 pound N per 1,000 sq ft of a nonburning fertilizer. Apply 0.25 inch of water within 24 hours after application to remove product from foliage and onto soil surface. Repeat applications can be made but do not apply more than 3 times annually. Do not use on areas containing more than 70% <i>poa annua</i> . Do not seed within 6 weeks prior to or 2 weeks after application. Do not apply to 'Tifdwarf' putting greens.
	prohexadione calcium (Anuew) 27.5 WG	0.9 to 1.75 oz	0.015 to 0.03	To enhance overseeding establishment, apply to hybrid bermudagrass 3 to 5 days prior to seeding. Delay verticutting, spiking or scalping for 1 to 2 days after application.
	trinexapac-ethyl (Governor) 0.17 G	129 to 165 lb	0.22 to 0.28	Apply before verticutting, scalping, or spiking the bermudagrass. Apply 1 to 5 days before overseeding. To minimize yellowing, use iron at recommended rates or available nitrogen at 0.2 to 0.5 pound per 1,000 square feet.
	(Primo Maxx) 1 MEC or (T-Nex) 1 AQ (Primo WSB) 25 WP	6 to 44 fl oz 2.75 to 21.8 oz	0.08 to 0.34 0.08 to 0.34	Application rate varies with turfgrass species and height of cut. Apply to actively growing, nonstressed turf. More growth suppression occurs at lower mowing heights. See label for specific rate and other directions and precautions. Repeat applications can be made but do not exceed a total of 21.4 pints per acre per year of Primo Maxx or a total of 174 ounces per acre per year of Primo WSB. Do not exceed 19 pints per acre per year of T-Nex. Refer to the respective Primo label for guidelines regarding mowing prior to and following application. Mix with 0.5 to 4 gallons of water per 1,000 sq ft (20 to 174 gallons per acre). Primo can be applied to putting greens. See label for directions.
Lawn Edging	maleic hydrazide (Retard) 2.25 lb/gal (Royal Slo-Gro) 1.5 lb/gal (Liquid Growth Retardant) 0.6 lb/gal	1.33 gal/100 gal water 2 gal/100 gal water 6.67 gal/100 gal water	3 3 4	Apply in spring to a 6-inch band along sidewalks. Consult instructions on applicator for delivery dosage.
	mefluidide (Embank) 0.2	1.36 gal/174 gal water	0.27	For Kentucky bluegrass, tall fescue, chewings fescue, red fescue, perennial ryegrass, and St. Augustinegrass. For bermudagrass, use 5.45 gallons in 174 gallons water. Apply in 6- to 12-inch bands. Avoid overlapping.
	trinexapac-ethyl (Governor) 0.17 G	100 to 259 lb	0.17 to 0.44	Do not exceed 2.5 pounds active ingredient per acre per year. These rates should provide 50% turf growth suppression for 4 weeks with minimal yellowing.
	(Primo Maxx) 1 MEC (T-Nex) 1 AQ (Primo WSB) 25 WP			Apply 0.75 to 2 ounces per 1,000 linear feet of Primo Maxx or T-Nex, or 0.4 to 2 ounces per 1,000 linear ft of Primo WSB. Apply to actively growing, nonstressed turf. Apply along perimeter of lawns, sidewalks, curbs, parking lots, driveways, flower beds, or fences. Apply in an 8- to 12-inch band along the perimeter of the lawn to reduce growth of turf into adjacent areas. Application rate varies with turf species. Follow label directions for repeat applications and other precautions.