



## STARTING PLANTS FROM SEEDS

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Growing your own transplants from seeds indoors can give you a head start on the growing season. In some cases it may be the only way to obtain plants of a new or special cultivar (variety) that is not widely available through garden centers.

To obtain vigorous plants, start with high quality seed from a reliable source. Select cultivars which provide the plant size, color (flower, foliage, or fruit), and growth habit you want. Choose cultivars adapted to your area. Many vegetable and flower cultivars are hybrids. They may cost more than open pollinated types, but they usually have more vigor, more uniformity, and better growth than nonhybrids.

Purchase only enough seed for 1 year's use, since germination decreases with age. The seed packet label usually indicates essential information about the cultivar, the year in which the seeds were packaged, the germination percentage, and whether the seeds have received any chemical treatment.

If seeds are obtained well ahead of the actual sowing date (or are surplus seeds), store them in a cool, dry place.

Laminated foil packages help ensure dry storage. Paper packets are best kept in tightly sealed containers and maintained around 40°F in low humidity. A good storage location would be in an air tight jar or a sealed, zip-lock bag in the refrigerator. Some gardeners save seed from their own gardens, but these may not produce plants similar to the parents; this is especially true of hybrids.

### Germination

Germination is the resumption of active embryo growth after a dormant period. Three conditions must be satisfied in order for a seed to germinate:

- The seed must be viable (the embryo must be alive and capable of germination).
- Internal conditions of the seed must be favorable for germination, that is, any physical, chemical, or physiological barriers to germination must have disappeared or must have been removed by the propagator.
- The seed must be subjected to appropriate environmental conditions, including water (moisture), proper temperature, oxygen, and for some species, light (see Table 1).

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**Table 1. Germination information for selected plants: approximate time to seed before last frost, days for germination, optimum temperature for germination, and light requirements.**

<b>Plant</b>	<b>Approximate Time to Seed Before Last Frost Date (Weeks)</b>	<b>Time Seeds Take to Germinate (Days)</b>	<b>Temperature (°F)</b>	<b>Light/Dark Requirement</b>
Ageratum	8	5 to 10	70	Light
Alyssum	8	5 to 10	70	Either
Aster	6	5 to 10	70	Either
Balsam	6	5 to 10	70	Either
Begonia	12 or more	10 to 15	70	Light
Broccoli	8	5 to 10	70	Either
Browallia	12 or more	15 to 20	70	Light
Cabbage	8	5 to 10	70	Either
Cauliflower	8	5 to 10	70	Either
Celosia	8	5 to 10	70	Either
Centurea	6	5 to 10	65	Dark
Coleus	8	5 to 10	65	Light
Cosmos	4 or less	5 to 10	70	Either
Cucumber	4 or less	5 to 10	85	Either
Dahlia	8	5 to 10	70	Either
Dianthus	10	5 to 10	70	Either
Eggplant	8	5 to 10	70	Either
Geranium	12 or more	10 to 20	70	Light
Impatiens	10	15 to 20	70	Light
Larkspur	12 or more	5 to 10	55	Dark
Lettuce	8	5 to 10	70	Light
Marigold	6	5 to 10	70	Either
Muskmelon	4 or less	5 to 10	85	Either
Nicotiana	8	10 to 15	70	Light
Pansy (Viola)	12 or more	5 to 10	65	Dark
Pepper	8	5 to 10	80	Either
Petunia	10	5 to 10	70	Light
Phlox	8	5 to 10	65	Dark
Portulaca	10	5 to 10	70	Dark
Snapdragon	10	5 to 10	65	Light
Squash	4 or less	5 to 10	85	Either
Stock	10	10 to 15	70	Either
Tomato	6	5 to 10	80	Either
Verbena	10	15 to 20	65	Dark
Vinca	12 or more	10 to 15	70	Either
Watermelon	4 or less	5 to 10	85	Either
Zinnia	6	5 to 10	70	Either

**Water** — The first step in germination is absorption of water. An adequate, continuous supply of moisture is important to ensure germination. Once germination has begun, a dry period can kill the embryo.

**Temperature** — Affects the germination percentage and the rate (speed) of germination. Some seeds will germinate over a wide range of temperatures, others have a narrow range. Many species have minimum,

maximum, and optimum temperatures at which they germinate. For example, seeds of tomato have a minimum germination temperature of 50°F, a maximum of 95°F, and an optimum germination temperature of 80°F. When germination temperatures are listed, they are usually optimum temperatures. Generally, 65°F to 75°F is best for most plants.

**Oxygen**—Respiration in dormant seeds is low, but they do require some oxygen. Respiration rate increases during germination. The medium in which the seeds are sown should be loose and well aerated. If the oxygen supply during germination is limited or reduced, germination can be severely retarded or inhibited.

**Light**—Can stimulate or inhibit seed germination of some species. Seeds that require light for germination include: ageratum, begonia, browallia, impatiens, lettuce, and petunia. Other plants germinate best in the dark. These include calendula, centaurea, annual phlox, and verbena. Some plants germinate in either light or dark conditions. Seed catalogs and seed packets often list germination and cultural information for particular plants. When sowing light-requiring seeds, sow them on the medium surface. Supplemental light can be provided by fluorescent fixtures suspended 6 to 12 inches above the medium for 16 hours a day.

### **Media**

A wide range of media can be used to germinate seeds. With experience, you will learn to determine what works best for you. The germinating medium should be rather fine in texture and of uniform consistency, yet well aerated and loose. It should be free of insects, disease organisms, nematodes, weeds, and weed seeds. It should also be of low fertility and capable of holding moisture, but yet be well drained. Purchase commercial potting media containing fine particle pinebark, sphagnum peat moss, and perlite, or prepare a combination of equal parts (by volume) of these materials. Do not use garden soil to start seedlings; it is not sterile, it is too heavy, and it does not drain well. Commercial growing mixes have low fertility, so seedlings must be watered with a dilute fertilizer solution soon after germination and emergence. Use  $\frac{1}{4}$  to  $\frac{1}{2}$  of the recommended rate.

### **Containers for Germination and Growth**

Plastic cell packs can be purchased or reused if sterilized. When using cell packs, each cell holds a single plant. This method reduces the risk of root injury when transplanting. Peat pellets, peat pots, or expanded foam cubes can also be used for producing seedlings. Resourceful gardeners often use cottage cheese containers, the bottoms of milk cartons or bleach containers. Just make certain that adequate drainage holes are made in the bottoms of the containers and the containers are sterile.

The importance of using sterile medium and containers can not be overemphasized. Before using containers, wash them to remove any debris and then immerse them in a solution of one part chlorine bleach to nine parts water for 5 minutes and allow to dry.

### **Sowing Seeds**

Seedlings are often started indoors 4 to 12 weeks before the last spring frost. A common mistake is to sow the seeds too early and then attempt to hold the seedlings under poor environmental conditions (light and temperature). This usually results in tall, weak, spindly plants that do not perform well in the garden. The following provides general guidelines for sowing seeds for transplants. However, it is important to refer to the instructions on the seed packet for more specific information.

When sowing seeds, fill the container to within  $\frac{3}{4}$  inch of the top with moistened, growing medium. For very small seeds, use a fine, screened medium such as a layer of fine vermiculite for the top  $\frac{1}{4}$  inch. Firm the medium at the corners and edges with your fingers or a block of wood to provide a smooth and level surface.

For medium and large seeds, make furrows 1 to 2 inches apart and  $\frac{1}{8}$  to  $\frac{1}{4}$  inches deep across the surface of the planting medium. Sowing in rows improves light and air movement. If damping-off disease occurs, there is less chance of it spreading. Seedlings in rows are easier to label and handle at transplanting than those that have resulted from broadcasting seeds. Sow the seeds thinly and uniformly in the rows by gently tapping the packet of seed. Cover the seeds lightly; a suitable planting depth is usually about two to four times the minimum diameter of the seeds.

Extremely fine seed such as petunia, begonia, and snapdragon should not be covered, but simply dusted on the surface of the germinating medium and watered with a fine mist. If these seeds are broadcast, strive for a uniform stand by sowing half the seeds in one direction, then sowing the remaining seeds in the other direction.

Large seeds are frequently sown directly in a small container or cell pack; this eliminates the need for early transplanting. Usually two or three seeds are sown per cell. Later thin them to allow only the most vigorous seedling to grow.

### **Watering**

Moisten the planting medium thoroughly before planting. After seeding, spray with a fine mist or place the containers in a pan or tray that contains about 1 inch of warm water. Avoid splashing or excessive flooding, which might displace small seeds. When the planting mix is saturated, set the container aside to drain. The medium should be moist but not overly wet.

The seed flats must remain sufficiently moist during the germination period. Excessive moisture, however, can lead to damping-off or other disease or insect problems. Place the whole flat or pot into a clear plastic bag to maintain moisture. The plastic should be at least 1 inch above the soil. Keep the container out of direct sunlight; otherwise, the temperature may increase and injure the seeds. Many home gardeners cover the flats with panes of glass instead of using a plastic bag. Be sure to remove the plastic bag or glass cover when the first seedlings emerge.

After the seeds have germinated, move the flats to a well-lighted location; the temperature should be 65°F to 70°F during the day and 55°F to 60°F at night. This will prevent soft, leggy growth and minimize disease problems. Some crops, of course, may grow best at different temperatures.

Seedlings must receive bright light after germination. Low light intensity will result in weak, spindly, pale green seedlings. Place them in a south-facing window. If a large, bright location is not available, place the seedlings under fluorescent lights. Use two, 40-watt, cool-white fluorescent tubes or special plant growth lamps. Position the plants 6

inches from the tubes and provide 16 hours of light daily. As the seedlings grow, the lights should be raised.

### **Transplanting**

As the seedling grow, they will require more space. Plants not seeded in individual containers must be transplanted. A common mistake is to leave the seedlings in the flat too long. The ideal time to transplant young seedlings is when the first true leaves appear, usually 2 to 3 weeks after seeding.

Containers should be economical, durable, and make efficient use of available space. Individual pots or plastic cell packs can be used. Another possibility is compressed peat pellets which expand to form compact individual units when soaked in water. They waste no space, do not fall apart as easily as peat pots, and can be set out directly in the garden. If you wish to avoid transplanting seedlings altogether, compressed peat pellets are excellent for direct sowing.

Dig up the small plants carefully with a knife or plant label. Let the group of seedlings fall apart and pick out individual plants. Ease them apart gently; avoid root injury in the process. Handle small seedlings by their leaves, not their delicate stems (Figure 1). Punch a hole in the medium into which the seedling will be planted. Plant a seedling at the same depth it was growing in the seed flat. Firm the medium and water gently. Newly transplanted seedlings should not be placed in bright, intense light for a few days after transplanting; shading may be needed. Keep them away from sources of direct heat. Continue watering and fertilizing as in the seed flats.

### **Hardening Plants**

Hardening is the process of conditioning a plant for growth outdoors. If plants produced inside are planted outdoors without undergoing a hardening period, their growth could be severely limited. Hardening is most critical with early spring crops, when adverse climatic conditions can be expected.

Hardening is accomplished by decreasing temperature and relative humidity gradually, and reducing water. This procedure results in accumulation of carbohydrates and thickening of cell walls. A change from a soft, succulent type of growth to a firmer, harder type is desired.

The process should be started at least 2 weeks before planting in the garden. Place plants outside in a protected area on warm days, and increase the length of exposure gradually. Do not put tender plants outdoors on windy days or when temperatures are below 45°F. Even cold-hardy plants will be injured if exposed to freezing temperatures before they are hardened.

The hardening process is intended to slow plant growth; but if carried to an extreme, significant damage can occur. For example, cauliflower will produce thumb-size heads and fail to develop further if hardened too severely; cucumbers and melons will stop growing entirely.

### **Further Reading**

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