



## Vegetable Gardening

# Growing Vegetable Seedlings for Transplanting

W. M. Colt, R. R. Tripepi and D. O. Wilson Jr.

Many Idaho gardeners prefer to grow their own vegetable seedlings because they can grow the cultivars (varieties) they want, when they want them. Growing transplants at home will also eliminate the risk of introducing "new" pests into the garden since diseases and insects are occasionally present on purchased vegetable plants. Transplanting is an important cultural practice for many vegetables because, in effect, it lengthens the available growing season, thereby allowing earlier harvest.

Seeds of some vegetable varieties germinate weakly or unevenly when sown directly in the garden, making it difficult to obtain uniform rows of seedlings. For this reason, garden space can be used more efficiently with transplants. Other benefits of transplanting include decreased damage from birds, insects, rain and weeds, elimination of thinning and more efficient use of seed. Garden vegetables most commonly grown from transplants include tomatoes, peppers, cabbage, cauliflower and broccoli, and to a lesser extent, cucumbers and melons.

## Buying Seed, Choosing Varieties

The first step in growing transplants is the most important of all: Start with fresh, viable seed from a reputable seed company, and choose varieties that are well adapted to your area. For most home gardeners, the cost of seed is small compared with the investment in land, labor and time, so buy the best seed available. Avoid "bargain" seeds because they often lead to problems that will cost you more in the long run.

Many new vegetable and flower varieties are hybrids. Hybrid seed may cost more but the extra cost is often justified. Hybrid plants usually have increased vigor, higher productivity, better disease resistance and other desirable characteristics.

## Soil for Seedlings

Soil for starting seedlings should be free of disease. You can buy disease-free commercial potting mixtures at nursery or garden supply centers. Commercial potting soils have been pasteurized to protect seedlings from damping-off, a fungal disease. This disease is caused by soil-borne organisms which cause the seedlings to rot before or shortly after emerging. If you want to prepare your own potting soil at home, use equal parts of garden soil, sphagnum peat moss and sand.

Mix the ingredients together, sift out lumps and pasteurize the mixture.

To pasteurize soil, first preheat your oven to about 200°F. Fill a container with moist, but not wet, soil and bake. The soil should reach temperatures between 160° and 180°F for at least 30 minutes. This process creates a rather unpleasant odor but is necessary to destroy soil-borne organisms. To keep the odor out of the house, you can pasteurize soil over a charcoal grill outdoors. An easy way to determine when the soil has reached the proper temperature for the necessary amount of time is to place a raw potato with the mixture in the oven or on the grill. The soil will be done when the potato is cooked. You can also use a meat thermometer to check soil temperature.

## Planting Containers

Almost any container that provides good drainage can be used for planting seeds. To avoid damping-off, use pasteurized containers, peat pots or styrofoam cups. If you use wooden boxes, flats, clay flower pots or metal containers, clean them thoroughly. Rinse them with a solution of 1 part chlorine bleach to 9 parts water. Alternatively, place containers in the oven for pasteurization at the same time as the soil. If the containers don't have holes for drainage, drill at least four holes not less than 1/2 inch in diameter in the base.

## When To Start Transplants

Two basic systems are used for starting seedlings. You can sow seeds directly in small pots or growing containers, or you can sow seeds into flats and later transplant the seedlings into growing containers. The first method involves less handling of the small plants. Beans, sweet corn and vine crops such as cucumbers, muskmelon, watermelon, pumpkin and squash must be directly seeded into growing containers since they will not survive transplanting as seedlings.

The sowing date of each vegetable is determined by the date the transplants should be set into the garden (Table 1). Cabbage, broccoli and cauliflower require 5 to 7 weeks from sowing to transplanting; tomatoes, 4 to 6 weeks; peppers and eggplant, 6 to 8 weeks, and cucumbers and melons, 3 to 4 weeks. Avoid sowing too early as this may result in tall, weak plants that grow poorly after being transplanted in the garden.

**Table 1. Starting and transplanting dates.<sup>1</sup>**

Plants	Starting date	Transplant to garden	Tolerates chilling
<b>Normally started indoors</b>			
Broccoli	March 10	April 20	Yes
Bussels sprouts	March 10	April 20	Yes
Cabbage	March 10	April 20	Yes
Cauliflower	March 10	April 20	Yes
Celery	January 10	April 20	Yes
Eggplant	March 10	May 10	No
Lettuce (head)	March 10	April 20	Yes
Onion (from seed)	February 10	April 10	Yes
Pepper	March 10	May 10	No
Tomato	March 25	May 10	No
<b>Sometimes started indoors</b>			
Bean, snap (string)	April 10	May 10	No
Beet	April 1-5	April 20	Yes
Corn, sweet	April 1-5	May 10	No
Cucumber	April 10	May 10	No
Endive	April 1-5	April 20	Yes
Kale	March 20	April 20	Yes
Kohlrabi	April 1-5	April 20	Yes
Melons	April 1	May 10	No
Parsley	February 10	April 20	Yes
Pumpkin	April 10	May 10	No
Squash	April 1	May 10	No

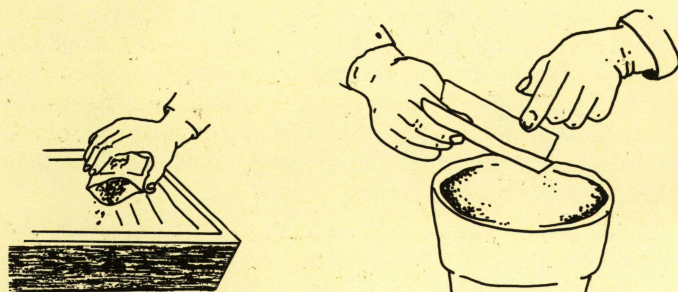
<sup>1</sup>Dates are for the Boise-Caldwell-Nampa area. Adjust transplanting date to last killing frost date and according to the amount of frost risk you are willing to take to increase the chance of an earlier harvest.

## Planting

Before planting, treat seeds with a fungicide such as Captan or Thiram. Open a corner of the seed packet and insert a small amount of the fungicide (about as much as you can pick up on the tip of a pocket knife). When using fungicides, always read and follow label instructions carefully! Also check the seed packet instructions to see if the seedlings will tolerate the fungicides.

Fill the planting container with growing medium, press it down firmly and level it about 1/4 inch from the top. You can sow seeds directly from the packet. Open one end and tap the packet so the seeds slowly shake out (Fig. 1). You can also use a V-shaped trough, folded from a piece of heavy paper (Fig. 1). Don't overcrowd by sowing seed too thickly. If you are using individual pots, usually you will place two or three seeds in each in case some fail to germinate.

Determine the planting depth by the seed size. A good rule is to plant seeds at a depth two to three times their minimum diameter (Fig. 2). Broadcast small seed on the surface of the germination medium and cover them with a thin layer of medium or fine peat moss. Sift the medium with window



Directly from packet

From V-shaped paper

**Fig. 1. Methods of sowing seed.**

screening (Fig. 3), a sieve or a flour sifter. Plant larger seeds in shallow furrows if you are using flats, or scatter them on the surface if you are using pots. Cover seeds to the proper depth by sifting some of the growing medium over them. A furrow maker will provide uniform depth and spacing if you are planting in flats (Fig. 4). Furrows should be spaced 1 1/2 to 2 inches apart. Always label your containers with the plant name and the planting date.

## Watering

After you have sown the seed, wet the germination medium with lukewarm water. Use a fine mist spray or place containers in a pan or tray with about 1 inch of warm water in the bottom. Remove them when the soil surface becomes moist. The water in the tray should not be so deep that it spills over the top of the flats or pots.

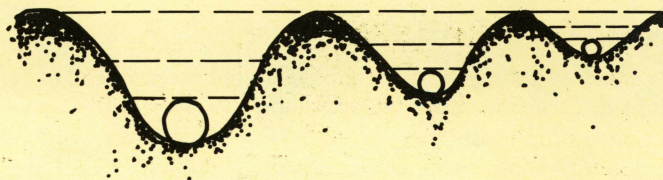
Although too frequent watering may cause seeds to rot, infrequent watering can delay emergence of small seeds or even cause the death of germinating seeds. Do not allow the soil surface to dry out completely, especially if small seeds are sown on or near the surface.

The best situation, of course, would be to have the seeds remain sufficiently moist during the germination period without having to add more water. One way to achieve this is to cover the whole flat or pot with a clear plastic bag or a pane of glass after the initial watering. The covering material keeps moisture in and keeps disease organisms from entering. The seeds should not require any further watering until they have germinated. Most seeds, except lettuce, do not require light to germinate.

## Seed Germination

Flats or pots should not be exposed to temperature extremes. This is especially important from planting until the first true leaves appear. Temperatures between 70° and 80°F are ideal for species with cold sensitive seedlings (Table 1). A supplemental source of heat may be necessary to maintain this temperature range, especially at night. A cold draft from a window can be deadly.

Species not sensitive to cold damage generally grow best between 60° and 70°F and usually will not be damaged if the temperature dips down near freezing occasionally. Try to avoid sudden changes in temperature since plants become adapted to their growing conditions (see section on hardening). Never place glass- or plastic-covered containers in direct sunlight because they could become too hot and kill the seeds or young seedlings.



**Fig. 2. Planting depth.**

Check daily for germination and remove the glass or plastic as soon as the seedlings have emerged. If the seeds are germinated in a shady location, gradually move the pot or tray into full sun. Direct transfer from shade to sun may result in burning of the leaves.

## Caring for Seedlings

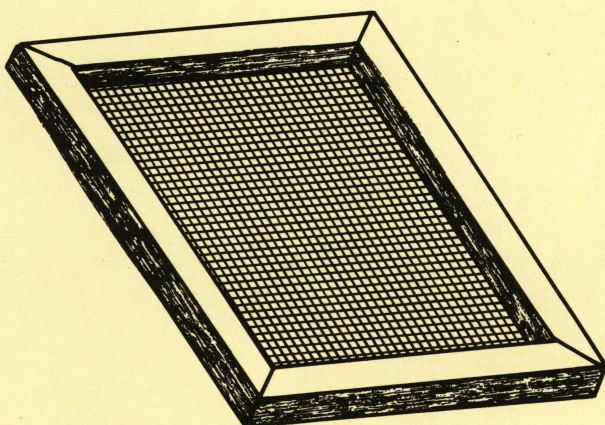
Seedlings will require frequent watering after the covers are removed from the containers. They will also need to be fertilized. Do both of these jobs at the same time by watering with a solution of 1 tablespoon of a soluble fertilizer per gallon of water. Place the flats or pots in a shallow tray of the solution, and remove them when you see moisture on the surface. You can also water with a rubber-bulb syringe that sprays a fine mist, or by pouring the solution into a small flower pot buried in the center of the flat.

You may need to provide supplemental light for the seedlings. A window that receives sunlight only part of the day will not furnish enough light to grow the best quality plants. South-facing windows probably will provide adequate sunlight. Cool-white fluorescent or plant-grow lamps placed 12 inches above the plants will provide the additional light necessary to prevent seedlings from becoming tall and spindly. Use this supplemental light for 12 to 18 hours per day. To ensure the proper light duration, connect the light to a timer.

## Transplanting and Thinning Seedlings

When the second pair of leaves (the "true" leaves) appear, replant seedlings that were germinated in flats to small pots or other flats that will allow them ample space for development. You can transfer the seedlings to anything from peat pots to paper cups, though the latter must have a drainage hole. To replant, dig up the small plants with a knife or spatula and separate the seedlings. Be sure to avoid damaging the roots (see Fig. 5). Poke a hole in the soil mix in the flat or individual containers and plant the seedling. Transplant young seedlings slightly deeper than they were growing in the flat. Firm the soil around the seedling and water gently.

If seeds were sown directly into peat containers, you will need to thin to one seedling per pot. Do this by using a razor blade to cut off all but the most vigorous plant at the soil line. Don't pull the extra seedlings. That could damage the root system of the one that remains.



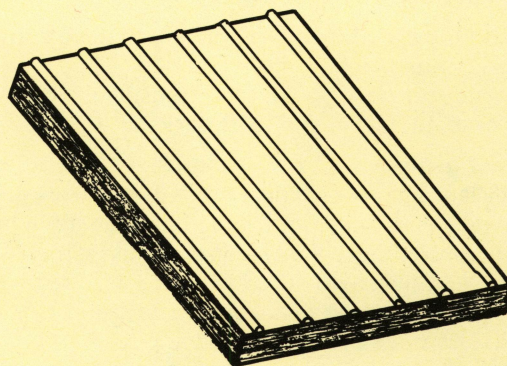
Make a sifting screen by attaching window screen to a wood frame.

Fig. 3. Sifting screen.

## Hardening Transplants

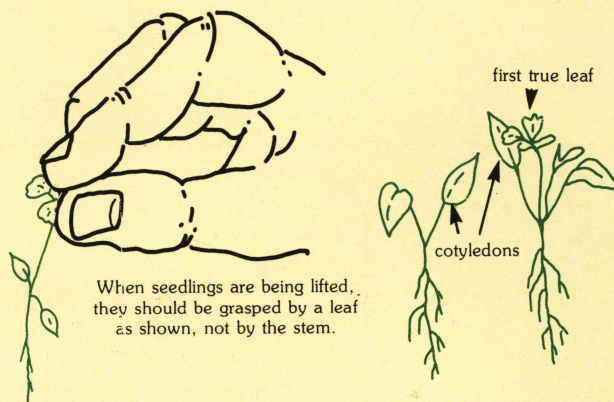
Before planting them in the garden, gradually "harden" or toughen the transplants. About 2 weeks before transplanting date, gradually withhold water, but don't let the plants wilt. Place the plants outdoors a few hours each day to expose them to outside temperatures and direct sun.

Gradually increase the length of exposure as planting time approaches. Avoid fertilizing during this period. Size of the vegetable seedling when it is transplanted affects the total yield of the plant. Best results are obtained from relatively small, stocky plants that have only 5 to 7 leaves. As a rule for fruiting vegetables such as tomatoes, peppers and eggplant, transplants that have not begun to flower will produce a greater yield and better quality fruit than larger, older transplants.



Make a furrow maker by nailing 1/4-inch dowels to a piece of wood. Space dowels 1 1/2 to 2 inches apart. Make it any size that works with your flats.

Fig. 4. Furrow maker.



When seedlings are being lifted, they should be grasped by a leaf as shown, not by the stem.

The first leaves that appear on many seedlings are the cotyledons. When the first true leaves appear, use a pencil to lift the seedlings for transplanting. Don't expose the roots to air any longer than needed.

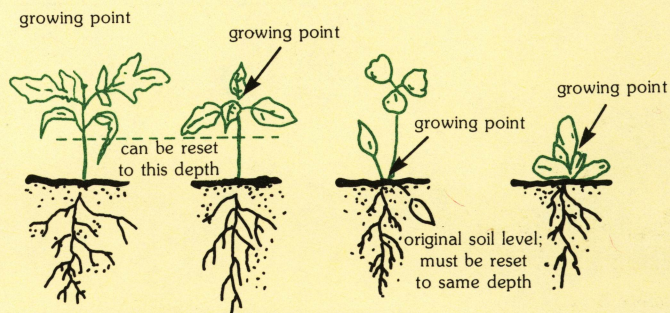


Fig. 5. In transplanting seedlings into flats, place the growing point (where leaves originate) on top of the soil level.

## Cold Frames or Hotbeds

You can use a cold frame for growing transplants, although it is a good idea to keep the seeded pots or flats indoors until seedlings emerge. The cold frame also provides an ideal transition between indoors and the garden since the plants gradually harden off in the cold frame while being protected from sudden drops in temperature. A cold frame is simply a glass or plastic covered box, heated only by the sun.

## Trouble Shooting

What if you are having problems growing good transplants? What should you do? First, check the following list of possibilities. If you continue to have difficulty, call the Extension agricultural agent in your county.

1. **Tall spindly plants** — Be sure you have enough light. If so, your plants may be shaded. They also may be spaced too closely. Thin the transplants to the spacing recommended on the seed package if necessary.
2. **Slow growth** — Possible causes are lack of fertility, insufficient light, cool temperatures or poor root growth due to wet soil. If water and light are adequate, a boost with any soluble houseplant fertilizer should stimulate growth. Wet soils, which do not allow the roots to receive enough air, are caused by overwatering or using heavy potting soils. Improve drainage by adding sand or perlite to the mix before sowing or transplanting. Make sure all containers have proper drainage holes in the bottom.
3. **Chlorosis (yellowing)** — Healthy leaves are green because they contain green chlorophyll pigments. When chlorophyll is not produced in sufficient quantities, leaves appear yellow. Plant growth is also slow because of insufficient nitrogen. Weekly applications of a 20-20-20 fertilizer or any soluble houseplant fertilizer should correct the problem. Be sure to follow the directions on the fertilizer label.
4. **Damping-off** — Poorly drained soil or excessive watering may result in a girdling of the seedling stems at the soil line. This problem is caused by several fungal organisms which are common in all soils but are usually more of a problem under cold, wet conditions. Full sunshine and well-drained potting soil usually minimize the growth of these organisms. A suitable fungicide, such as Captan, can be mixed with water and used as a drench over the young seedlings if the problem is severe. Be sure to follow the directions on the fungicide label. Pasteurization of the soil, discussed earlier, and thorough cleaning of the container, tools, etc., will also help prevent damping-off of seedlings.
5. **Emergence failure** — Sometimes a large fraction or all of the seeds die in the soil. The most common causes of this kind of failure are poor quality or old seed, improper amount of soil moisture and exposure to temperature extremes. Rapid damping-off before emergence can also contribute to this problem.

### The Authors

W. M. Colt is Extension horticulturist and D. O. Wilson is assistant professor and seed physiologist, both at the University of Idaho Southwest Idaho Research and Extension Center, Parma. R. R. Tripepi is assistant professor and horticulturist, Department of Plant, Soil and Entomological Sciences, Moscow.