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Starting Vegetable Transplants

Introduction

Before learning how to grow vegetable transplants, let's consider why it's a good idea to start vegetable plants indoors. There are several reasons for raising seedlings indoors before transplanting them later to the field. These reasons include the following:

- For seeds that are expensive, such as many of the newer hybrids, seeding indoors to raise transplants conserves seeds. There is a higher germination rate, and more high-quality plants can be produced in a greenhouse under controlled environmental conditions.
 - Starting seeds indoors extends the growing season. This is important for early yields, since plants can be ready to set out immediately after reasonable risk of frost is past.
 - Earlier harvest is more attainable by using transplants than by direct seeding in the field. Generally, an earlier harvest is more valuable to the market. Costs associated with raising transplants can easily be recouped.
 - Since any variety of seed can be ordered for transplant production, a grower has a much wider selection of varieties. The choice of varieties of commercially available transplants is limited to the most popular varieties.
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Quality Transplants

Transplants of high quality should exhibit certain characteristics. They should be mid-sized, have a healthy, green appearance, and not be tall or leggy. It is best if they are not yet flowering, since this tends to stress plants following transplanting. Flowering plants often will lose blossoms after transplanting. Be sure that transplants have no insects or diseases on them, so that plants will have a better chance to get off to a good start.

Structures for Raising Transplants

Greenhouses

The best structure for starting vegetable transplants is a greenhouse. The greenhouse should be located in full sun in an area with good drainage. It should be oriented in a north-south direction to minimize the effects of shading from the greenhouse frame.

Inexpensive, plastic-covered structures are fine. Although glass-covered greenhouses are excellent, they are much more expensive to construct and require more fuel for heating. Plastic-covered

greenhouses are less expensive, but they have to be re-covered periodically as the plastic film wears out. Use of a 3-year greenhouse film with ultraviolet (UV) inhibitor is recommended.

Seedlings grown in the late winter will need both heat and ventilation, so include a heater, fans, and vents. Even in cool winter months, ventilation will be needed to keep the temperature down on sunny days. A fan and louver system should be thermostatically controlled. To be sure that louvers open before fans come on, the louver thermostat should be set at a lower temperature. If you will be using more than one fan, set up the environmental control to provide two or more stages of cooling (one fan turned on at a time).

For more information on greenhouse environmental control, see Extension Publication 1879, [*Environmental Control for Greenhouse Tomatoes.*](#)

Hotbeds

An alternative to using a greenhouse to start transplants is to use a hotbed. A hotbed is similar to a cold frame, except that it has a source of heat. Either electric heating cables or a hot water recirculation system can be used to distribute heat evenly in the plant bed. Or, a small heater and blower can be installed inside the hotbed. Heat must be evenly distributed in the hot bed to avoid parts of it getting too hot and parts of it getting too cold.

Seeds

Use new seeds or seeds that were stored properly. Using poor or old seeds limits your yield potential and income at the onset. If storage of seeds is necessary, use zip-lock bags. Push the air out of the bag and then freeze. Seeds need a cool, dry place to retain viability.

Choose varieties that will both produce well and sell well in your area. Hybrid seeds are more expensive than open-pollinated varieties. For example, hybrid tomato seeds may cost 2¢ per seed (\$3,000/lb), while open-pollinated tomato seeds may cost \$40 per pound. (1 lb of tomato seed is about 150,000 seeds.)

Hybrids have several important advantages:

- greater vigor
- better uniformity
- higher yield
- improved disease resistance

Seeds from hybrid varieties should not be saved from mature fruit -- they will not be true to variety.

Containers

There are a wide variety of containers available for starting seeds for transplants. Most growers start seeds either in flats or in cell packs.

Flats can be of plastic or wooden construction. The main advantage of using flats is that more

plants can fit into the same space if plants are in flats. However, if you start seeds in flats, you will need to transplant to larger cell packs or to individual pots as the seedlings get bigger.

Seeding directly into cell packs saves time, because transplanting into a larger container later is not necessary. Cell packs come in many different cell sizes; the overall tray size is standardized. For tomatoes and peppers, 72-cell packs work well. For larger-seeded vegetables, such as cucumbers, squash, and watermelons, 48-cell packs work better.

If simple 4 X 8 foot benches are constructed, 16 standard flats or cell pack trays (21 inches X 10 3/4 inches) can fit on top in two rows.

Other types of containers include clay pots, plastic pots, peat pots, and compressed peat pellets.

Peat pots are containers of peat moss compressed into the shape of a pot. These are convenient since the entire pot can be planted in the ground. This is an excellent system, since there is minimal root disturbance. However, peat pots are more expensive per unit than cell packs or flats.

Peat pellets are compressed circles of peat that swell to form cylindrical containers when wetted. Seeds can be planted directly into a small hole in the top. These pellets also can go directly into the outside soil. Peat pellets are more expensive than peat pots.

If transplanting into plastic or clay pots, pots should be 2 1/4 inches square or larger to promote early yield.

Growing Medium

It is essential that the growing medium be clean of diseases, insects, and weed seeds. In addition to being clean, the medium needs to be loose, well-drained, and fine-textured. The best growing medium will have the best combination of good moisture-holding capacity, good drainage, and high nutrient retention capability.

It is too risky to use outside soil for raising transplants for commercial vegetable production. If soil is contaminated, seedlings may be lost to disease. Use a commercially prepared seedling mix. It is worth the cost of commercial media to ensure that the seed germination rate is high and that the quality of the seedlings is excellent.

Most growing media consist of varying proportions of peat moss, vermiculite, and perlite. They also may contain limestone and a wetting agent. Some media are "charged" with nitrogen, phosphorus, potassium, and some micronutrients, as well. A simple homemade medium mixture can be prepared in the following proportions: 1 gallon peat moss, 1 gallon vermiculite, 1 tablespoon superphosphate, and 2 tablespoons ground limestone.

Always be careful not to contaminate your growing medium after opening (or mixing) it. Do not dump it on the ground or floor unless a sheet of heavy plastic is placed under it. Also, be careful to keep any tools or implements clean. Damping-off organisms are common and can destroy seedlings.

Tools and other items can be sterilized using a mixture of 1 part bleach to 9 parts water. It is important to note that in sterilized growing media, reintroduced diseases can spread faster than in unsterilized media, since there is no competition among pathogens.

Generally, it is safest to use new plastic flats rather than to reuse them.

Seeding

After choosing the type of container for starting seeds, fill the containers with a clean medium. Do not fill them to the top -- leave room for a little water to sit on top of the growing medium.

If using open flats, use a board to "screed" the medium across the top to make it level. Make shallow rows about 2 inches apart in the flat, or broadcast seeds over the entire flat. Try to sow seeds as uniformly as possible.

Label the flats, cell packs, or pots with the variety, if using only one variety, and the date of sowing; if there is more than one variety, label the rows with row markers.

Be sure that containers drain well. Plants should never be in standing water. If you have trays under flats, they should be slitted so that they can drain easily. Standing water promotes damping-off diseases.

Larger-seeded plants, such as squash, cucumber, and watermelon, grow best if seeded directly into cell packs, peat pots, or pots. Sow two seeds per cell or container and later eliminate one.

Generally, seeds should be planted at a depth equal to about two times their diameter.

Fertilizing Seedlings

Most commercial mixes do not contain fertilizer; a few contain small amounts. Do not assume that the commercial medium is "charged" with fertilizer unless there is a guaranteed analysis on the label.

Even if using a commercial mix that is "charged," additional fertilizer will soon need to be added, since the initial charge is short-lived. Seedlings will need to be fertilized as soon as they emerge. A 20-20-20 highly soluble greenhouse fertilizer is appropriate. Follow closely the dilution recommendation on the bag. Overfertilizing at this point can injure seedlings or promote damping-off disease. Fertilize two to three times per week with the liquid solution.

Watering

It is best to dampen the growing medium thoroughly before sowing seeds. This will ensure good distribution of water throughout the container while minimizing the chance of washing or splashing small seeds away.

Water freshly seeded flats or trays gently. A strong force of water is likely to wash the seeds out of the growing medium.

Watering should be evenly distributed across the flat. There is a tendency to miss the corners of flats, especially at the corners of benches.

Little water is needed before seedlings emerge. Too much water will promote damping-off organisms. Once seedlings emerge, check them for dryness at least two or three times per day and water as needed. Never allow seedlings to wilt.

Temperature Control

Following are some temperature guidelines for commonly transplanted seedlings:

Tomato and Pepper

Heater thermostat settings:

Start seeds at 65 - 75 °F.

After emergence, lower temperature to 60 - 65 °F.

Fan thermostat settings:

Day temperature can be about 10 degrees warmer than night temperature.

Do not allow the greenhouse to get too hot. Turn fans on at 75 - 80 °F.

Too high a temperature will produce leggy plants.

Cabbage, Broccoli, and Cauliflower

Heater thermostat settings:

Seeds should be started at 55 - 60 °F.

After emergence, 55 °F is fine for cole crops.

Fan thermostat settings:

Day temperature can be about 65 °F for these and other cool-season crops.

Root zone heating is another method to stimulate quick germination. Flats can be set on electric heating pads or on benches with recirculating hot water pipes.

Light

Flats that have just been planted need no light until plants emerge. Once there is any emergence, full light should be made available. Supplemental light is not necessary.

Transplanting to Larger Containers

If seeds are sown in flats, they will need to be transplanted into larger containers. When seedlings have at least one pair of true leaves, pull them out by the leaves and transplant them into individual cells or small pots.

Seedlings can be removed with a knife, with a wooden label, or with your fingers. Do not allow

seedlings to get too crowded in flats before transplanting them, as this will affect their growth.

Poke a hole in the growing medium of the new container and set seedlings in at the same depth at which they were already growing. If seeds were sown in individual containers, at this time, thin to one seedling.

Water seedlings in soon after transplanting or thinning.

[Table 1](#) shows the relative difficulty of transplanting various vegetables. For those that are particularly difficult to transplant, it is better to seed them in individual containers or cells rather than to start them in flats and later move them to larger containers.

Table 1. Relative difficulty in transplanting various vegetables.

Easy to transplant	Medium difficulty	Difficult to transplant
broccoli	cauliflower	cucumber
brussels sprouts	celery	muskmelon
cabbage	eggplant	squash
lettuce	onion	watermelon
tomato	pepper	

Timing

The approximate length of time from seeding to transplanting is shown in [Table 2](#).

Table 2. Approximate length of time needed to grow vegetable transplants for the field.

Cool-season crops (broccoli, cabbage, cauliflower, head lettuce)	8 - 10 weeks
Warm-season crops (tomato, pepper, eggplant)	5 - 7 weeks
Vine crops (muskmelon, watermelon, squash, cucumber)	3 - 4 weeks

[Table 3](#) indicates probabilities for when the last spring frost is likely to occur.

Table 3. Statistically derived last frost dates for spring planting in Mississippi.

This table shows the probability that a freeze will occur on or after the dates indicated. For example, in Canton, there is a 90 percent probability that the last freeze will occur on or after March 12. However, there is still a 50 percent chance of a frost on or after March 25 and a 10 percent chance of a frost on or after April 7. This historical data and your personal risk tolerance can be used to help decide when to set out transplants.

District and Location	90%	50	10%
Upper Delta			
Charleston	3-20	3-29	4-12
Clarksdale	2-25	3-15	4-03

Cleveland	3-11	3-26	4-10
Rosedale	3-04	3-20	4-06
North Central			
Batesville	3-24	4-04	4-14
Hernando	3-12	3-26	4-10
Holly Springs	3-26	4-05	4-15
University	3-23	4-05	4-19
Water Valley	3-24	4-04	4-15
Northeast			
Booneville	3-20	4-01	4-14
Corinth	3-22	4-03	4-16
Tupelo	3-15	4-01	4-18
Lower Delta			
Belzoni	2-28	3-16	4-01
Greenville	3-02	3-18	4-02
Greenwood	3-02	3-17	4-02
Moorhead	3-06	3-23	4-10
Stoneville	2-28	3-18	4-05
Yazoo City	3-03	3-21	4-08
Central			
Canton	3-12	3-25	4-07
Eupora	3-21	4-03	4-15
Forest	3-12	3-27	4-12
Kosciusko	3-15	3-29	4-12
Pickens	3-14	3-26	4-07
East Central			
Aberdeen	3-17	3-30	4-12
Columbus	3-11	3-27	4-11
Houston	3-23	4-04	4-16
Kipling	3-21	4-03	4-16
Philadelphia	3-19	3-31	4-12
State University	3-02	3-20	4-07
Southwest			
Brookhaven	2-27	3-13	3-27
Liberty	3-06	3-21	4-04
Natchez	2-10	3-10	4-07
Port Gibson	3-10	3-24	4-07
Vicksburg	2-18	3-13	4-04

Woodville	2-20	3-11	4-30
South Central			
Collins	3-07	3-25	4-11
Columbia	3-03	3-19	4-03
Monticello	3-10	3-25	4-09
Tylertown	3-05	3-21	4-06
Southeast			
Bay Springs	3-06	3-20	4-04
Hattiesburg	3-06	3-17	4-03
Laurel	2-25	3-12	3-26
Newton	3-19	4-01	4-14
Meridian	3-12	3-27	4-12
Russell	3-10	3-25	4-09
Coastal			
Bay St. Louis	1-24	2-20	3-20
Biloxi	1-25	2-20	3-18
Gulfport	1-29	2-22	3-17
Picayune	2-17	3-08	3-28
Poplarville	2-11	3-03	3-23
Wiggins	2-23	3-14	4-02

Diseases

Overwatering is the most common problem with seedlings. Plants that have too much water applied, or that have "wet feet," have a tendency to get damping-off diseases. The primary symptoms are that plants fall over from the base of the plant and seedlings often develop a lesion near the base of the stem. If there are only a few sick seedlings, remove the affected plants and discard them.

Excess water in flats, standing water under flats, poor light, and high temperatures stimulate disease in seedlings. For information on controlling seedling disease, refer to Extension Publication 554, [*Disease, Insect, and Nematode Recommendations for Commercial Vegetables in Mississippi*](#).

Hardening Plants

Hardening is the process of gradually acclimating tender plants to the outside environment. Harden plants for about 2 weeks before planting in the field. At first, move the plants to cooler outdoor temperatures in a shady location. Gradually move plants into the sunlight for a few hours each day. Do not try to harden tender transplants outdoors on windy days or when the temperature is below 45 °F. Reduce the water supplied, but do not let the plants wilt.

Transplanting Outside

Water plants before transplanting! Their root systems will take a while to develop sufficiently to "forage" for water on their own.

The best time to transplant is in cloudy and cool weather. This kind of weather will help to reduce transplant shock.

Minimize root disturbance! As the root ball is broken, thousands of tiny root hairs are broken off. Much of the water uptake is through these tiny roots, so it is best to keep them intact. Carefully remove seedlings from their containers, keeping as much growing medium around roots as possible. Handle the seedlings carefully. Don't drop them into the holes for later planting.

According to some new research in Florida, tomato and pepper transplants will benefit from planting up to the first true leaves rather than at the same depth as they were in the cell packs. This leads to higher early yields. Tomatoes, if leggy, should be planted even deeper, because the stem will develop adventitious roots along the stem. Other types of vegetables should be planted at the same depth that they were in the rooting mix.

Plants in peat pots or peat pellets can be planted directly into the ground. However, tear off the bottoms of the peat pots. Be sure to bury the upper edges of peat pots so that water is not lost through the exposed edges; if the edges of peat pots are left exposed, seedlings may dry up on hot or windy days.

Starter Solution

When transplanting to the field, water plants soon after transplanting, using a starter solution. This is a fertilizer solution that is high in phosphorus. Apply about 1 cup of starter solution to each plant immediately after setting it into the ground.

A starter solution can be made by mixing 1 tablespoon per gallon of a 10-52-17 fertilizer. For larger quantities, use 3 pounds of 10-52-17 in 50 gallons of water.

Using a starter solution will help to overcome transplant shock and get young plants off to a good start. Since root systems are not yet very developed, putting a soluble fertilizer within easy reach of the root ball helps to make nutrients easily available to the plant.

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