

Starting the Garden with Transplants¹

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Starting vegetables, such as peppers and tomatoes, in the garden as transplants rather than seeding directly into the garden row is a common practice. Some plants can become stressed if they are disturbed after they germinate, while others thrive. This publication provides considerations and best practices for selecting the best crops to transplant and how to prepare transplants for home and community gardens.



Figure 1. A potting bench with some supplies typically needed for producing transplants, including potting media, seeds, trays, and labels.

Credits: Lisa Hickey, UF/IFAS

Advantages

Selecting seeds and germinating them in advance for transplanting into your garden is easy as long as you follow a few key guidelines. Using transplanted vegetables has many benefits compared to planting seeds directly into the garden. When using transplants, or starts, the main benefits are:

- 1. Avoiding adverse weather**—Sow seeds indoors or under a protective structure during cool weather, then move outdoors when weather warms up. Heating mats can also be used to facilitate faster and greater germination of seedlings. For those gardening in the southern portions of the state, heavy rain and wind conditions damage directly sown seeds and newly sprouted seedlings.
- 2. Achieving earlier and higher yields**—Transplants give higher early yields, and, in the case of watermelons, give larger fruits. Warm-season crops can establish early and get a head start during cool weather. Cool-season crops, such as lettuce and crucifers, can be started in a sheltered area, transplanted into the garden in the spring after the risk of frost has passed, and harvested before the daytime temperatures get too hot. Excess heat and cold can change the flavor and appearance of vegetables and reduce their yield.

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3. **Avoiding insects and diseases**—Young plants are susceptible to damage from insects and diseases; transplanting allows plants to develop their defense systems before introducing them to the garden.
4. **Avoiding weed competition**—Directly sown seeds can compete with weed seeds during germination, while transplants in a planting pot or seed flat are growing in a weed-free environment.
5. **Catching up**—If you are starting your garden late, purchasing transplants allows you to catch up compared to direct seeding.
6. **Choosing the best plants**—Because seed flats produce many more plants than needed, only the very best quality plants should be selected for transplanting in the garden. If you have leftover healthy seedlings, keep them for a week or two just in case you need to replace damaged plants in the garden.
7. **Obtaining a small number of plants**—When only a few plants are needed, these may be purchased from a nursery or grown in seed flats. Young plants are typically less expensive than larger, older plants. Examine plants carefully and select plants that look healthy. Avoid plants with wounds (such as torn leaves and broken stems) because they are entry points for plant pathogens that cause disease. Also avoid plants with leaf spots or insects on any part of the plant, including under the leaves.

Disadvantages

The main disadvantages are:

1. **Spending money**—Transplants can be produced with materials found at home, but sometimes a trip to the store is needed if your supplies are low. There are many products available for gardeners who transplant, and it is tempting to spend more money than necessary. Gardening can be fun on any budget. Many counties have seed-saver clubs and give away, trade, or sell seed for a small donation. Seed can be planted in paper cups using soil from the yard.
2. **Cleaning**—Cleaning and sanitizing containers and tools takes time, and both steps are needed. If you recycle pots and trays and clean them with a brush and water but do not properly sanitize them, they may harbor harmful pathogens that can damage or kill your transplants. Some disease-causing organisms such as *Botrytis* and *Pythium* infect transplants but don't start causing big problems

until they get to the garden and infect surrounding plants. Gardeners that use containers made of porous material, such as wood or Styrofoam, should take extra care to remove all debris from the many small holes and sanitize as described below. When in doubt, the extra cost of a tray or a fresh bag of media can often be justified with fewer disease problems, better yields, and an earlier harvest.

3. **Grazing**—In addition, the sudden appearance of young, tender plants can be the perfect meal for deer or rabbits. Be mindful of wildlife and cover young transplants at night with netting or a lightweight bedsheet to discourage grazing.

Which Vegetables to Transplant

Certain vegetables may be transplanted with ease, others require more care to transplant successfully, and some may not be transplanted unless they are kept in their biodegradable containers. Table 1 provides recommendations for the best planting strategy for common garden vegetables. More about seed selection can be found in EDIS article HS506, *Seeding the Garden* (<https://edis.ifas.ufl.edu/vh026>). Most plants are ready for transplanting into the garden four to six weeks after seeding. Refer to local variety and planting date recommendations in the *Florida Vegetable Gardening Guide* (<https://edis.ifas.ufl.edu/vh021>) and count backwards in the calendar to determine when to seed vegetables into containers. For example, in central Florida, gardens are planted in late February through early March, after the risk of frost has passed. Therefore, seed transplants four to six weeks earlier than your ideal plant date.

Containers for Transplants

Once you have selected your vegetable varieties, you will have to decide which containers to use. Select containers that are an appropriate size for your transplants. Containers that are too small dry out quickly and can cause large transplants like tomatoes to become root bound. Containers that are too large need more media and can retain excess water. If you plan on using transplant containers again, select materials that are easy to clean and sterilize.

Plantable Containers

Many of those listed above in the “Difficult to transplant” category in Table 1 may be seeded and planted directly in the garden in plantable containers. These containers are designed to protect root systems of plants that can be finicky to transplant and will decompose in the garden soon after planting. Materials such as coconut coir, peat,

rice hulls, paper, and similar fibrous materials are pressed into pots and are available in a variety of shapes and sizes (Figure 2). Gardeners can also make their own containers out of paper with creative folding or a pot shaper. Fill with soil or media, sow seed, and transfer the entire container to the garden when ready. Because decomposition is a biological process, the rate your pot will decompose at depends on its materials and method of manufacture, soil chemical, physical and biological properties, temperature, and moisture (Nambuthiri et al. 2015). If the pot seems rigid at transplanting, it may be useful to score or slice the bottom and sides of the pot (try not to damage the roots) to allow roots of tender crops and herbs to reach garden soil faster.



Figure 2. Transplant containers: (left) Korist, a cultivar of kohlrabi, in plantable peat containers pressed to form a 128-cell tray and (right) Kale seeded to a 128-cell plastic tray. Both crops are seeded in a peat-perlite-vermiculite media mixture. These size trays work well for community gardens or for gardeners who plan to plant one crop sequentially.

Credits: Lisa Hickey, UF/IFAS

Instead of using potting mixture or sterilized soil, another option is a peat pellet. A peat pellet is a compressed mixture of peat and nutrients about the size of a jar lid, often wrapped in a fine net to retain its shape when wet. When placed into water, it expands to form a planting pot soft enough to insert a seed. Manage these like peat pots.

Not all containers made of natural materials are designed to be planted into the garden. Some can be composted in the home garden, but others require municipal recycling or aren't recyclable at all. Follow the manufacturer's instructions, and if in doubt leave it out. It is better to remove the plant from the container than limit root growth.

Seed Trays and Pots

A seed flat, or tray, is about the most practical way for a home gardener to start a small number of plants and works best for plants in the “Easy to transplant” and “Transplant with care” categories. A variety of seed flats are available to use in the garden. Flats can have one large area, or they can be divided into smaller “cells” or individual spaces for

plants (Figure 2). Cells come in a variety of shapes (round, square, and cone), but cell size matters the most. Cell size is indicated by the number of cells in a tray. A “252” tray contains a tray with 252 cells that are 1 inch square each. Most gardeners will select trays with larger cells. Look for trays with 72 cells (each cell is 1.5 inches square and 2.25 inches deep) or 32-cell trays that are 2 inches square and 2 inches deep. Larger cell sizes can accommodate larger transplants and therefore are recommended at the start of the season to ensure a sturdy transplant during temperature transitions. Any small, shallow, wooden or plastic box can be used as a seed flat; however, the 3-to-5-inch-deep, 12-inch-wide, and 18-inch-long flat is most convenient. Many commercial transplant producers use lightweight and sturdy polystyrene trays (i.e., Styrofoam). These are also available for gardeners but can be hard to sterilize. Plastic inserts are available for polystyrene trays; these inserts are easier to clean and can extend the life of the tray.

Avoid materials that conduct heat, like metal or glass. It should not be too heavy to move easily when the soil is moist. Small open spaces in the bottom are needed to provide drainage. Cheesecloth or newspaper may be placed in the bottom of a large tray before adding soil or media to prevent media from dropping through drainage holes, while allowing water to pass through. Trays can be placed on a shallow pan to catch excess water.

Cleaning and Sanitizing Flats and Pots

Containers can be reused if properly cleaned and sterilized. First, remove all surface dirt with a scrub brush to eliminate any deposits or debris that may harbor disease-causing organisms, and rinse well with clean water. Clean containers with soap, preferably a natural glycerin or castile soap made for washing skin or dishes, and rinse well. If possible, avoid liquid soaps with fragrances, dyes, preservatives, and phosphates; these ingredients aren't necessary to obtain good results, and phosphate is harmful to the ecology of Florida's water systems. To sanitize containers, soak them in a chlorine bleach solution (1 part plain bleach to 9 parts water) for at least 10 minutes, followed by a thorough rinse (Denhard et al. 2013). You can also use this method for tools.

Selecting and Preparing Soil and Media

Transplants need a growing medium that is lightweight, will retain air and water, and will allow tender roots to expand and develop. A potting soil mixture can be purchased commercially or made by mixing ingredients using your own recipe. Potting soil is typically a combination of peat, sphagnum moss, perlite or vermiculite, and pine bark fines (partially composted bark pieces that range from ¼ to ½ inch). Use a potting mixture rather than garden soil or topsoil in transplant pots. Garden soil can work, but unless it is sterilized first, it may harbor harmful plant pathogens. A mixture made of equal volumes of sterilized soil or commercial topsoil, perlite, and peat or coconut coir can be used.

- Vermiculite and perlite are silica-based minerals that are superheated until expansion, much like popping corn. Both add essential aeration to potting mixes.
- Pine bark fines will retain too much water if used alone and should be combined with one part perlite or vermiculite to two parts pine bark fines to ensure good drainage and airflow.
- Coconut coir is the shredded husk of coconuts and can also be used as an ingredient in potting mixtures instead of peat. Select finely shredded fibers (also called pith) labelled for starts. Coir is pH neutral, while peat can be slightly acidic. Coir is easier to hydrate and can retain more nutrients than peat moss. Both coir- and peat-based mixtures provide good results.

If sterilization is necessary, prepare your media mixture by removing old plant material, plastic, and other contaminants that could catch fire in your oven. The soil should be moist but not wet. Place the soil in an oven-proof container around 4 inches deep and cover the container with foil. Insert a heat-proof thermometer through the foil and into the soil to monitor the temperature. Put the container in an oven set to around 200°F. Once the soil reaches a temperature of 140°F, maintain a temperature of at least 140°F to 180°F for 30 minutes (Agrios 2005; Harmon and Bledsoe 2004). Most organisms that cause plant disease (fungi, bacteria, most viruses, and insects) are killed in this temperature range (Agrios 2005). Don't let the soil get hotter than 200°F, and cool completely before using.

Place containers on an old cookie sheet or lunch tray for drainage and transport. Fill the containers to the top with the growing mix, press down lightly and level with a board. A mixture that is very dry or contains peat that has dried

out will repel the water. Slowly moisten the filled flat with water and let drain. The moistening step should be repeated until the entire mixture in each cell is damp. Another method is to dampen the mixture prior to loading it into the seed flats; this helps water to adhere more easily to the premoistened mixture. After watering, the surface should settle to just below your seed tray top.

Seeding the Containers

Follow the instructions for seeding rates and spacing on your seed package. Broadcast tiny seeds over the surface and press them gently into the surface. There is no need to cover them with additional soil or media. For larger seeds, make furrows in the seed flat ¼ inch deep and two inches apart; cover seed and press until firm.

Warmth and humidity are essential for good germination. Place a lightweight material that allows airflow, such as a few sheets of newspaper, over the flat until seedlings begin to emerge. Some gardeners prefer to create a mini greenhouse during cool temperatures by covering containers with clear plastic domes. Regulate humidity in the dome by poking a few small holes in the lid if too much moisture is collecting inside, and cover the holes with tape when moisture and heat accumulation are desired. Some planting trays are sold with clear domes as a kit, but they are not tall enough to accommodate larger transplants. Clear plastic salad containers work, and if very large domes are needed, try a clear plastic storage container. Thin plants to 2–3 inches apart when they are about 2 inches high. If the seedlings have been removed without damaging the roots, they can be transplanted to another container.

If a continual supply of a specific vegetable is desired, repeat the seeding process approximately every two weeks; continue this process until you have made it well into the growing season. Know the D-T-H, or the Date to Harvest period, to assist in planning the length of planting season. This method will supply a harvest of vegetables at steady intervals rather than one large harvest of vegetables.

Before setting plants in the garden, transplants must be hardened, or gain firmer vegetation and deeper roots, to aid in withstanding the change in environment. One to two weeks before planting the transplants into the garden, reduce the frequency of watering and stop fertilizing to slow aboveground plant growth and stimulate belowground growth. At the same time, place the transplants somewhere they will be exposed to partial sun and a breeze for a couple hours, then shelter the plants again. Repeat this process daily while increasing the time of exposure and amount of

sun until the plants require little to no sheltering to remain healthy.

Managing Water, Nutrients, and Temperature

Many prepared potting mixes already contain fertilizer in the right proportion and are convenient to use. If you have prepared your own mix or soil, your transplants likely need nutrients. Consider adding a weak solution of fertilizer according to the strength and frequency recommended on the label. If you have made your own mix, if transplanting is delayed, or if larger transplants are desired, a weak fertilizer solution can be applied once a week after the first set of true leaves are fully expanded until it is time to harden them off. Special starter solutions may be purchased, or one can be made by dissolving 1–2 tablespoons of 6-6-6 fertilizer in one gallon of water.

Plants need nitrate, a form of nitrogen that is soluble in water, to grow. When irrigating, apply only enough water so the soil or media is equally as moist from the top to the bottom. If water is running quickly out of the bottom of the tray, you have applied too much, and you are also washing away valuable nitrogen.

Do not let the soil or potting mix dry out. Small containers may need to be watered 2–3 times a day, because they will dry out quickly due to the small volume of growing medium. Plan to increase water applications when it is hot. Invest in a good watering wand with a spray head larger than a standard hose nozzle to minimize damage to tender plants from high-pressure sprayers while watering.

Plant growth and therefore water and fertilizer requirements are affected by temperature. Transplants in black plastic containers and small containers can overheat quickly, slowing growth and potentially damaging roots. Monitor the temperature of your media and be sure it stays below 100°F. If temperatures are 50°F or less (during the day or night), a heat mat can help you stay on schedule by increasing the rate of growth. A thermostat set to 70°F or a timer can be connected to a heat mat to reduce plant stress during cold nights.

Transplanting Suggestions

While growing your transplants, monitor them frequently (every few days) for insect and disease indicators. For example, look for leaf spots. Necrotic or yellow spotting on the leaves indicate problems. If a problem arises, catching it early will prevent spread. Remove plants with disease

indicators like necrotic leaf spots immediately, and dispose of the plants away from your transplant area. If harmful pests are present, try to handpick them off the transplants before spraying with pesticides.

If your plantable containers attract green algae (Figure 2), increase the airflow around the containers by spacing them out or adding a fan. If the transplants are under a dome, remove the dome for hour or so until the condensation evaporates. The algae won't harm your plants—in fact, it is a modest source of nitrogen.

Most vegetables are ready to set in the garden when they are four to six weeks old. Set only the best plants that are strong, stocky, vigorous, and disease-free. Tomato plants that are four to five weeks old grow stronger and yield better than older transplants. Retain extra transplants for one to two weeks, and use them to replace transplants that may have been eaten by wildlife or didn't establish well due to mechanical damage or any other issues during transplanting.

Be sure your garden is free of weeds to minimize competition for nutrients, water, and light. Transplant when environmental conditions are best—soon after a rain, when cloudy, or in the late afternoon when the garden will have minimum exposure to direct sunlight.

Avoid disturbing roots when transplanting. When seedlings are to be removed from undivided boxes or flats, use a knife to carefully cut the area into squares so the root mass per transplant is roughly equal. If the transplants are spaced far apart, it may not be necessary to use a knife to separate the roots. In that case, use a trowel and lift the soil and roots from the bottom and place into the prepared transplant hole. If individual plant containers are used, moisten the soil or media in the pot, and remove the plant gently from the container before placing in the garden.

Set transplants deep enough to ensure roots are at least an inch under fresh garden soil. Spindly transplants can be set a little deeper, as long as the true leaves are a few inches above the soil line. Depending on the size of your transplants and the crop, this is typically 4–6 inches deep (Figure 3). When setting the plant into the soil, lightly press but do not “pack” the soil around the roots; gently irrigate around the hole to settle the soil around the roots. Cover the area around the plant with dry soil or mulch to reduce evaporation.



Figure 3. (left) Set transplants 4 to 6 inches deep, or (right) deep enough to cover the top of the transplant media with at least an inch with fresh garden soil.

Credits: (left) T. Petri, UF/IFAS, (right) D. Treadwell, UF/IFAS

If transplants have been properly hardened off, they should not need additional protection from the elements. If severe weather is forecast, cover transplants with banana or palmetto leaves, row covers, or similar lightweight covering, and remember to remove the cover once the threat is over. If frost is a concern, irrigate in the late afternoon, allowing enough time for leaves to dry before sunset. Moist soil is a more efficient temperature buffer than dry soil.

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Table 1. Crop Response to Transplanting.

Easily survive transplanting	Transplant with care	Difficult to transplant
Beet	Carrot	Bean
Broccoli	Celery	Cantaloupe
Brussels sprouts	Eggplant	Corn
Cabbage	Kale	Cucumber
Cauliflower	Kohlrabi	Mustard
Chard	Leek	Okra
Collards	Onion	Peas
Endive	Pepper	Squash
Herbs	Potato	Turnips
Lettuce	Radish	Watermelon
Spinach	Salsify	
Tomato	Sweet potato	