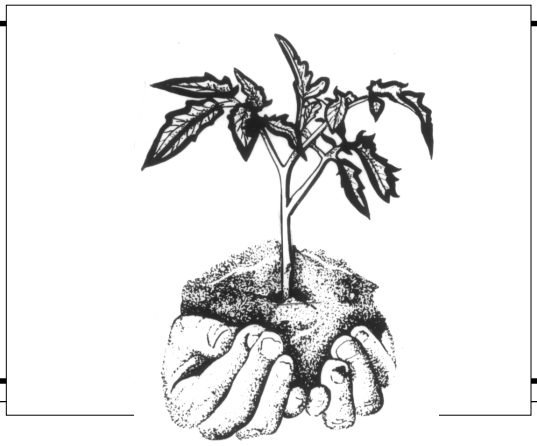
VEGETABLE TRANSPLANTS



BY
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Transplants are used in vegetable production for two main reasons. Earlier production from a plant that is partially grown can result in higher prices for early vegetables and establishing market contacts sooner. Uniformity and consistency of the crop can also result since direct-seeded crops in our Great Plains climate are subject to heavy rains, wind, and fluctuating soil temperatures.

Vegetable crops differ in their ability to be transplanted. The ability of the crop to survive, develop a new root system rapidly, and recover from the transplanting process all influence transplanting. It is possible to "group" vegetable crops into several categories.

Easy to transplant crops. Are efficient in water absorption and rapid formation of new roots (beets, broccoli, cabbage, lettuce, tomatoes).

Moderately easy-to-transplant crops. Do not absorb water as efficiently when young, but new roots form quickly (cauliflower, eggplant, onion, pepper).

Difficult-to-transplant crops. Resume growth slowly after root system is injured. Require special care and handling (cucumber, melons, squash).

TRANSPLANT GROWTH "CYCLE"

Growing plants for field setting can be divided into three stages: germination, plant growth, "hardening" or acclimation.

Germination. Most vegetable crops are grown from seed. Seeds will germinate when supplied with water and an appropriate temperature. A few vegetable crops, such as lettuce, require light. A minimum temperature below which no germination will occur, an optimum temperature, and a maximum temperature is known for most crops. Germinating seeds at the optimum temperature offers several advantages:

■ *Greater germination percentage.* Important for high-value seeds to get the maximum number of plants per quantity of seed.

■ *Speed of germination.* Important to keep a plant production schedule and start crop quickly.

■ *Concentrated germination.* Plants will germinate within a few days of each other, ensuring a more uniform crop.

Germination Temperature for Vegetable Seeds

	Minimum °F	*Optimum °F*	*Maximum °F*
Asparagus	50	75	95
Cabbage	40	85	100
Broccoli, Cauliflower	40	80	100
Eggplant	60	85	95
Lettuce	35	70	85
Muskmelon	60	90	100
Onion	35	75	95
Pepper	60	85	95
Squash	60	95	100
Tomato	50	85	95
Watermelon	60	95	105

(Knott's Handbook)

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Keep the temperatures at or near the optimum temperature for best results. Remember: the optimum is near the maximum temperature in most instances, so watch your seeds and monitor temperatures with a probe thermometer. Locate seeded flats in a warm area, cover with plastic at night (or an insulating "blanket") to reduce evaporation and hold in heat, or use a germination chamber with a heat cable or heat source.

Plant Growth. Plants require water (mineral nutrients or fertilizer), favorable temperatures, and light to grow. Adjust temperatures for day-night conditions. On dull, dreary days when light levels are lower, reduce temperatures to prevent weak spindly plants.

Growth Temperatures

	Minimum	*Optimum Range*
Onions	50	55–75
Cole Crops	50	55–70
Tomatoes, pepper, eggplant	60	65–75
Melons, cucumber, squash	60	65–75

"Hardening" or Acclimation. During the last week of growing, plants can be acclimated to the shock or stress of field setting by slowing growth rate. This is done by lowering temperatures, withholding water, or both. This acclimation slows growth and encourages physiological changes within the plants to enable them to withstand the transplanting process. A thickening of leaves, their waxy covering, and changes in the constituents of the plants will ensure better field survival and frost tolerance for cool-season crops.

A shift in fertilization schedules to reduce nitrogen fertilizer (which encourages vegetative growth) and an increase in phosphate fertilizer (which encourages root development) is suggested for 3 to 5 days prior to field setting. Excessive hardening or acclimation should be avoided since transplanting and production problems can result.

Acclimation Conditions

Cole crops	45–55°	7–10 days
Lettuce	45–55°	7 days, reduce watering
Pepper	60–65°	Reduce watering
Tomato	60–65°	Reduce watering
Eggplant	65–70°	Reduce watering
Melons, cucumber, squash		Reduce watering

DIRECT SEEDING VERSUS TRANSFER OF SEEDLINGS

In earlier times, seeds often were germinated in a separate flat by seeding thickly. Then, young plants, when 1 to 2 true leaves began to develop, were "pricked out" or transferred to growing containers. With modern sterilized mixes, and considering the labor and reduction in growth from this process, most growers are direct seeding into the containers used for growing plants. However, this does require ideal germination conditions for a larger area of bench space. Transfer of seedlings does allow selecting uniform plants, but as much as one week delay may result from this process.

GROWING MEDIA

There have been many advances in potting mixes and media in recent years. A trend has developed to use synthetic or "soilless" mixes because of their uniformity, freedom from disease or insect problems, and ease of use.

Pre-mixed soilless mixes. Jiffy Mix, RediEarth, Sunshine Mix, Metro Mix, etc., are common brands of synthetic mixes. Most contain peat and vermiculite plus other additives. Drainage is excellent, water holding capacity is good, and they are lightweight. However, they do require fertilization since they contain or hold relatively few nutrients.

Mixed media. Several "recipes" are available to "mix your own" from the raw ingredients, using peat, vermiculite, sand, and other materials. Most common are the UC (California) mixes, Cornell mixes, Glass House Research Institute Mix, etc. "Recipes" for these can be found in the Knott's Handbook.

Soil mixes. Some growers prefer soil-containing mixes since the buffering capacity and nutrient holding capacity of soil is an advantage. Most common are the Penn State Mixes and John Innes mixes which blend soil with peat, perlite and sand. Soil used needs to be "pasteurized" and contaminated soil should be avoided. Use a standard recipe to assure repeatable results.

FERTILIZATION

Vegetable transplants, especially those grown in soilless mixes, do require regular fertilization. Soilless mixes usually require fertilization 2 to 3 times per week using a 20–20–20 soluble fertilizer (or similar analysis). Usually, 6 to 8 ounces of fertilizer material per 100 square feet of bench area is needed. It can be applied in a sprinkler can or an injector may be used to dilute a concentrated fertilizer solution into a hose watering system. Some growers prefer to use a more dilute fertilizer solution and apply fertilizer with each watering. Avoid heavy fertilization in periods of dark, dreary weather. Rinse foliage after applying fertilizer. Some soluble fertilizers are

20–20–20	(¾–1 lb / 50 gal)
15–15–15	(1–1½ lb / 50 gal)
15–30–15	(1–1¼ lb / 50 gal)

STARTER SOLUTIONS

When plants are field-planted the root system needs to establish quickly during a time when the soil is usually cold. A soluble high-phosphate fertilizer poured around the root system while transplants are watered should be used. Soluble materials such as l0–52–l7, 9–47–l5, l0–50–l0, etc., are available, or use l8–46–0. Follow bag instructions for soluble fertilizers or use 3 lb / 50 gal water for granular fertilizers. Granular materials may not completely dissolve, so mix fertilizer in water and stir repeatedly for several hours. About l cup of water containing starter fertilizer is used around each plant. A dilute solution of this fertilizer should be added once or twice during the last week of transplant growing.

TRANSPLANT CONTAINERS

Numerous containers are available for growing plants. The size, volume and style are all important. Smaller plants usually require smaller containers. Deep containers (3 inches deep) usually can be used with smaller top dimensions l–l½ inches. Some common containers used are:

Plastic cells. Many shapes and styles are available. Several types can be reused many times. Usually 2½ to 3 inches deep in sizes from 1¼ to 2½ inches are common sizes.

Peat pots. These pots are porous, allowing good drainage and aeration and are planted "pot and all" to reduce root disturbance. 2, 2¼, and 2½ -inch sizes are most common with 2 inches of depth. Round or square shapes are available.

Jiffy-7. This pellet of compressed peat is allowed to absorb water, forming a ball-shaped container surrounded by a plastic netting. They are expensive, but handy to use since no media is required. They dry out rapidly, requiring frequent watering.

Todd or "Speedling" flats. This styrofoam flat, used by Speedling Co., can be purchased for growing plants. The containers are made of styrofoam, are reusable, and come in a variety of sizes: 1, 1¼, 1½, and 2-inch sizes, 3-inches deep are most common. Flats should be grown on a wire mesh bench to allow "air pruning" of the roots.

Plugs. A recent development in plant growing, plugs are very small cells filled with peat and / or vermiculite media. "Plug" trays come in sizes holding 200, 400, or 600 cells and can be automatically seeded.

Smaller transplant containers allow more plants to be grown per area of bench but smaller containers dry out more rapidly, produce a smaller, more spindly plant, and are subject to more plant losses when transplanting under warm, dry conditions. Experiment with various containers that best meet your needs for certain crops. You may also choose to use several sizes of containers for each crop to "hedge" your production schedule.

SOUTHERN-GROWN PLANTS

Several companies provide transplants for vegetables, either "bare-root" plants that are field grown and shipped in bundles or containerized plants that are greenhouse grown and shipped with a "root ball" of media attached. These plants offer advantages of economy and quality. Certain companies have minimum orders that limit a small grower getting a few plants. One problem with Southern grown plants is determining a date for shipment that corresponds with our fluctuating spring weather.

Check with companies well in advance, determine their abilities to adjust shipment dates in the spring, and be alert for quality of the plants (freedom from disease, condition, etc.) from the supplier.

TRANSPLANT MACHINES

Several types of transplanters are available to mechanize the field transplanting process. Older transplanters open a furrow and plants are placed in the furrow by hand. Newer models transfer plants to the furrow by "arms" on the machine which grip and hold the plant or drop the plant and pot into the furrow from a cone over the transplanting furrow. Models of "punch" planters are also available which puncture plastic mulches and set the plant into the holes. Another type of planter for transplanting through plastic mulch is called a "water-wheel" which consists of a large wheel filled with water that rolls over the top of the bed, punching holes at a pre-spaced interval. From a seat behind the water wheel, a rider places plants by hand in the hole.

Adjustment of the planter is critical. The furrow should be deep enough to accommodate the stem and root system. The press wheels should firm soil around the root system to insure good contact between roots and soil. Water with starter solution can be supplied around each plant by a metering device and tank on the planter or tractor. Operate the planter at a speed that allows careful placement and attention to problems that develop. The operators should not be so busy placing plants in the machine that they can't watch for problems that develop.

Choosing a transplanter is a big investment. Consider your general needs and crops that can be transplanted. If possible, visit other growers to see the transplanting machines in operation and consider your situation in relation to theirs. Also, shop around for prices, dealers, and companies that manufacture transplanting devices. The July issue of the *American Vegetable Grower* has a buyers' directory which lists transplanting equipment and supplies.

Note: Trade names are used to identify products. No endorsements are intended, nor is criticism of similar products not mentioned.

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