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THE NEW ORGANIC GROWER

A Master's Manual of Tools and Techniques for the Home and Market Gardener

REVISED AND EXPANDED EDITION

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DIRECT SEEDING CHART

	Machine-Seeded	Hand-Seeded	Spacing (inches) Plant	Row	Also Transplanted
Bean	*		4	30	*
Beet	*		3	18	*
Carrot	*		1	12	
Chinese Cabbage	*		12	12	*
Corn	*		12	30	*
Cucumber		*	12	30	*
Kohlrabi	*		6	12	*
Parsnip	*		3	18	
Peas	*		2	30 or 60	*
Potato		*	12	30	
Pumpkin		*	24	120	*
Radish	*		2	4	
Rutabaga (Swede Turnip)	*		4	18	
Spinach	*		3	12	*
Swiss Chard	*		6	12	*
Summer Squash		*	24	60	*
Winter Squash		*	24	120	*

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TRANSPLANTING

TRANSPLANTING IS THE PRACTICE OF STARTING SEEDLINGS IN ONE PLACE and setting them out in another. In this way large numbers of young seedlings can be grown in a small area under controlled cultural conditions before they are taken to the field. Whether the seed-starting facility is indoors under lights or outdoors in a cold frame, poly tunnel, or greenhouse, the space must be kept clean and well maintained. Since conditions in any covered area cannot be completely natural, I take precautions by carefully removing all plant debris in the fall and making sure it is empty of growing plants by early winter, so as to allow the low temperatures to do their work in freezing out pests. I recommend the use of a thermostatically controlled bottom-heat propagation mat to maintain optimum germinating temperatures when starting warm-weather crops.*

Transplanting has traditionally been used for those crops (celery, lettuce, onion, and tomato) that regrow roots easily. These crops don't suffer much from being transplanted, although they obviously grow better the less their roots are disturbed. Transplanting is also of value for many crops (cucumber, melon, and parsley) that are less tolerant of root disturbance, but it must be conducted in such a way that the plants hardly know they have been moved. The best transplant system is one that does not disturb the roots, is uncomplicated, can be mechanized, and is inexpensive.

**The best source for information on all topics such as germination temperatures, numbers of seeds or transplants required for a given acreage, and any agricultural tables and lists ever compiled, is* Knott's Handbook for Vegetable Growers, 3rd Edition *by Oscar A. Lorenz and Donald N. Maynard (New York: John Wiley & Sons, 1988).*

Greenhouse to Field

Transplanting should be understood as three separate operations: *starting, potting on,* and *setting out.*

Starting involves its own three subdivisions—type of containment, soil mix, and controlled climate. The seeds are sown in some sort of prepared bed or container. The container usually holds a special soil mix or potting soil. This mix differs from garden soil by being compounded of extra organic matter and drainage material, so the seedlings will thrive despite the confined conditions. A controlled climate is provided by growing the plants in a greenhouse, hot-

Setting out a tomato plant grown in a 4-inch soil block.

bed, cold frame, or sheltered area to enhance early growing conditions for the young seedlings.

Potting on means transferring the seedlings from the initial container to a larger container with wider plant spacing. With soil blocks, this isn't always necessary from a practical point of view, except with those crops that are grown for a longer time or to a larger size before being set out. Potting on is always valuable from the perspective of the highest plant quality, however, since only the most vigorous of the numerous young seedlings are selected.

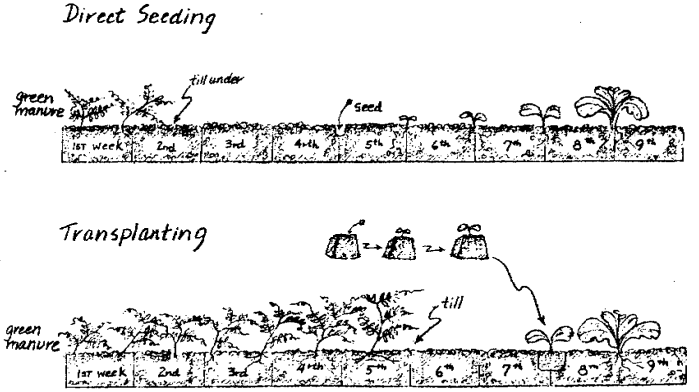
Setting out is the process of planting the young plants in the field or in the production greenhouse where they are to grow. The greater the efficiency with which this transfer can be accomplished, the more cost-effective transplanting becomes as a component of vegetable crop production.

A Sure Harvest

Transplants assure the grower of crops throughout the growing season at the times and in the quantities required. A seed sown in the field is a gamble, but a healthy three- to four-week-old transplant set out in the field provides an almost certain harvest. Transplanting is the most ***reliable*** method for obtaining a ***uniform*** stand of plants with a ***predictable*** harvest date.

Transplanting is ***reliable*** because the grower has better control over the production environment. The germination and emergence variables that can be so unpredictable in the field are more certain in the greenhouse. The crops are ***uniform*** because there are no gaps in the rows. No land is wasted from a thin stand due to faulty germination. Vigorous transplants set out at the ideal plant density for optimum yield have a very high rate of survival. The harvest is ***predictable*** because the greatest variability in plant growth occurs in the seedling stage. Once they are past that stage, an even maturity and a dependable harvest can be counted on.

It is far easier to lavish extra care on thousands of tiny seedlings in a small space in the greenhouse than over wide areas in the field. During the critical early period of growth, when ideal conditions can make such a difference, the grower can provide those conditions with less labor and expense in a concentrated area. Transplanting also allows for far more productive use of a green manure program to maintain fertility. Whereas many direct-seeded crops germi-



nate poorly in a soil containing newly incorporated green manure residues, transplanted crops can thrive and grow quickly. (In the early stages of decomposition, compounds are formed which inhibit seed germination.) Thus, green manures can be left to grow longer before setting out transplants. Rather than having to turn under a green manure the recommended three to four weeks before a direct-seeded crop, green manures can be left to grow until two weeks before a transplanted crop. Depending on the age of the transplant, that can increase the growth period of the green manure by up to five weeks. Under these conditions, green manures are a viable option before many early crops.

Cheating Weeds and the Weather

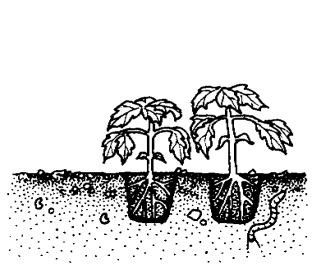
When crops are sown in the field, weeds can begin germinating at the same time or even before. Direct-seeded crops may also need to be thinned, and they must contend with in-row weeds while young. Transplant crops start out with a three- to four-week head start on any newly germinating weeds, because the soil can be tilled immediately prior to transplanting. Further, since transplants can be set out at the final spacing, they do not require thinning and are much easier to cultivate for the control of any in-row weeds that may appear.

Transplants can measurably increase production on the intensively managed small farm, because they provide extra time for maturing succession crops. This is done by starting the succession crop as transplants three to four weeks before the preceding crop is to be harvested. Immediately after harvest, the ground is cleared, the plants are set, and the new crop is off and growing as if it had been planted three or four weeks earlier (which, of course, it was). The result is the same as if the growing season had been extended by three to four weeks. Transplanting allows less land to be used more efficiently for greater production.

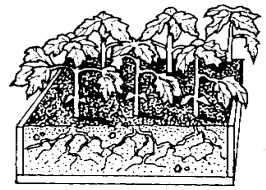
Earlier maturity is another obvious advantage to transplanting. Plants started ahead inside and set out when the weather permits have a head start and will mature sooner than those seeded directly. In many cool climates, tomatoes, melons, peppers, and others are only successful as transplanted crops.

Transplanting Methods

In earlier days, vegetable growers relied heavily upon *bare-root* transplants, seedlings dug up from a special bed or outdoor field and transplanted with no attempt to retain a ball of soil around the roots. Uniform results and good survival rates are difficult to achieve with this method. Most of the fine root hairs that supply the plant with water are lost upon uprooting. This reduces the absorbing



Transplants in peat pot.



Transplants in traditional wooden flat.

Root circling in a plastic pot.

surface of the root system and markedly delays the reestablishment and subsequent growth of the plants. This "transplant shock" can be avoided by moving plants without disturbing their fragile root systems.

Many types of containers have been used to keep the root ball intact—clay pots, plastic pots, peat pots, wood or paper bands, wooden flats, plug flats, and others. The plants and soil are either removed from the container before planting or are planted outside, container and all, if the pot (peat pot, paper band) is decomposable. Unfortunately, most containers have disadvantages. Peat pots and paper bands often do not decompose as intended and inhibit root growth. They are also expensive.

Traditional wooden flats grow excellent seedlings, but some of the seedling roots must be cut when removing the plants.

Individual pots of any type are time-consuming and awkward to handle in quantity. The plug-type trays that contain individual cells for each plant solve the handling problem by combining the individual units. But they share a problem common to all containers—root circling. The seedling roots grow to the wall of the container and then follow it round and round.

Plants whose roots have circled do not get started as quickly after they are put out in the field. An attempt has been made to improve on this situation by designing the tray cells with a hole in the bottom for air pruning and ridges in the cell walls.

Fortunately, there is another kind of "container" better than all of the above. That container—the soil block—is the subject of the next chapter.

TRANSPLANT CHART

	Optimal Spacing (inches)		Transplant Age	Also
	Plant	Row	in Weeks	Direct-Seeded
Beet	4	12	3–4	*
Broccoli	24	30	4	
Brussels sprouts	24	30	4	
Cabbage	18–24	30	4	
Cauliflower	18–24	30	4	
Celery	12	12	8	
Celeriac	12	12	8	
Chinese Cabbage	12	12	3	*
Corn	12	30	2–3	*
Cucumber	12	30	3	*
Eggplant	24	30	8	
Kale	12	12 or 18	4	
Kohlrabi	6	12	3–4	*
Leek	6	12	4–8	
Lettuce	12	12	3–4	
Melon	12	60	3	
Onion, Bulb	3	12	4–8	
Onion, Scallion	1	12	4–6	
Parsley	6	12	6	*
Peas	2	30 or 60	2	
Pepper	12	30	8	
Spinach	3	12	2–3	*
Summer Squash	24	30	3	*
Swiss Chard	6	18	3–4	*
Tomato	24	60	8	*

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SOIL BLOCKS

IT IS ALWAYS SATISFYING TO FIND A TECHNIQUE THAT IS SIMPLER, MORE effective, and less expensive than what existed before. For the production of transplants, the "soil block" meets those criteria. The Dutch have been developing this technique for some 80 years, but the human experience with growing plants in a cube of "soil" goes back 2,000 years or more. The story of how cubes of rich mud were used to grow seedlings by the Aztec horticulturalists of the *chinampas* of Xochimilco, Mexico, makes fascinating reading.[1] A related technique is the old market gardener's practice of using 4- to 5-inch cubes of partially decomposed inverted sod for growing melon and cucumber transplants.

How Soil Blocks Work

A soil block is pretty much what the name implies—a block made out of lightly compressed potting soil. It serves as both the container and the growing medium for a transplant seedling. The blocks are composed entirely of potting soil and have no walls as such. Because they are pressed out *by* a form rather than filled *into* a form, air spaces provide the walls. Instead of the roots circling as they do upon reaching the wall of a container, they fill the block to the edges and wait. The air spaces between the blocks and the slight wall glazing caused by the block form keep the roots from growing from one block to another. The edge roots remain poised for rapid outward growth. When transplanted to the field, the seedling quickly becomes established. If the plants are kept too long in the

Transplanting soil blocks.