

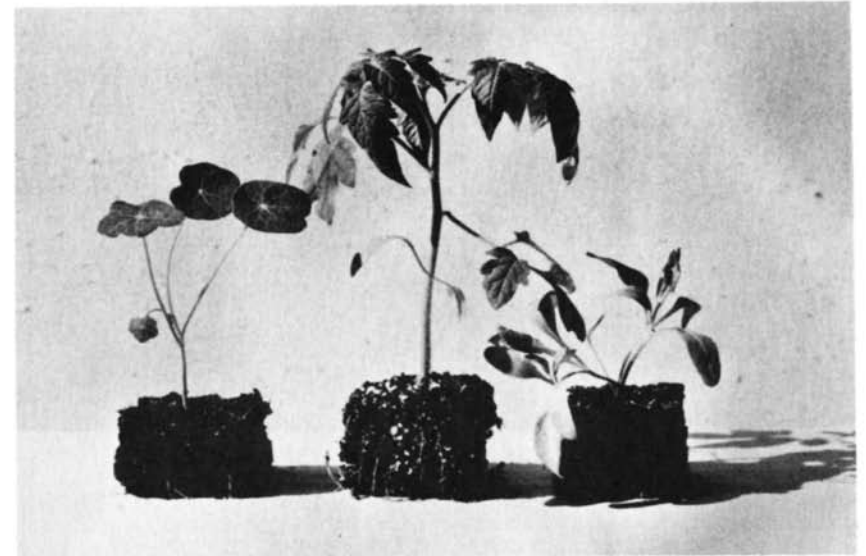
Seven Quick Steps to Soil Blocks

1. Empty bag of growing medium into tub. (To make your own growing medium, see pages 5-8.) Hint: Set a little aside in case you make the mix too wet on your first try.
2. Add water and wait an hour for it to soak in. If you don't have the time, then be sure to stir thoroughly. Add enough water to give a thick oatmeal-like consistency. Too watery and the mix won't form blocks; too dry and it won't go into the blocker. Trial and error are the best teachers.
3. Thrust the blocker into the mix 2 or 3 times to fill the chambers snugly (see Figure 3).
4. Scrape off the excess mix on the side of the mixing tub (Figure 4).
5. Set the blocker onto the tray. Hold the T-shaped plunger in place while pulling the frame up. Blocks are left in the tray (Figure 5).
6. Place the next set of blocks $\frac{1}{8}$ inch over from the previous set.
7. Wash the blocker after you've finished making blocks. Otherwise the natural acids in any growing medium will eventually corrode the surface.

TRANSPLANTS IN SOIL BLOCKS

by David Tresemer

REVISED EDITION



Nasturtium, tomato, and four beets in soil blocks.

By Hand & Foot, Ltd.

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ACKNOWLEDGMENTS

Soil blocks as a growing technique are enjoying great popularity now, so much so that several companies have gone to the Orient to have inexpensive copies made of the original. I have stayed with the original, which is still the best. And to Michael Ladbrooke, the English engineer who designed and now manufactures the original hand blocker, I must give the recognition that is due. He understands soil blocks and many details about growing handsome and healthy plants. To him, and to Eliot Coleman, who has seasoned Ladbrooke's knowledge with his own ingenious techniques, I owe my basic understanding of soil blocks.

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Lettuce seedlings in 1½-inch blocks.

Seeds of many vegetables, fruits, and flowers can be sown in a special soil mix in a protected environment, either in a greenhouse or on the kitchen window sill, so that the plants can be set out in the garden at a later date: transplants. People would transplant more of their crops if they had a system that consistently worked, was easy to do, was economical, and didn't have a clutter of containers to clean and store at the end of the season. Soil blocks, containerless cubes of soil mix, is a better system, and has in fact been widely used in Europe for many years. The English engineer, Michael Ladbrooke, has recently made the technique available to the average gardener by designing a hand-size soil-block maker.

In the following, I will first present the virtues of transplanting, then present the improvements which soil blocks have over other transplant techniques. Thus the basic principles of transplanting in soil blocks will be covered, making more understandable the instructions on how to make and care for blocks.

This manual is specifically about blocks and a new gardener will have to look elsewhere for basic training in plant care. Some recommendations are given at the back of this manual.

TRANSPLANTS

Earlier harvests.

Gardeners eager for fresh produce are constrained at the early part of the season by killing frosts and soil temperatures which are too low for reliable seed germination and good growth of a seedling. Starting seeds early indoors hurries the day when the fruits, flowers, and vegetables are ready. In areas with short growing seasons — which can mean a short period between frosts in the far North or a short period between hot droughts in the deep South — transplants are the only way to bring some kinds of plants to maturity.

Controlled conditions.

By using a special soil mix which is either bought or homemade, along with regular watering and simple fertilization, seeds and plants are given conditions which are seldom matched by the weather and soil of the garden. Germination is more reliable and closer to one hundred percent of the viable seeds. Early growth is quicker and more robust, and not stunted by the lack of nutriment (e.g., phosphorus does not move in cold soil).

More time to prepare the garden before planting.

You needn't wait for the fickle spring weather to settle down before getting your plants started. Green manures have a bit more time to grow and, once chopped into the soil, they have a bit more time to decompose.

Headstart on weed control.

After the first working of the soil in the early spring, subsequent cultivations should go no deeper than two inches because weed seeds below that level will not germinate. Transplants are set out after one or two shallow cultivations of the garden. This takes care of most of the weeds of the season, without the problems of careful in-row and between-row weeding. Such a headstart is especially important with plants that have long germination periods, including many herbs and flowers, because they are usually completely obscured by the faster-growing weeds if sown directly in the garden. Since transplants are already established, it is also much easier to put mulch close to them.

Insect damage avoided.

Plants are set out when they are past the stage of greatest vulnerability. Protecting against cutworms, for example, is much easier with established plants in warm soils than with small seedlings in a cooler soil. If pesticides are used, either organic substances or toxic chemicals, a small amount can be incorporated into the soil mix, thus avoiding the spraying of the whole field which can be dangerous to humans and to beneficial soil organisms.

Thinning eliminated.

Most gardeners pour the small seeds of lettuce from the seed packet as from a pepper shaker into a shallow furrow in the garden. A week later, the worst weed to contend with is the lettuce itself. On hands and knees, the gardener carefully removes the unwanted lettuce plants, unavoidably tearing at the intertwined roots of the lettuces chosen to stay. Thinning is extremely tedious and it has always seemed to me inadequate consolation to say that the thinnings are nutritious eating: They are hard to gather and hard to clean. With lettuce, I can set my best-looking transplants in at the twelve-inch spacings which I desire for my mature plants.

Better management of second crops.

Transplants are not only for early spring. Fall crops can be started in a controlled environment and established plants put into the garden as soon as space is available. For example, fall cabbage plants can follow early peas as soon as the vines are removed. Thinning is avoided and weeding, at a time when weeds grow very quickly and can overwhelm vegetable sprouts, can be better controlled.

Much greater choice of varieties.

Store-bought transplants are expensive in comparison to the cost of raising your own, and only available in a limited number of popular varieties. As is clear from this manual, many plants can be started early, in varieties you choose as most appropriate for your soil and palate.

SOIL BLOCKS

Many different techniques exist for raising transplants. In this country,

there is much controversy among gardeners and professional greenhouse growers about what sort of container to use. One method uses no container at all! Developed in Holland and used widely throughout Europe, *soil blocks* are lightly pressed cubes of soil mix without any container. They have several advantages over other methods for transplants.

Transplants in soil blocks do not suffer root shock when set out in the garden.

The roots of transplants raised in a large flat twine together in the flat; when the plants are cut apart into blocks with a knife, many of these roots are cut. Since the water intake system of the plant has been injured, the plants droop and lose a fair portion of the headstart gained indoors. The result is similar with peat pots or other rough-sided pots from which transplants are removed to be planted.

Transplants removed from smooth-sided containers such as small plastic pots or styrofoam trays have usually sent their roots to the edges of the container, where they curve round and round the inside surface of the container at the outside edge of the soil mix. When these plants are put in a soil with very different characteristics from the soil mix — primarily there is a great deal more air and less water-holding capacity in the garden soil — the roots are shocked. This is also called “root insult”; anyone who has seen a bed of new plants wilting and forlorn will know that these terms are not exaggerated.

In contrast, the roots in soil blocks grow to the edge of the block and turn back inward — roots shun the surface of the soil in any direction — to make a root ball centered in the center of the block. There is little or no shock when the plant is set out, since the roots can adapt to the new environment more gradually. Extensive research, especially in England, has shown soil blocks to be superior to bare-root transplants and to plants grown in molded plastic trays.

The way in which the root ball is concentrated in the soil block means also that it is sturdier than other transplants. When I was first introduced to soil blocks, a block with plant was tossed to me. I gasped. I had always felt that transplants were such delicate things. I was certain it would fall apart when I caught it. It didn't. I now enjoy tossing blocks to people.

For the same reason, blocks seldom need to be “hardened off,” something I shall discuss later on.

Roots do not encounter impenetrable barriers.

Many people use pressed peat pots for starting transplants. The pots come in a variety of shapes and sizes, and are filled with a soil mix. When transplanting time arrives, the plant, pot and all, is set into the garden. The first time I used peat pots was with brassicas. After they were set out, the brassicas grew to a point, then withered and died. Water didn't help. I dug them up, expecting to find an infestation of root maggots. Instead I found a compact root mass that had been unable to penetrate the wall of peat. The plants had died of starvation and drought. Other people have had this and also the opposite problem — their plants have drowned in a peat-pot puddle during a wet spell.

This problem with peat pots may come from the paper pulp glue used to bind the peat together. Yet the pots which use less of this glue often come apart

before they reach the garden.

I have also experienced a barrier problem with pressed peat pellets. These are small hard wafers of peat moss which swell when soaked in water and are held together by a small polyethylene net. The barrier here is vertical and comes, I think, from the fact that peat loses its ability to absorb water after being wetted and dried, as is done in the manufacture of pellets.

The same problem of impenetrability exists with the paper pot system developed in Japan.

Trash is not left behind in the garden.

The sides of peat pots, the polyethylene net bags of peat pellets, and paper of paper pots are not left behind in the garden.

The system is less expensive.

Soil blocks are made with a small hand tool which quickly pays for itself — in comparison to buying individual peat pellets or peat pots, or in comparison to the replacement of containers which deteriorate over time, such as any of the molded plastics. There is also a savings in labor as no outer wrappers or containers need to be removed at setting out. Some gardeners like to recycle other containers such as coffee cans and egg cartons, but I find these to work very poorly and their collection and preparation to consume a great deal of time.

A few plants at a time or many at a time can be started.

A flat must be filled with soil mix even if you want to start a small number of plants. Using soil blocks means you can, if you wish, sow only a few at a time. It solves “the continuous lettuce problem”: every Monday morning, eight blocks can be made, set in a tray, and seeded. On the fourth Monday, you will have 32 lettuces started, and the first eight can be set out in the garden. In two more weeks you will be “in lettuce” for the rest of the season.

In terms of larger quantities, commercial growers use the very same soil blocks, but made with machines which can lay as many as ten thousand blocks in an hour onto the greenhouse floor. Millions of plants are started each week in Europe this way.

The mix is wetted ahead of sowing.

With other systems you fill the containers with dry soil mix, and then have the difficult problem of thoroughly wetting the mix in the separate containers. This can be a serious problem as these mixes are based on highly absorbent materials which, when dry, however, are resistant to the absorption of water. Making blocks requires wetting down the soil mix in a tub ahead of time, which assures a thorough penetration of moisture into the medium because you actively stir the water into the mix. The ability of blocks to stand by themselves is as much a result of the thorough wetting as of the pressing together of the medium into the block.

A small depression is formed at the top of each block.

A small depression is formed by the block maker. With other methods, a small hole must be made with the finger or a stick, which is an extra step.

More kinds of vegetables and flowers can be sown in blocks.

Primarily because of freedom from root shock, several plants usually not recommended for transplanting can be raised successfully in blocks, for example, sweet corn, beet root, cucumbers, . . .

Indoor space is used more efficiently.

Developed in Holland where space is at a premium, soil blocks permit more plants per square foot than round pots. You can further increase the efficiency of this system by starting plants in mini-blocks (discussed below). And, blocks are free-standing and stable when moved in trays, unlike top-heavy round pots which are easily tipped over by the accidents of transportation.

There must be some disadvantages! There are. There is a danger when working with a well-designed system to expect there will be no problems. Though the equipment and techniques presented in this manual are sophisticated, they must be supplemented by a planter's attitude. With transplanting, you must end your winter hibernation a little earlier. A daily check of the growing plants for warmth and moisture means a certain amount of discipline and routine. Timing must be closely tied to the weather and the preparation of the garden. When I sow and transplant, I think of the Estonian women and their cabbages. At sowing, they bake large pancakes so that the cabbages will have large leaves; at transplanting, they wrap a round stone in a white linen rag and set it at the end of the cabbage bed so that the cabbage heads will grow white and firm. These actions might seem uselessly superstitious but it shows a level of concern and appreciation for the plants which should not be lacking even with the best of equipment.

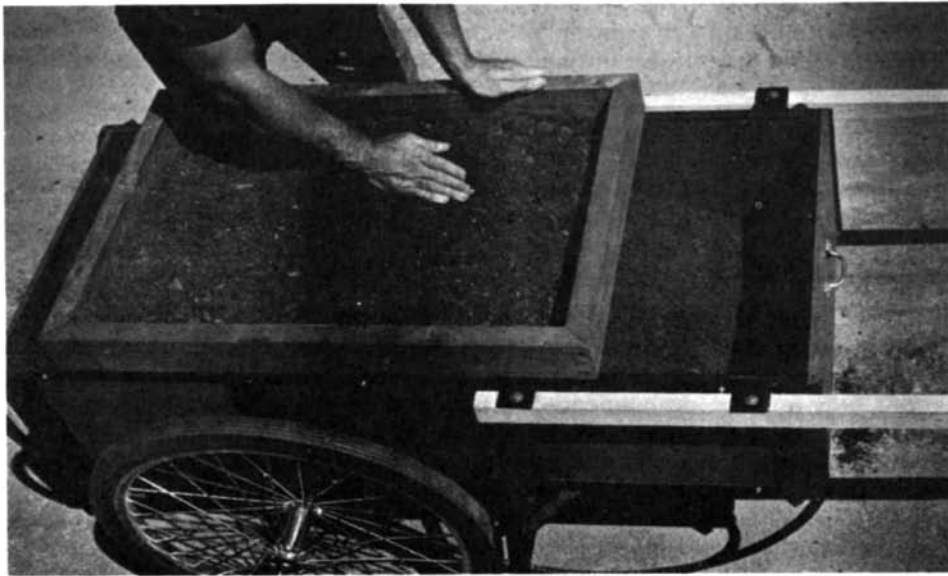
MAKING BLOCKS

I shall discuss the making of the blocks from the point of view of the home gardener, and later mention some ways market gardeners can increase their efficiency by using soil blocks.

Soil

There are many planting media available commercially. If “the medium is the message” — to the plant and ultimately to us — then we need to take care with the composition of our planting medium. Though I have used the term “soil mix,” most media which you can buy are without soil and they advertise this fact. There are common fears of diseases, weed seeds, and insect pests in soil. However, while it is wise to avoid a soil from an unknown source, you may have soil in your garden which has excellent properties for a planting medium: good humus content, good fertility, good crumb structure, weeds under control, and the sort of vitality which would imply a low level of disease and insect pests. After all, the spores of the diseases of tiny seedlings are in the air we breathe and can only be discouraged, not eliminated. Likewise, over 99 percent of animal species in the soil is beneficial to the growth of plants; in a lively soil such as your own, you may be quite safe from insect pests.

Clearly, I am not in favor of sterilizing your soil by steam or chemicals. If your soil has any of the above problems, or if you are using a particularly sensitive kind of plant, then avoid the mixes which use soil.



1. Screening sphagnum peat moss.

Peat

The most popular constituent of planting media is peat. It is light to transport, free of weed seeds and diseases, and holds a great deal of water for the plant's use. Peat is vegetable matter often of great age, but only partially decomposed because it has accumulated under water or in areas where high moisture and acidity have slowed down the process of breakdown to a standstill. Some peat bogs are many feet thick, the prevalent species either mosses of the Sphagnum genus or reed sedges. For horticultural purposes, peats are ground up a bit and large pieces screened out. They have great capacity to absorb and store water — 7 to 30 times their own dry weight — while still providing spaces for air. Peats also contain water-soluble organic acids which can increase the microbial activity in the soil which releases nutrients for plants. These acids and their effects can, however, be excessive and many peats must be buffered (e.g., with lime) to avoid retardation of plant growth. Peats differ in their ability to hold water, yet their structure is so complicated that a good peat cannot be easily defined. In general, peats which are harvested from the bottom of the bog are more decomposed, denser, darker in color, and less sponge-like.

Despite the talk of German vs. Scandinavian vs. Wisconsin peats, the fact is that much of our peat comes from Canada. In general, a milled and screened peat from sphagnum moss of medium fiber length and moderate acidity (pH) is the best for soil blocks; but in the end trying out different brands is the only way to find a good one. A warning: Every peat I have used has required another screening by me, through a quarter-inch hardware cloth. The screen in Figure 1, which fits both the Green River Tools™ and the Garden Way® handcarts, makes quick work of this job.

Sand

Sand increases air spaces in soil blocks, and improves drainage. Sand from the seashore can be too fine and too salty. Sand made from sea shells or limestone chips must be avoided. Builder's sand is good, as it is recently ground and has sharp edges, but is unsuitable if it is made from limestone or if it is contaminated with something that won't bother a cement wall but will bother plants. Granite grit can be just right but sometimes the particles are too large (over 0.5 mm). So, something as simple as sand turns out to be complicated also!

Compost

The same theme is repeated here: Great variation in commercially available products, and the possible superiority of your own compost. In any case, it should be well decomposed and screened through a quarter-inch hardware cloth (Figure 1).

Other ingredients

Pulverized pine bark which has aged or composted for a couple of months can be used to replace all or part of the peat.

Vermiculite is a form of mica which has been heated until it pops like popcorn. It has great capacity to hold water, is sterile, and can release significant amounts of potassium as it ages. Use only the horticultural type since vermiculite made for insulation of buildings can include substances toxic to plants.

Perlite is a form of volcanic ash, also holds water, and is sterile. However, the particles are often too large for blocks, and perlite can release toxic amounts of sodium, potassium, aluminum, boron, and fluoride.

Mixes

There is no one perfect mix for soil blocks. Professional growers use any of the mixes available in large quantities, with adjusted acidity and fertilization levels, as well as added fungicides and wetting agents (which speed absorption of water by peat fibers). There is sometimes a gamble here, however. Makers of peat-based planting media do not wish to be placed under the rigid state laws which govern fertilizers; therefore, they do not publicize the nutrient levels of their products. A recent analysis of 23 popular media showed huge variation in levels of nitrates, phosphates, potassium, calcium, and soluble salts; many mixes had nutrients at toxic levels! Such high levels of nutrients (especially nitrates) actually inhibit the germination of seeds. Imbalance of nutrient levels leads to exaggerated microbial activity and possible problems with fungi and molds.

Many home gardeners are interested in a seed-starting medium which is free of petrochemicals and which does not push the plant so hard with fertilizers that it has problems later on. These mixes are very rarely available commercially but it is possible to mix your own. Here are some alternatives:

1. Garden soil: Your garden soil may have an excellent structure for soil blocks: High in humus and good fertility. I describe the color and structure of such a soil as "chocolate cake." Soils tend to have crusting problems when the surface dries out, but your soil may be an exception. Or you might use one half compost to lighten up the soil. I met one grower in

England who had made two million blocks over twenty years, by hand from his own garden soil and compost. Remember to dig some soil and put aside some compost in the fall because it may be frozen or impossibly mucky when it is time to start seeds.

2. **Peat moss:** Many professionals who use soil blocks make them from 100% milled and screened sphagnum peat moss. In theory, the low pH of pure peat (down to 4.0) should stunt plants but at the seedling stage this is not a serious problem. However, for very acidic peats and for plants which will be in blocks for more than two weeks, some sort of buffering should be provided. The ideal pH for blocks is 5.4 on up to 6.0. Another caution: Peats that are from the very top of the bog (white peats) and peats that are from the very bottom of the bog (black peats) are not good on their own and should be combined.
3. **Peat-based mixes:** Several mixes are based on peat, which some block makers insist should comprise no more than half of the medium. For example: peat moss 50%, vermiculite 25%, good garden soil 25%, a small amount of clay dust as a binder. Or Thalassa Cruso's recommendation for potting soil: one third commercial potting soil or leaf mold, one third peat moss, one third perlite or sharp sand. These mixes would make more fragile blocks but if you can set the blocks in trays until the roots bind the mix together, then they might work very well for you.
4. **My favorite:** The mixture I like is three parts white peat moss (as always, milled and screened), one part black peat moss or sedge peat moss, one part well rotted compost, a handful of ground calcium limestone to every cubic foot to buffer the peat, and a handful of ground basalt rock powder. This combination assures a wide range of nutrients at low levels and a good matrix for establishment of the roots.

Charging the blocker

It is best to wet your mix some hours before you make blocks. You will find that the penetration of water into the planting medium is much better if you do. But such planning ahead is not always possible.

Wet the medium thoroughly into a slurry-like consistency. Since I like to leave any unused soil mix in the tub for next time I make blocks, I avoid galvanized metal tubs, since the acids in any soil mix will dissolve the galvanized coating. This will ruin the tub and poison the plants. I recommend a sturdy plastic tub (Figure 2).

Thrust the block maker into the pile two or three times to fill the block

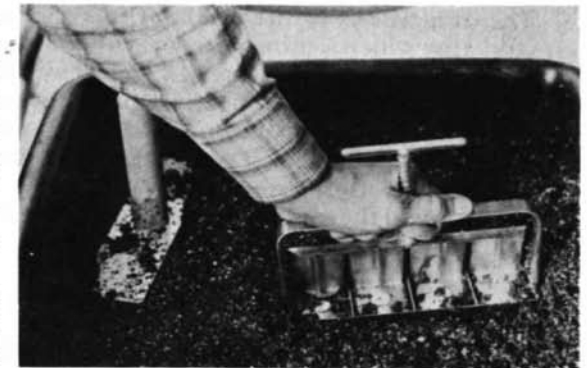


2. Wet the soil mix thoroughly.

chambers snugly. The English call this "charging the blocker." It is very hard to pack the soil mix too tightly into the blocker, thus excluding needed air spaces, unless you are using a very heavy soil mix. The handblocker shown in Figure 3 is the Ladbroke™ block maker.

Scrape the blocker across the side of your mixing tub to remove any excess soil mix from the bottom of the blocks (Figure 4).

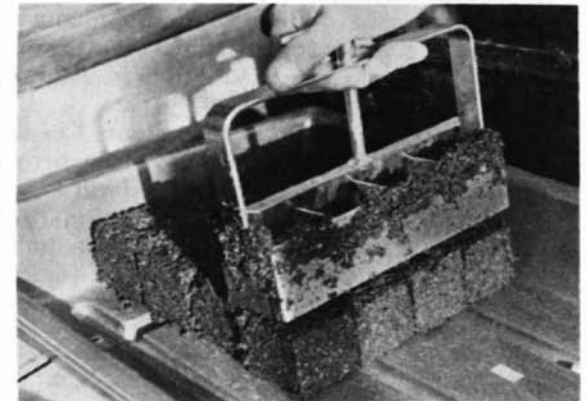
Depress the plunger to eject the blocks onto a tray (Figure 5). Any kind of tray or flat board is acceptable. Sides are not necessary since soil blocks do not fall over like pots. The basic design of my favorite tray was devised by the market gardener Eliot Coleman. The tray holds 44 two-inch blocks or 75 1½-inch blocks (Figure 8). The sides are exactly two inches high so that trays can be stacked with blocks in them when awaiting seeds or when the seeds are germinating (Figure 6). The rim is no higher than this so that there is good ventilation across the top of the block, an essential precaution against "damping off." The fourth side is open so I can get to the blocks without lifting them up and out of a tray when setting out. The wood does not break as do most plastic trays, and it holds a bit of moisture for the blocks. And, it fits neatly into the tray holder attachment to my handcart (Figure 13).



3. Charge the blocker.



4. Scrape off the excess soil mix.



5. Push the blocks onto the tray.

The dimensions of the inside of this tray are 22 inches by 7¾ inches. A smaller tray which is more popular with the home gardener holds nine rows of two-inch blocks and measures 18 inches by 7¾ inches (as seen on cover).

The blocker can be dipped in a pail of water between chargings if it gets gummed up. It *must* be thoroughly cleaned at the end of the day to remove the soil acids (and fertilizers, if you use commercial mixes) from the metal surface of the blocker.

I have found the average time it takes to stir the mix, charge the blocker, and fill a tray of 44 blocks is three minutes.

SEEDING

Each block has a small depression in the top for accepting a seed. Large seeds, such as for squash or corn, can be handled very easily between the fingers. Push a seed down into the block and pinch a bit of the soil mix around the seed.

For small seeds, such as lettuce or tomato or onions or many kinds of flowers and herbs, I use a technique shown to me by Michael Ladbrooke, the English engineer who designed the handblocker (Figure 6). In one saucer he spreads out the seeds, and in another saucer he has a bit of water. He wets the end of a sharpened match stick or a sharpened wooden plant label stake. He touches the end of the stick to a lettuce seed. The lettuce seed adheres nicely to the end of the stick. He then presses the stick to the inside of the depression in the block and the lettuce seed stays there. Every so often he wets the tip of the stick again.

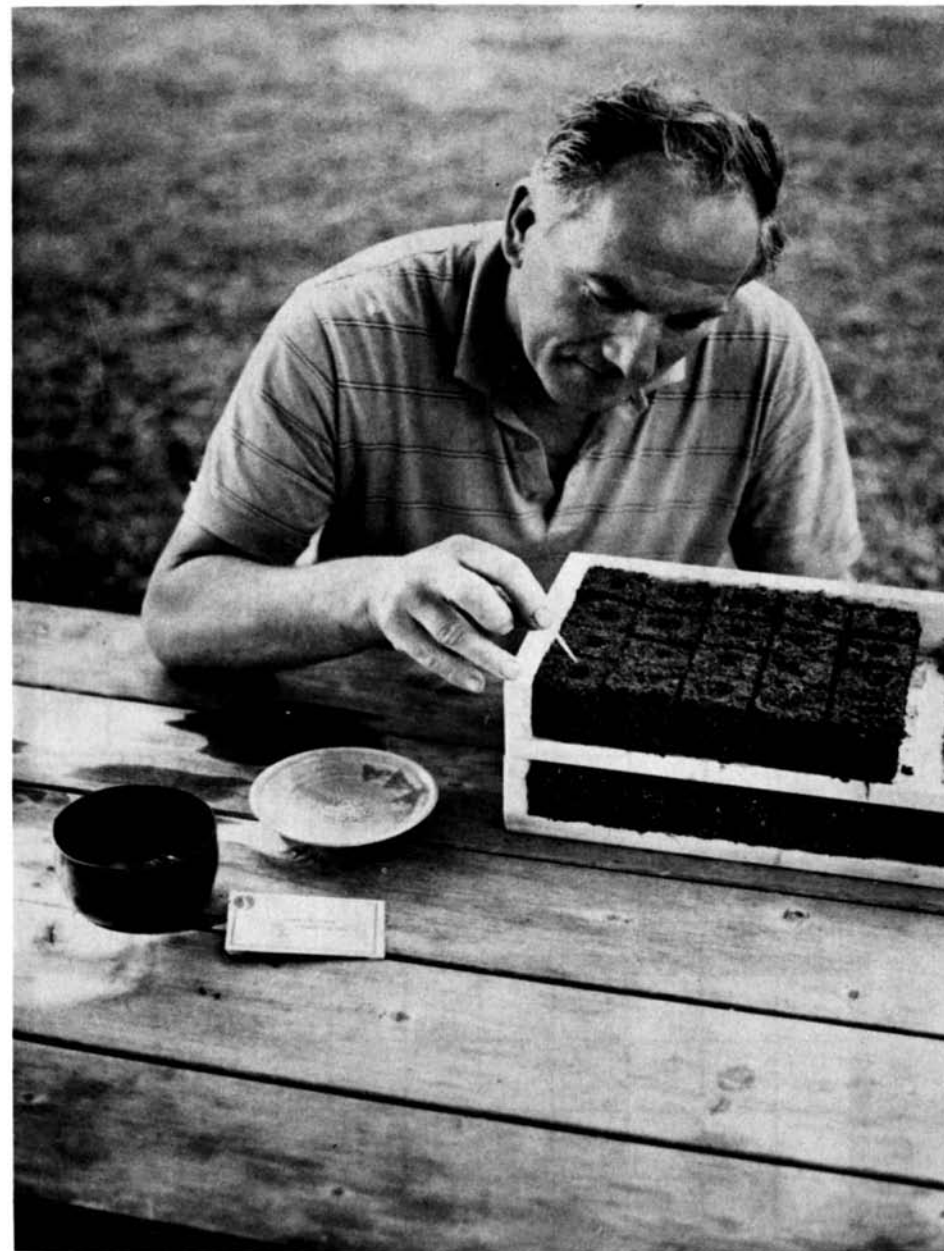
I had originally thought this technique was rather tedious. However, I soon realized that every minute spent at this stage is repaid ten times later on. I sowed two trays of lettuce (88 plants) in six minutes this way. How long would it have taken me to thin 88 feet of lettuce row in the garden?!

Therefore, do not sow more than one seed per block. It is better to have an empty block here and there — and you will because no seed packet comes with 100% viable seed — than to thin the plants in your blocks.

Some growers with little space and a crop with poor germination will pre-germinate their seeds and then transfer the best ones (“prick out”) to soil blocks at the two-leaf stage.

After getting a seed into the block, I usually pinch the top of the block to cover the seed. But when you can assure proper care so that the blocks will not dry out, this is not necessary. A seed will sprout nicely on the surface of a moist medium. The only seed which professional growers cover is celery, and that by sprinkling a bit of shredded peat over the sown blocks. Some growers use “split-pill” seeds which are pelletized for easy handling, do not need to be covered, and open into two halves when wet to let the plant out.

Extremely important at seeding time is to make a map of what you have sown, as in Figure 7. It should include plant species and variety, the source of the seed, date of sowing, and date of emergence of the seedling (germination time). You might also want to include number of seeds per block (sometimes you want to have more than one, as discussed later), the type of planting medium you used, any special treatments in fertilization, and how the seedling



6. Michael Ladbrooke demonstrating the sowing of small seeds.

7. Soil Blocks Tray Chart.

Tray #	1	2	3	4	5	6	7	8	9	10	11
A											
B											
C											
D											

Tray #	1	2	3	4	5	6	7	8	9	10	11
A											
B											
C											
D											

Tray #	1	2	3	4	5	6	7	8	9	10	11
A											
B											
C											
D											

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performed. You might also want to include information about how the plants seemed to coordinate with moon cycles and planetary movements, as is detailed in the fascinating planting calendar mentioned at the end of the manual. The chart in Figure 7 works for the larger tray which I use, but the double line shows the end of the more popular nine-row tray.

TENDING BLOCKS

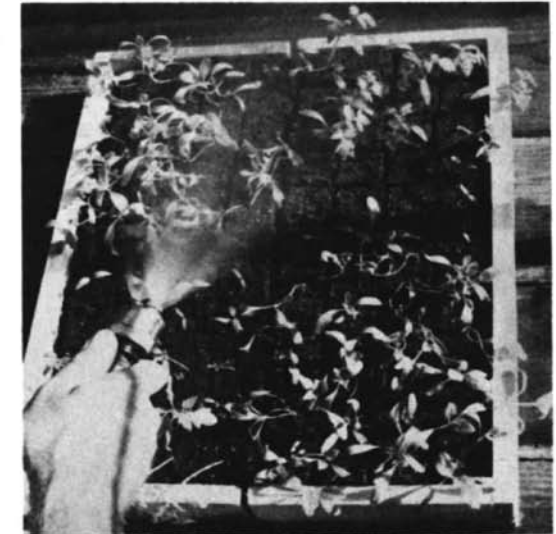
Water

No water is needed for the first three days or so as the blocks are quite wet when formed. I stack the trays (as in Figure 6) to help keep the water in. After that point, you need to keep them moist. Heavy watering will drown the plants and erode the blocks. Blocks can be pretty strong — I was able to plant blocks which had stayed out in two days of torrential rains in trays which had no drain holes — but mistreatment undermines the advances made by plants in blocks.

Best for watering is a fine spray attachment to a hose (Figure 8), or a hand-pumped mister or a watering can with a fine spray pattern in its hose. In really hot weather, the blocks may need to be misted or lightly sprayed twice a day, the rule being "little and often." Water thoroughly; do not simply moisten the top of the blocks. Peter Tonge waters from the bottom, a technique used often with potted plants: Put one inch of water in the bottom of the mixing tub and set the tray of blocks into the tub. The tray is $\frac{3}{4}$ -inch thick so the top quarter inch of water moves among the blocks and is sucked upward by capillary action. This sort of extra care should only be necessary if you permit your blocks to get too dry. Set the trays together as in Figure 8 so the blocks do not lose moisture from the open fourth side.

Nutriments

Most of a seed is food stored for the young plant and a seedling will thrive in conditions of warmth, light, and moisture without any extra feeding. After several days, the seed storage is exhausted and additional support must be found in the soil mix or in added fertilizer. My favorite soil mix has some available minerals, but after a week I supplement this with very dilute solu-



8. Watering "little and often."

tions of fish emulsion applied with a watering can. Larger operations can use a sprayer for fertilization.

Light

The needs of the plant, including whether supplemental lighting may be necessary for a seedling, can be read from the plant itself. Tomatoes, for example, should be as wide as they are tall, with dark green, thick, hairy, crinkled leaves (see Frontispiece); if they are taller than wide (called "leggy"), with light green or yellow leaves, that are thin, without hair, or flat, then they may be suffering from inadequate light. Ironically, I need to use extra lights when raising fall vegetables because my greenhouse is shaded by a large maple tree in summer.

SETTING OUT

Studies have shown that watering soil blocks before setting out is more important than the moisture in the garden soil in maintaining a good lead over other kinds of transplants.

The trowel in Figure 9 can be used to move soil and mix planting media, but its specialty is making a hole that is just a bit larger than two inches deep, two inches wide, and two inches long, exactly the size of the soil block. (The other end of the trowel does the same thing for a 1½-inch block.) The trowel should



9. Setting out into the garden.

be inserted into the ground vertically and pulled straight back. If blocks have been placed too closely together in the tray and some roots have grown across the space between them, the trowel can also be used to cut between blocks as with a knife and scoop them up as with a spatula.

Set out on an overcast day or in the late afternoon. After the block is set in the earth, press soil around it from both sides. If the ground is moist, as in the spring, watering is unnecessary. If the ground is dry and dusty, the transplant will not find it easy to keep going, so watering the area around the plant after planting is a good idea. If wet blocks (soaking wet, not swimming) are planted into moist soil, subsequent irrigation will be unnecessary for many crops.

Hardening off means putting transplants outside of their protective environment for several days before setting in the garden to acclimatize them to colder temperatures, hotter temperatures, varying temperatures, drying winds, and so forth. Hardening off means slowing down the plant's growth and is a big step backwards in the process of transplanting. Techniques include "temperature hardening" (lowering the plant's temperature to the ambient temperature of the garden), "drought hardening" (not watering for several days), and "brushing" (actually wiping the plants with a paintbrush to simulate windy conditions).

Transplants in soil blocks need little or no hardening off because the root ball is intact and inside the block. However, plants that will be set out at a harsh time of year, or which have been in soil blocks for over three weeks, or which are tender and succulent from very warm growing conditions indoors, are more vulnerable and should be introduced to the garden environment more gradually. This does not mean the sudden introduction of harsh conditions — as one old gardener told me, "hardening is not hammering" — but rather a little bit of stress intermediate to the rigors of the garden climate. Most often, hardening can be dispensed with completely without harm to the plant.

TOOLS FOR LARGER GROWERS

The principles of the manufacture and tending of blocks are covered above. Completely automated farms would employ the same principles but with large machines which are available for these tasks. My interest is small and intermediate technologies which also are not overly dependent on labor. Such improvements for blocking include mini-blocks, a larger handblocker, a block-sized hole punch, a holder for moving trays of blocks, a wide axle, and slitted row covers. Separately, each technique helps bring the harvest sooner by at least a couple of weeks; together these three techniques can speed the harvest by four to eight weeks.

Mini-blocks

With Eliot Coleman, Michael Ladbrooke has also developed a handblocker which makes twenty ¾-inch blocks at each pressing. Three reasons exist for starting a seed in a smaller block in order to put it later into a larger block: First, each plant takes up less bench space during germination; second, there is less mass to heat (a miniblock is one nineteenth the volume of a two-inch block); third, a plant tends to use up the space it is in and is revived when set

into a larger space. The last reason is why repotting of house plants is best done in small steps, planting in a new pot one inch larger than the previous one, rather than setting a small plant in a large pot at its beginning.



10. Tomatoes in mini-block and two-inch block.

By adding the two steps of making mini-blocks and setting them into larger blocks, we have increased the demands on the time and management skills of the gardener. However, studies of this system which are currently underway have shown that production is improved sufficiently to warrant the effort.

When the plant is almost two inches tall, say after five to ten days, depending on the species, the mini-block is set into a two-inch block with a pair of tweezers (which can be made from two plant stakes tacked at one end to a one-inch long piece of one-inch dowel, see Figure 10). For mini-blocks, the depression in the top of the two-inch blocks is not round but a cube just over $\frac{3}{4}$ -inch on a side.

Large handblocker

Every Monday morning for the last eight years, the English greenhouse grower David Dillistone has made seven thousand blocks with a large handblocker and seeded them with lettuce seeds — all in three hours (Figure 11). His standup blockmaker makes twenty $1\frac{1}{2}$ -inch blocks at each charging. The two-inch size makes twelve blocks at a time. The gardener's handblocker (Figures 3-5) has a limit of ten thousand per season — at least, that's how many

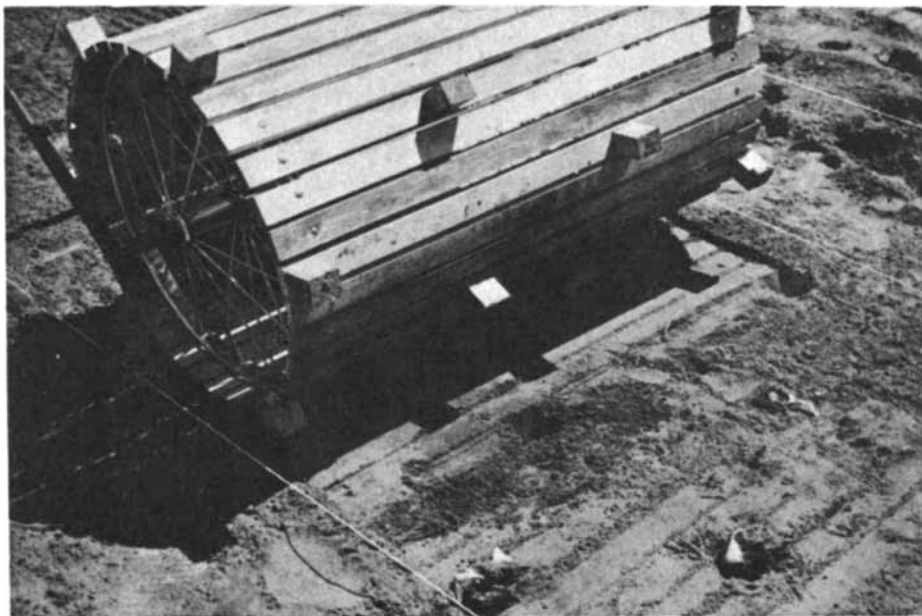


11. David Dillistone with his large hand blocker in lettuce production.

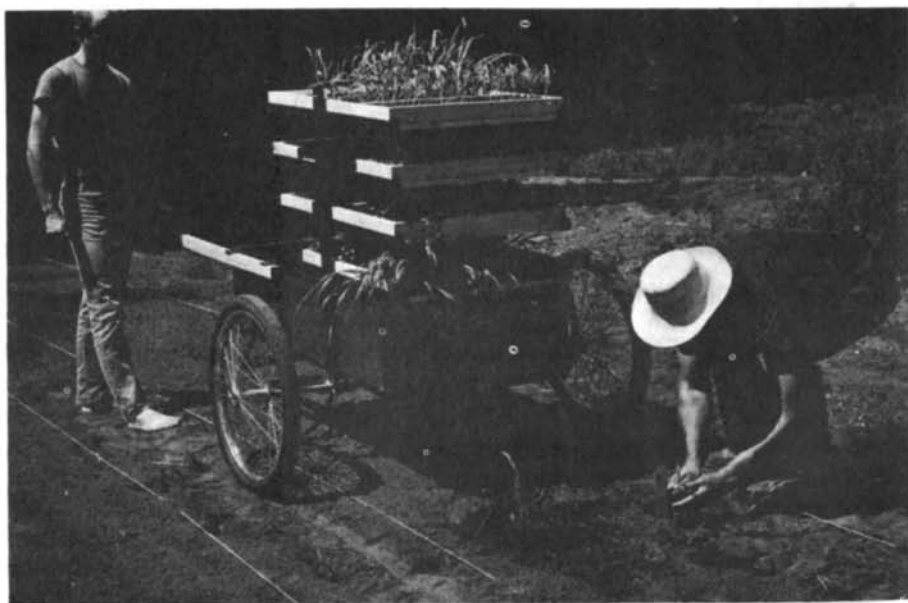
one grower told me he makes each year. At that scale of production, I would switch to the larger size.

Hole punch

Setting blocks in a single or double row is easily done with string and stakes. In a wide-bed system, you may want to space plants more closely in a grid system to increase productivity and to make weed control more effective. Such measurements can be made much more easily with a device we call a "hole punch": 36 slats, two inches wide and 38 inches long, fit snugly around two handcart wheels 26 inches in diameter. Screwed to the slats are a pattern of two-inch cubes of wood. Pulled through recently tilled ground, either by hand or attached to the rototiller which is preparing the seedbed, the hole punch



12. Hole punch gives right spacing for lettuce plants in a wide bed.



13. Tray holder brings plants to the garden; wide axle straddles wide bed.

leaves a grid of holes ready for soil blocks. In well-drained but moist spring soils, the punch leaves a hole ready to plant without a trowel's help. In poor soil or atop a black plastic mulch, the punch leaves a pattern which is an indication of where to make proper holes. This system permits the following spacings within a row, in inches: 4, 6, 8, 12, 16, and 24 (wooden cubes attached to every second, third, fourth, sixth, eighth, or twelfth slat). Distance between rows can be as wide as 36 inches. Plants can be staggered, as in Figure 12, which shows a pattern for four rows of large leaf lettuce, twelve inches apart within the row and thirteen inches diagonal distance between plants. Of course, other spacings could have been chosen for this lettuce, depending on the variety of the plant, type of soil, personal habits in spacing, etc.

Tray holder

Moving plants from the greenhouse to the garden is difficult when dealing with large numbers. A tray holder which fits both the Green River Tools™ and the large Garden Way® handcarts holds sixteen large trays of blocks, or 704 blocks, leaving the inside body of the cart for other equipment which you wish to take along (Figure 13). The same tray holder can be used for other sorts of trays.

Wide axle

For straddling a wide bed of 42-48 inches, a wide axle can be put on the handcart to keep the wheels in the paths. I have seen one person pull a cart at a moderate pace while a professional market gardener quickly set blocks into the bed without handling any trays! The wide axle also permits the cart to straddle the row at harvest-time.

Slitted row covers and other plastics

Several types of plastic materials have been used in vegetable production. Based on research at several universities and research centers, slitted row covers have become increasingly popular in conjunction with soil blocks for extending the season. Two rows of slits, each slit five inches long and $\frac{3}{4}$ -inch apart, permit the ventilation of excess heat from the plastic tunnels, a great improvement over other covers where scorching is a problem. Protection against frost is not that great — four degrees in the spring and six degrees in the fall; the main virtue is warming the soil that brings the harvest two to four weeks sooner than uncovered plants.

Used mostly by market gardeners, some large home gardens have begun to sprout tunnels in the spring and fall. The plastic comes in five- or six-foot widths, a thousand feet rolled up on a pressed cardboard tube. Other plastics used in the garden include black plastic mulch, Reemay gauze for covering plants, and other sorts of polyethylene sheets for tunnels.

Devices for laying slitted plastics or other materials in rolls are either simple and require many people — a long broomstick through the tube held by one person at each end while a third person unrolls the plastic — or are very expensive — a tractor-mounted device would cost approximately two thousand dollars.

An intermediate technology is an accessory which fits both the Green River Tools™ and large Garden Way® handcarts (Figures 14 and 15). With this device:

1. One person can unroll and set the slitted row covers (two people are needed on a windy day).
2. No one has to carry the plastic roll, which is awkward and heavy.
3. The plastic can be tensioned while laying so that it does not droop. And the plastic can be rolled back onto the cardboard tube when it is time to remove it from the field. This is an important feature: The plastic can be used another season or two, a savings in time and money and a reduction in waste. Even the expensive laying devices do not have this feature.

Figure 14 shows one person pulling out a length of slitted plastic from a roll which is five feet wide. The cart is parked at the end of the row of sweet corn recently transplanted in soil blocks. Figure 15 shows the handcart in more detail, and the first hoop of the tunnel. More detail about how this system works is available from sources listed at the end of the manual.

SPECIFIC PLANTS

Different species, different varieties within species, different climates, different tastes and markets: All of these are reasons that I can only discuss each type of plant in a general way. Soil blocks, and the other forms of season extension discussed here, can only supplement good gardening practices; they cannot substitute for knowledge learned from other sources and from experience.

All things being equal, studies have shown that blocks give the greatest boost when plants are two weeks old at transplanting. All things are not equal, however, and conditions in a protected environment are far superior to those in the garden at many times of year. Some plants are kept in blocks eight weeks or more; in these cases allowance must be made for supplemental feeding to meet the needs of the seedling. Check the plant by looking at the roots, not the tops; if the roots begin to change from white to brown, or if the block becomes root-bound, it is time to set out. However, if the weather is poor, the plants can be slowed down to await setting out by lowering the temperature and reducing light levels.

Block size is a matter of great controversy among the research centers working on blocks. Much of the argument is inapplicable to small or large gardeners, since researchers are using large greenhouses (where the cost of heated space is very high), very strong fertilizers and pesticides, and commercial water misting systems. Though every plant species and every growing system may have its ideal block size, we have concentrated here on the two-inch block for purposes of simplicity and exchangeability of equipment, with some mention of the 1½-inch block and the ¾-inch mini-block.

One of the fascinating possibilities proposed in research on blocks is the use of more than one seed per block. With onions, for example, which are far superior in taste and storability when raised from seed versus from onion sets, as many as nine seeds in each block was found to produce increasing yields per acre. The highest percentage of bulbs over 2½ inches in diameter came from six seeds per block. Besides, onions at one seed per block would have to be set out almost end to end.



14. Laying slitted row covers over soil blocks.



15. Handcart, slitted row covers, lettuce in blocks.

What I gain by sowing several seeds per block is the ability to weed *in* the rows as well as between the rows. In staggered spacings of blocks (as in Figure 12), I can weed in three directions — in the aisles between longitudinal rows and along two diagonals. Harvest is easier also; at three parsley plants per block, for example, it is already bunched.

The general rule for spacing multi-plant blocks in the garden is to end up with the same density. That is, a block with four plants in it should take as much row space as four separate plants in a direct seeding system.

Concerning timing, the aim is to transplant a vegetable when the soil is warm, not necessarily on the last day of expected frost, so that the plants will continue their accelerated growth. Therefore, transplants are generally set out later than people are tempted to sow directly into the garden. The earlier you push your plants, the more they will need to be hardened off and perhaps protected from wind in the garden. The best advice for the beginning transplanter is to extend the season just a little bit the first year, and further only with experience.

For translating from Fahrenheit to Celsius: 32° F is 0° C; 40, 4; 45, 7; 50, 10; 55, 13; 60, 16; 65, 18; 70, 21; 75, 24.

Beans. One to three seeds per block, primarily for germinating the seeds before last frost date in the spring. I find this practical only for a small number of early snap beans and lima beans; certainly it is not practical for drying beans.

Beets, Red. Up to four seeds per block firmly seated and thoroughly moistened; germination temperature at least 60° F, 50° F thereafter; sowing to planting is four to five weeks. Seed should be rubbed and, if possible, monogerm. If monogerm cannot be assured (e.g., if you raise your own beet seed), then sow one seed per block and still get multi-plant blocks (see Frontispiece). Blocks work well for production of greens or of roots. When raising for roots, it is important to drop the block to the ground before setting out; called “shattering,” this loosens up the block a bit so that the taproot can grow down as soon as possible. Figure 16 shows six beets ready to harvest grown in one block (the measure in the background gives an idea of how much space this takes).

Brassicas. Including Brussels Sprouts, Broccoli, Calabrese, Cauliflower. One seed per block; germination temperature at least 50° F, frost protection thereafter; sowing to planting is six to eight weeks.

Cabbage. Three plants per block have given larger yields than one plant per block at the same planting density for pointed spring cabbage. Round head types need one seed per block. Germination temperature needs to be 50° F with only frost protection thereafter. Sowing to planting is seven to eight weeks.

Carrots. Repeated tests have failed to produce large and long — marketable — carrots or parsnips. However, success has been had with short and fat varieties (e.g., “Early French Frame Rondo”) and other varieties where some gnarling is not a concern to the gardener.

Celeriac. One seed per block; germination temperature at 65° F, 55° F thereafter; sowing to planting is four to five weeks.

Celery. One seed per block; germination temperature at 65° F, 55° F thereafter; fluctuation from warm days to cool nights seems to help; sowing to planting is nine weeks.

Chinese Cabbage. At one seed per block for a fall crop, blocks permit the protection of these plants from conditions which would encourage bolting when setting out in midsummer.

Chrysanthemums. Stick unrooted cuttings into blocks with a deeper hole dibbled into it. Set out when the plant has ten leaves, usually three to four weeks. Some growers keep the blocks quite warm and moist for the first two weeks, then “cool out” (or temperature harden) for two weeks, then set out.

Corn, Sweet (Maize). Up to four to five seeds per block, although I prefer two as sweet corn is a heavy feeder. Germination temperature at least 45° F with ventilation over 65° F. Sowing to planting can be as much as four weeks. The problem with sweet corn is its long taproot, which drops quickly out of the bottom of the block looking for deep soil. Thus pushing sweet corn too far in blocks can completely ruin the crop; better to plant out, perhaps to slitted row covers for early crops, as in Figure 14, in 10-14 days (as on the cover) than to keep too long in blocks.

Cucumbers. See Squashes.

Eggplants. One seed per block; germination temperature ideally 75° F, 70° F thereafter; sowing to planting in 8-10 weeks.

Flowers. Many have a very long germination period (three weeks is very common), and are dwarfed by weeds when directly sown. One seed per block; germination temperature at least 60° F, and as warm thereafter; optimum temperature is 65-70° F; sowing to planting varies with germination times. Flowers are excellent for smaller blocks, as they are often set out as soon as the first or second set of true leaves appears. Examples of flowers raised successfully from seed are violets, begonias, marigolds, pansies, petunias, salvias, poinsettias, and geraniums. Several flowers including dahlias, geraniums, and chrysanthemums are very successfully raised from cuttings: see Chrysanthemums.

Herbs. See Flowers. Many herbs do well at two to four seeds per block, e.g., parsley, dill, and basil.

Leeks. Up to four seeds per block, raised like onions.

Lettuce. One seed per block; germination temperature at least 45° F, but no higher than 65°-70° F, frost protection thereafter; sowing to planting in nine weeks for earliest crops, down to four weeks for midsummer crops. If you are in an area where leaf rot of the lower leaves is a problem, then make the hole a bit shallower so that the block sticks up out of the ground. Some growers simply set the lettuce block on top of scuffed earth if under glass or plastic. Recent research has shown high nitrate levels in fall-grown lettuce, even if grown organically, so pushing lettuce late into the fall is not recommended.

Melons. See Squashes.

Onions, Bulb. Up to four to six seeds per block; germination temperature at least 60° F, 50° F thereafter. Typical time from sowing to planting is eight weeks. Transplants should be five to six inches tall. Although often recommended, trimming the tops of onions has been shown to take time and possibly harm the plant.

Onions, Bunching. At eight seeds per block, when they are mature they can be tied in a bunch before being pulled from the ground. Dip them in water and take them to market.

Parsnips. See Carrots.

Peas, Fresh. Planting peas in blocks is only justified by those wishing to provide for the very early market, and by those who compete with their neighbors in the race for early peas. Four seeds per block; germination temperature at least 45°F, frost protection thereafter; sowing to planting in three to four weeks.

Peppers (Capsicum). As with Eggplants.

Perennials. Blocks can also be used for small corms and bulbs, root and stem cuttings, etc. The depression in the top of the block must be made a bit deeper for these uses.

Potatoes. Recently potatoes are being planted from seed. See Tomatoes for general culture.

Spinach. Up to three seeds per block; germination temperature at 50°F, frost protection thereafter; sowing to planting in three to four weeks. Spinach usually winters over well after a fall planting, but raising in blocks would be appropriate after a particularly severe winter. For a late summer crop, blocks would give the moisture necessary for good germination and protect the seedlings from sudden heat waves which might cause bolting to seed.

Squashes (Summer and Winter; also Marrow and Courgette). One seed per block; germination temperature ideally at 75°F but at least at 65°F; sowing to planting in four to five weeks.

Tomatoes. Professionals use up to five seeds per blocks, germinating at 65°F, for plants set out at four weeks of age, although one to three seeds per block are recommended for difficult growing areas. Since many people are eager to get early tomatoes and wish to sow more than four weeks before the soil has warmed, they can start one seed in a two-inch block (or preceding that in a mini-block as in Figure 10) and then plant into four-inch plastic pots or milk cartons after four to six weeks. Some people have made a four-inch block maker with scrap wood but I feel this only makes sense for large production where this is performed by machine. Market gardeners would do better to set tomatoes out under slitted row covers than to push plants too long in the greenhouse. Since tomatoes will sprout roots from any part of the stem, set them more deeply into the soil, up to the first or second set of true leaves.

Turnips. Up to four seeds per block; germination temperature at least 50°F, after which frost protection; sowing to planting is three weeks (the root does not do well much longer than that).

Other plants. Small grains to be raised in hills, hops, trees from seed and cuttings, alpine strawberries which have a very long germination period, etc. The ericas (heathers) should not have lime in the soil mix as they are acid-loving.



16. Multi-plant blocks: Beets.

EPILOGUE

The old planting rule goes:

One for the cutworm,
Two for the crow,
Three for the blackbird,
And four to grow.

With soil blocks, the old rule can be changed to:

Plant four, harvest four . . . all from one block!

RECOMMENDED FURTHER READING

Introductory

- Bubel, Nancy. *The Seed-Starters Handbook*. Emmaus, PA: Rodale Press, 1978
Step-by-step introduction to starting a garden, with tips on individual fruits and vegetables and saving your own seed.
- Bigs, Tony. *Vegetables* (The Simon and Schuster Step by Step Encyclopedia of Practical Gardening). New York: Simon and Schuster, 1980.
Step-by-step introduction to starting a garden, with tips on individual vegetables. Though written by someone in an area with long seasons and moderate temperatures, and who loves thinning, it gives excellent introductory information about many vegetables and techniques.
- Cruso, Thalassa. *Making Things Grow Outdoors*. New York: Alfred Knopf, 1971.
A great deal of practical experience and good common sense.
- Kimberton Hills Agricultural Calendar for Farmers and Gardeners: A Beginners' Aid for Understanding the Influence of Cosmic Rhythms in Work on the Land (available from Kimberton Hills Publications, Box 155, Kimberton, PA 19422).
- Sanderson, Kenneth C. Growing with artificial media. *Southern Florist & Nurseryman*, July 29, 1983, 13-17.
Analyses of many potting soils.

Soil blocks as a propagation technique

- McGee, J. M. T. Physiological aspects of transplanting vegetables and other crops. *Horticultural Abstracts*, May 1981, 265-272, June 1981, 355-368.
- Johnny's Selected Seeds, Albion, ME 04910.
Dates for sowing, setting out, and harvest for many different varieties of vegetables.
- Browse, Philip McMilan. *Plant Propagation: Seeds, Roots, Bulbs, and Corms, Layering, Stem Cuttings, Leaf Cuttings, Budding and Grafting* (The Simon and Schuster Step-by-Step Encyclopedia of Practical Gardening). New York: Simon and Schuster, 1979.
Soil blocks can be used for more than seeds. Profusely illustrated.
- Tonge, Peter. "Sure-fire Transplants," *Christian Science Monitor*, July 22, 1983, 16.
- Coleman, Eliot. *The Use of Ground Rock Powders in Agriculture: Granites, Feldspars, Micas, and Basalts*. Harborside, ME. Small Farm Research Association, n.d. (available from Green River Tools for \$2.00).
- Tresemmer, David. *Handcart Handbook* (revised edition). Brattleboro, VT: By Hand & Foot, Ltd., 1985 (\$4.50). On handcart accessories which fit with the soil block system.

Plastics

- Tresemmer, David. *Laying and Retrieving Horticultural Plastics*. Brattleboro, VT: By Hand & Foot, Ltd., 1983.
- A Summary of Current Research Results on Row Covers*. Reading, MA: Ken-Bar, Inc.

Complete References

A complete bibliography on soil blocks is too lengthy for this handbook. Updated regularly, it can be obtained from Green River Tools.

ADDITIONAL NOTES

Growing Medium (pages 7-8): Recent information shows that vermiculite can be contaminated with asbestos fibers. Studies at Woods End Labs have shown that wetting agents (commonly added to commercially available potting and seed-starting mixes to make peat moss more wettable) to be toxic to plant root hairs. Also a thorough study of sterilization of potting soils has shown that it is temporary (one hour before reinfestation occurs), it releases potentially toxic amounts of ammonia, copper, and manganese, and the bacteria which reinfest are not the beneficial but the pathogenic type. More on the specifics of this research can be obtained from *By Hand & Foot*. As for soil blocks, these ingredients and practices should be avoided. Green River Tools has developed a growing medium for soil blocks which I recommend you look at, feel, smell, and then replicate with your own ingredients according to the guidelines on pages 5-8.

Wetting (page 8): It's best to wet the medium to an oatmeal-like consistency, and stiff oatmeal at that. Too wet and the stuff slides right out of the blocker.

Mini-blocks and maxi-blocks (pages 15 and 16): The reason to make a mini-block or a maxi-block rather than depend on fertilizing two-inch blocks is that plants run out of room for their root systems. Ideally, the biomass below the soil surface should equal that above, and if this ratio is pushed too far (i.e., too little space below the soil in proportion to what is growing above), the plant will suffer rather than gain from early seeding. It is well known that the best way to pot a plant is to start it in a small container and repot it in a container only slightly bigger than the previous one, as roots tend to go to the edges of any container.

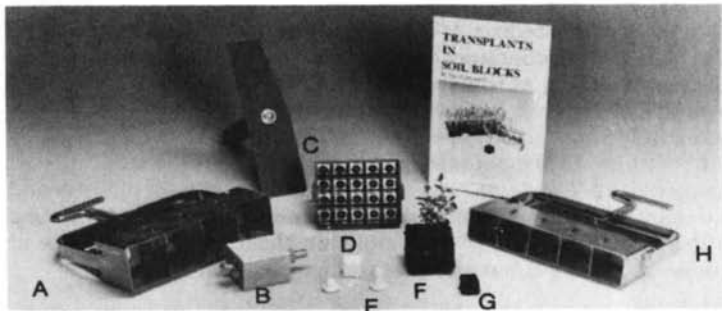
Hole punch (page 17): Troybilt has used the idea from the first edition of this manual to make a hole punch to be pulled behind a rototiller. The holes are easily made in the fine tilth left by the churning tines. Write them for details.

Multiplants (pages 11, 20-24): Most Americans are unfamiliar with this idea and I have received many letters of disbelief. Yes, you can sow several seeds of some vegetables in the same hole. No, you do not thin them or separate them at planting out time. Yields are equal and management is much easier.

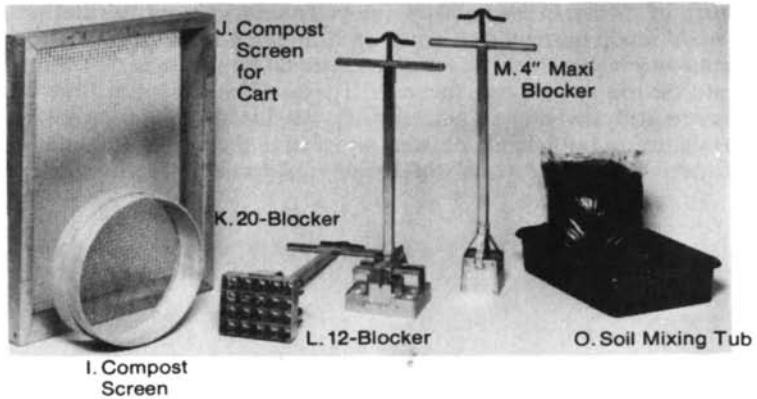
Where did soil blocks originate? Soil blocks have been used in Mexico, since the birth of Christ, in the highly developed chinampas agricultural system. Farmers would scoop nutrient-rich muck up from the bottom of canals and spread it in a mass two inches thick. As it dried, it was cut into squares, and a small hole poked into the top of each one, for seeds. These soil blocks were called "chapines." This system still survives near Mexico City. We don't know if the technique travelled to Holland and England, or was reinvented there. We do know that the first handblockers were made with heavy steel frames about a hundred years ago.



17. Blocks on a large scale: 80,000 brassicas in a greenhouse in Holland.



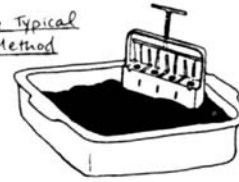
- A. Standard 4-Blocker
- B. Dibble for Double Digger
- C. Soil Block Trowel
- D. Mini-Blocker
- E. Inserts
- F. 2" Soil Block
- G. 3/4" Mini-Block
- H. 5-Blocker



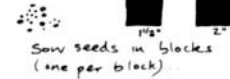
Equipment at all scales, from miniblockers to large mechanized machines, can be had from Green River Tools, P.O. Box 1919, Brattleboro, Vermont 05301 (802) 254-2388.

Choices with Soil Blocks

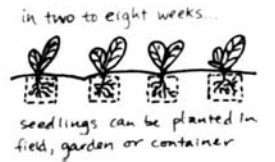
The Typical Method



make 1 1/2" or 2" blocks with growing medium...



Sow seeds in blocks (one per block)...

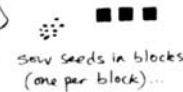


in two to eight weeks...
seedlings can be planted in field, garden or container

Mini-Blocking

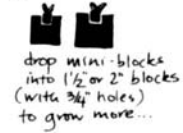


make mini-blocks...

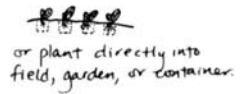


Sow seeds in blocks (one per block)...

after ten days or so...

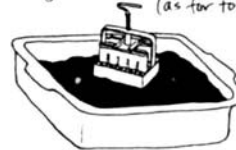


drop mini-blocks into 1 1/2" or 2" blocks (with 3/4" holes) to grow more...

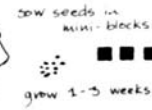


or plant directly into field, garden, or container.

Large Scale Production Method (as for tomatoes)



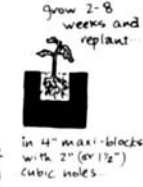
make mini blocks with growing medium...



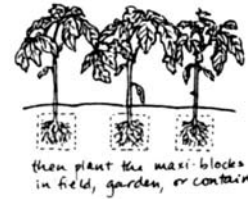
sow seeds in mini-blocks
grow 1-3 weeks...



drop mini-blocks into 2" blocks (with 3/4" cubic holes)



grow 2-8 weeks and replant
in 4" maxi-blocks with 2" (or 1 1/2") cubic holes



then plant the maxi-blocks in field, garden, or container.

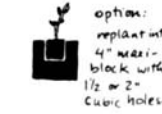
Cuttings of herbs, flowers, shrubs...



prepare cutting...



insert into 1 1/2" or 2" block (with deep holes) 1-8 weeks...



option: replant into 4" maxi-block with 1 1/2" or 2" cubic holes...



then set out in field, garden, or container.

"Pricking Out" for slow growers (such as celery, herbs, tree and shrub seeds, etc.)



seeds are broadcast in flats... prick out seedlings into blocks (with deep holes)...



then set out in field, garden, or container...



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