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FACT SHEET

FOR PART-TIME
FARMERS AND
GARDENERS



UNITED STATES
DEPARTMENT
OF AGRICULTURE

STARTING PLANTS FROM SEEDS

Growing plants from seeds started indoors can be rewarding. Plants of many annual flowers and vegetables may be started indoors. Vigorous plants started indoors flower sooner and produce an earlier harvest than those started outdoors. Home gardeners can also grow varieties that may not be available from local nurseries.

Selecting Seeds for Planting

Purity and trueness to type—Good seeds should not contain seed of other crops or weeds, and should be the correct variety. For best results buy quality seed from a reliable dealer.

Packages and Storage—Seeds sold in packages should show crop, variety, germination percentage, and chemical seed treatments, if any. Seeds should be kept dry and cool to insure good germination at planting. Laminated foil packets insure dry storage. Paper packets are best kept in tightly closed cans or jars until seeds are planted.

Hybrid seeds—Many new vegetable and flower seeds are hybrids. Hybrid seed often costs more than seed of non-hybrid varieties. However, hybrids usually have increased vigor, better uniformity, better production, and sometimes specific disease resistance or other unique cultural characteristics. Each gardener must decide whether the added benefit justifies the added cost. It often does.

Saving your own seed—Some experienced gardeners save their own seed. This practice is risky unless the gardener knows the proper techniques for selecting, producing, handling, and storing the seed. Seed from hybrid plants should never be kept. Likewise, it may be unwise to keep seed from plants that are readily cross-pollinated, such as sweet corn, squash, and pumpkins. Bean seed may carry viruses and other diseases from one season to the next.

Containers for Sowing Seeds

Containers for starting seeds should be clean, sturdy, and fit into the space available for growing plants in the home. Having the proper container helps get seedlings off to a good start and may save work in later stages of seed development.

Wood flats, fiber trays, plastic trays—Plants that are easy to transplant may be seeded directly in flats or trays for later transplanting into individual pots or wider spacing in flats. Starting seeds in such containers saves space as

compared to seeding directly into individual pots. However, where time is more important than space, direct seeding in pots may be preferred.

Clay and plastic pots—Both types can be cleaned and reused, and are excellent for growing transplants. Plants to be transplanted must be removed from the soil ball carefully at planting time. Seeds may also be planted directly into them.

Peat pots—These popular pots are made from peat or paper waste fibers, and may be purchased individually or in strips or blocks. They are porous, and provide excellent drainage and air movement. The entire pot can be planted, so there is minimum root disturbance at planting time.

Compressed peat pellets—When dry, expandable peat pellets are about the size of a silver dollar, but somewhat thicker. When placed in water, they swell to form a cylindrical container filled with peat moss, ready for seeding or transplanting. They may be planted directly into the garden. Use the pellets in trays so that they are easily watered and held upright.

Soil Mixes and Other Growing Media

The medium used for starting seed should be loose, well drained, and of fine texture. You may use commercially prepared mixes or materials can be mixed at home.

Vermiculite—This material when used alone provides good seed germination. It is clean, and if not contaminated during handling, will not need sterilization. If other seeding mixes are used, it is useful for covering seeds, since it does not form a crust, and seedlings can easily emerge. Vermiculite is available in several grades. For seeding, a fine grade is best.

Synthetic mixtures—Mixes that contain no soil are available for growing seeds. These contain either a combination of peat moss and vermiculite or peat moss and perlite. They may be purchased ready-made or can be mixed at home. To prepare such a mix, use 4 quarts of vermiculite, 4 quarts of peat moss, 1 tablespoon of superphosphate, and 2 tablespoons of pulverized limestone. These mixes, as well as vermiculite used alone, have little fertility. Seedlings must be watered with a diluted fertilizer solution soon after they emerge.

Soil-Vermiculite mix—Seeds may be started in a mixture of about one-third of good garden soil and two-thirds of vermiculite. Since good soil contains some fertility, prompt fertilization after germination is not so essential. When garden soil is used, the mix must be sterilized before seeds are planted in it.

Soil-peat-sand-mix—Large seeds, or vigorous-growing seeds may be planted in a mix of two parts good garden soil, one part shredded peat moss, and two parts of either perlite, or vermiculite, or sharp sand. Soil sterilization is necessary.

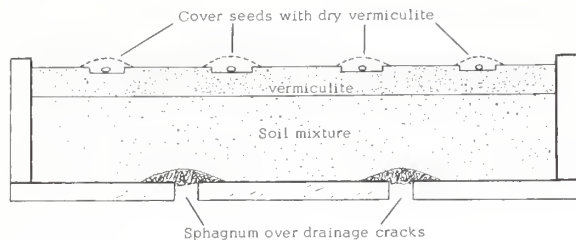


Figure 1

Milled sphagnum moss—A ground sphagnum moss is sometimes used for starting seeds, since it appears to have an ability to inhibit the seedling disease, damping off. It should be well moistened before use. Since it contains no fertility, prompt fertilization is essential after seeds have germinated.

Layered mixes—Another technique used for germinating seeds is to partially fill a flat or pot with a sterilized soil mix, and then top it with a layer of vermiculite or milled sphagnum moss in which the seeds are planted. After germination, roots of seedlings move from this top area into the soil mix, which provides fertility, and adding liquid fertilizer is less critical. Figure 1 illustrates this technique.

Sterilizing Mixes and Containers

To guard against damping-off and other plant diseases carried in soil and on containers, be sure to clean and sterilize materials.

Mixes—Place the moist, but not wet, soil mix in a container which can be covered to keep the soil from drying rapidly. If a cover is not available, cover with aluminum foil, and seal down at the edges. The mixes may be sterilized directly in the pots or flats in which they are to be used. In addition to killing disease organisms, many weed seeds are killed by sterilization.

Pinch a small hole in the center of the foil, and insert the bulb end of a meat or candy thermometer into the soil so that the bulb is about at the center of the soil mass. Place the pan in an oven at 200 to 250° F. Keep the soil in the oven till the thermometer shows a temperature of 160 to 180° F. Remove the pan and allow it to cool. Baking soil will give off a strong odor, so some ventilation may be desirable. The time necessary for sterilization depends on the volume of soil, as well as its moisture content. Dry soil cannot be sterilized well.

After the soil has been sterilized, make sure that containers, tools, and working area are also clean and sterile. Clean soil can be easily reinfected by careless techniques. *In sterile soil reintroduced disease may spread faster than it would in unsterilized soil.*

Containers—Wash thoroughly in soapy water all containers that have been used to remove all debris. Don't put wooden flats or plastic containers in the oven. Rinse wood and plastic items in a solution of one part chlorine bleach and ten parts water. Let them dry before filling with soil.

Seeding

The proper time for sowing seeds depends upon when plants may normally be moved outdoors. The period may range from 4 to 10 weeks, depending upon the speed with which seedlings grow and the cultured conditions in the home.

1. Fill the container up to three-fourths of an inch from the top with the mixture to be used. It should be moistened before filling if the mixture is dry. Make sure the container has adequate drainage. Before filling, cover holes or cracks in the container with sphagnum moss or broken crockery.

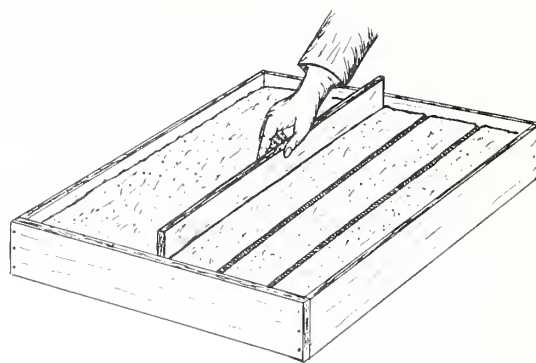


Figure 2

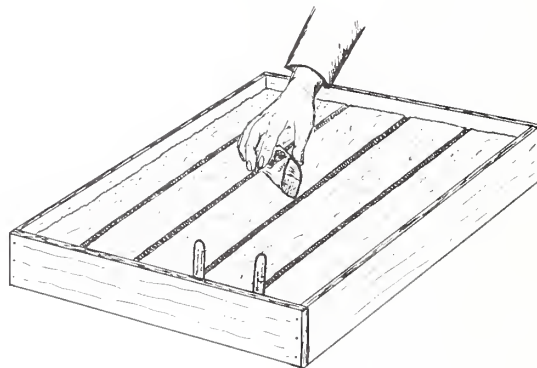


Figure 3

Sketches by Barbara Barkwell Long

2. Level, and gently firm the planting medium. Use clean small board for leveling and firming.
3. Make shallow row about 1 to 2 inches apart in the flat using a narrow board or large wooden label, (fig. 2). When different seeds are used in the same container, they are easier to keep track of if planted in rows. If only one type of seed is used, it may be scattered or broadcast over the surface.
4. Sow the seeds uniformly and thinly in the rows. Many small round seeds may be slowly dropped in the rows by tapping the package as it is held over the rows (fig. 3). Label each row promptly with plant type, variety, and date of planting. Plants large seeded vegetables such as cucumber, cantaloupe, and watermelon directly into peat pots. Other seeds may also be handled this way to save transplanting, but sowing is difficult with very small seeds. Plant two seeds per pot and later thin to one plant. This saves later transplanting, and means less root damage at planting time.
5. Cover the seeds with dry vermiculite or milled sphagnum moss. The depth of covering depends on the size of the seeds. Very fine seeds such as petunia or begonia need not be covered. Moisten the surface with a fine mist, or place the container in a pan of warm water to absorb moisture from the base. Don't place in water that is deep enough to run over the top of the pot or flat. It may mix seeds or cover them too deeply. Bottom watering helps avoid damping off by keeping the soil surface dry. As a general rule, seeds other than the very fine seeds should be covered to a depth of about two times their diameter.

TABLE 1. GUIDE TO SOWING VEGETABLE SEEDS IN THE HOME

Vegetables	Time to seed before last frost ¹	Comments
Cool season crops		
Broccoli	10 weeks	Grow cool. Will tolerate light frost outdoors.
Cabbage		after hardening, and may be transplanted to garden early.
Cauliflower		
Head Lettuce		
Warm Season crops		
Tomato	7 weeks	Keep warm. Do not subject to frost.
Eggplant		
Pepper		
Vine crops		
Cucumber	4 weeks	Sow directly in peat pots. Keep warm at all times.
Cantaloupe		
Squash		
Watermelon		

¹Your county agent can give you dates of average last frost in the spring for your area.

6. Slip the flats or containers into clear plastic bags.

Since they retain moisture, no additional watering should be necessary until after seeds have germinated.

7. Place seeds in a warm location for germination. Generally a range from 65 to 75° F. is best. A few plants, such as larkspur, snapdragon, sweet pea, cabbage, broccoli, and cauliflower, are best started at about 55°. Don't place covered containers in direct sunlight.

8. Watch daily for germination. Moved to bright light, and containers as soon as germination is well under way. If not all seeds germinate at the same time, cut strips of plastic or cloth, and keep ungerminated rows covered until seedlings appear. Seeds are quickly killed if allowed to dry during germination. Watch closely for development of damping-off, and control promptly.

After germination, place those plants listed as preferring cool temperatures in a cool location.

Damping-off

When seedlings fall over at the ground line, they are being attacked by a fungus disease known as damping-off. If only a few seedlings are attacked, dig out and discard the infected plants and soil. Drench the entire soil mass with a fungicide if the disease is scattered throughout the flat or pot. This may not provide complete control. High temperature, poor light, or excess moisture stimulate spread of the disease by weakening plants to make them more susceptible to it. Best control is cleanliness and prompt action when the disease appears.

Growing Seedlings

After seeds have germinated, they must be promptly given the best possible growing conditions to insure stocky vigorous plants for outdoor planting. Cultural requirements must be considered carefully.

Light—Seedlings must receive bright light promptly after germination. Place them in a bright, south window if possible. If a large, bright window is not available, place the flats under fluorescent lights. A fixture containing two 40-watt cool white fluorescent tubes is adequate. Place the seedlings about 6 inches from the tubes, and keep lights on for 14 to 16 hours each day. As seedlings grow, the lights may need to be raised to prevent leaf burn as seedlings touch the tubes.

Plants need some red and infrared radiation. Since this is

TABLE 2. GUIDE TO SOWING COMMON ANNUAL FLOWER SEEDS IN THE HOME

Time to seed before last frost	Plant types	Germination time (days)	Growth rate	Cold and frost Tolerance after hardening
14 weeks	Begonia	10-12	slow	none
	Pansy	6-10	medium	good
	Viola	6-10	medium	good
12 weeks	Lobelia	15-20	slow	none
	Stocks	10-14	medium	good
11 weeks	Black-eyed Susan vine	10-12	slow- medium	none
	Impatiens	15-18	medium	none
	Torenia	10-15	medium	medium
10 weeks	Petunia	6-12	slow- medium	slight
			medium	slight
7 weeks	Ageratum	5-8	medium	none
	Scabiosa	8-12	medium	slight
	Snapdragon	7-12	medium	medium
	Verbena	12-20	medium	slight
8 weeks	Bells of Ireland	21+	medium	medium
	Dianthus	5-7	medium	medium
	Salpiglossi (Planted tongue)	8-10	medium	none
	Vinca (Periwinkle)	10-15	medium	none
	Scarlet Sage (Salvia)	12-15	medium	none
	Statice	15-20	medium	slight
	Nicotiana	10-15	medium- fast	slight
7 weeks	Nierembergia	10-15	medium	slight
	Phlox, Annual	6-10	medium- fast	none
	Sweet Alyssum	4-8	fast	slight
	Aster	8-10	medium	slight
6 weeks	Balsam	6-8	medium- fast	none
	Celosia (Cockscomb)	6-10	fast	none
	Cornflower	6-10	fast	good
	Marigold	5-7	fast	none
	Portulaca	6-10	fast	none
	Portulaca	6-10	fast	none
4 weeks	Cosmos	5	fast	none
	Zinnia	5-7	fast	none

not supplied by common fluorescent tubes, additional light from incandescent lamps or windows is necessary.

Temperature—Most annual plants and vegetables prefer night temperatures between 60 and 65° F. Day temperatures may run about 10 degrees higher. If temperatures are warmer than this, leggy plants result. Cool season vegetable crops and a few flowers already listed prefer night temperatures no higher than 55° F, and day temperatures near 65. An unused bedroom, basement, or sunporch is often a good location.

Moisture and Watering—Good air humidity is an asset for producing good plants. A humidifier may be used, or shallow pans of gravel filled with water may be placed as close to the growing area as possible. Flats should never be over-watered. Allow drying between waterings, but don't allow seedlings to wilt at any time.

Fertilization—Seedlings will need some fertilization for best development. Those in totally artificial mixes need prompt and regular fertilization. Use a soluble house plant fertilizer as sold in garden centers, nurseries, or on plant supply counters. Young, tender seedlings are easily damaged by too much fertilizer. Apply fertilizer at about half of the recommended strength a few days after seedlings have germinated. After that, fertilize at 2-week intervals with the dilution recommended by the manufacturer. Water and fertilize carefully.

Transplanting

As soon as seedlings have developed at least one set of true leaves and are large enough to handle, they should be transplanted to individual pots or spaced out in flats. Failure to transplant promptly results in crowded, spindly seedlings that may not be able to develop properly. If a hotbed is available, seedlings may be transferred directly to it. Artificial mixes or a soil mix of one part soil, one part peat, and one part sand may be used.

To transplant, carefully dig up the small plants with a knife, spatula, or wooden label. Let the group of seedlings fall apart, and pick out individual plants. Occasionally if seedlings have been too close, they are difficult to separate. Gently ease them apart in small groups which will make it easier to separate individual plants. Avoid tearing roots in the process. Handle small seedlings by their leaves; small thin stems break easily.

Poke a hole in the soil into which the seedling will be planted. Make it deep enough so the seedling can be put at the same depth it was growing in the seed flat. Small plants or slow growers may be placed 1 inch apart and rapid growing, large seedlings about 2 inches apart. After planting, firm the soil and water gently. If seeds were sown in individual peat pots or pellets, thin them to one seedling at this time.

Keep newly transplanted seedlings in the shade for a few days, or place them under fluorescent lights. Keep them away from heat sources. Continue watering and fertilizing as was done in the seed flats.

Vegetables easily transplanted include broccoli, cabbage, brussels sprouts, lettuce, and tomatoes. Those with a little slower root development include cauliflower, celery, eggplant, onion, and pepper. They may be successfully transplanted, however. Plants that do not transplant well and therefore are seeded in individual pots include cucumber, muskmelon, squash, and watermelon.

Most flowers normally grown indoors transplant well, but a few that are difficult to transplant include poppy, larkspur, lupine, sweet pea, and cornflower. These are generally seeded outdoors; but to start them indoors, place them directly into individual pots.

Moving Plants Outdoors

Hardening

Plants which have been growing indoors can't be planted abruptly into the garden without injury. To prevent any damage, they should be hardened before planting outdoors.

This process should be started at least 2 weeks before planting in the garden. If possible, plants should be moved to cooler temperatures outdoors in a shady location. A cold-frame is excellent for this purpose. When first put outdoors, keep in the shade, but gradually move plants into sunlight for short periods each day. Gradually increase the length of exposure. Don't put tender seedlings outdoors on windy days, or when temperatures are below 45° F. Reduce the frequency of watering to slow growth but don't allow plants to wilt. Even cold hardy plants such as cabbage and pansy will be hurt if exposed to freezing temperatures before they have been hardened. After proper hardening, however, they can be planted outdoors, and light frosts will not damage them.

Planting into the Garden

When plants have grown large enough to handle easily, and hardening is complete, they may be planted into the garden if weather conditions permit.

Carefully remove plants from the growing flats, leaving as much soil mix as possible around the roots. Dig the hole about twice as large as the soil mass around the roots. Set the plants at about the same level they have been growing in the pots. A few plants such as tomato and marigold are able to develop roots along the stem. If they have become leggy, they may be planted deeper than they were previously growing. Place soil loosely around the roots, and apply about one cup of a starter solution. This solution is made by dissolving 1 tablespoon of high-phosphorus fertilizer in 1 gallon of water. A 10-52-17 or similar analysis is satisfactory.

Plants grown in clay and plastic pots must be removed from them before planting. Those grown in peat pots or peat pellets can be planted intact. Breaking the base of the peat pot often helps improve root penetration and drainage. Make sure the top edges of the pot are thoroughly covered. If not covered, it may act as a wick and evaporate moisture around the root ball. This delays root penetration or even causes the plant to dry up on hot sunny days.

Transplant on cloudy days if possible. In warm, sunny weather cover the newly planted seedlings with newspaper tents or some other type of shading for 2 or 3 days until they are well established. Keep plants watered as necessary.