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Starting Plants from Seed at Home

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Germinating and growing vegetable and flower seeds until they are ready to be planted in the garden will save you money and give great satisfaction. Home germination of flower and vegetable seed may be necessary if you plan to plant a fall garden or in order to produce your favorite varieties of vegetables during the year. A variety of systems can be used for starting transplants. These systems should provide an ideal environment for both seed germination and plant growth. They should also be dependable when seeding a variety of plants and give consistent results.

STEPS IN SEED GERMINATION

1. Seed Selection and Storage. It is best to start with new seed, so order only one year's supply. While some seed may be stored for several years with slight deterioration in quality, other seed may be viable for only one year.

2. Selection of Germination Medium. The germination medium should be well drained and well aerated, relatively low in fertilizer or other toxic chemicals, and sterile (free of insects and diseases). The medium can be prepared from a combination of peat, vermiculite, or similar ingredients. However, since relatively little medium is needed for seed germination, it may be best to consider purchasing a commercially packaged growing medium from a garden supply store or greenhouse operator. Commercially packaged growing media (e.g., Pro-Mix, Sunshine Mix, Metro Mix, Choice Mix, Ball Growing Mix, Jiffy Mix, Redi Earth, etc.) consist of a mixture of two or more of the following materials: sphagnum moss peat, bark, perlite, vermiculite, coarse sand, processed bark, or expanded shale. These media have several advantages. They are convenient and suitable for most plants directly from the bag. They are also free from weeds, insects and diseases, and limestone and fertilizers have been added to support plants for 2-6 weeks. Most are suitable for germinating seeds as well as growing transplants. The main disadvantage of these media is their unavailability in small packages at garden centers and discount stores. They are generally available at greenhouses and greenhouse suppliers with retail outlets. Some commercial media may be too fine-textured and will not be suitable for certain methods of germination.

3. Selection of Containers. The container used for seed germination may vary but it should have certain characteristics. It should be 2-3 inches deep and sterile and it should have holes in the bottom for drainage as well as for water uptake. A single container may be used for many cultivars of plants. However, it would be best to germinate only one cultivar of a certain plant in a small container so that the environment for each may be more accurately controlled.

4. Sowing Seed. The germination medium should be damp before it is placed in the container. Fill the container to within about 1/2 inch of the rim. Seed should be scattered uniformly across the surface or sown in rows at the rate of 10-20 seeds per square inch. You may choose to give each seed more space, depending on seed size and length of time small transplants will be left in the container. Seeds sown too thickly will result in excessive competition among plants and spindly growth. Small seeds, such as petunia and snapdragon, should be left uncovered. Cover larger seeds with a thin layer of germination medium. Finely pulverized sphagnum moss has fungicidal properties and would be ideal for covering seed if it is available. Most seeds will germinate in either darkness or light. The light system described later will be satisfactory for those seeds that require light for germination. Laying a newspaper on top of the container will provide darkness required by other seed. Special needs regarding light and dark treatments should be stated on the seed packet.

5. Temperature Requirements for Germination. The ideal temperature for germination will vary depending on the plant cultivar. However, most seeds will germinate very well when grown within a 70-80 F range. Again, specific temperature needs of seeds will be indicated on the seed packet (or see Table 1). If the temperature is maintained below or above the recommended range, the germination rate will be slower and fewer seeds will germinate. Most homes are kept at temperatures somewhat below the recommended range but there may be some areas in the home that are suitable. A small heating cable, preset at 70-75 F,

may be purchased at garden supply stores. The cable should be placed in the bottom of a flat on top of 1/2-inch of sand and then covered with an additional 1/2-inch of sand. The temperature of seed flats set on the sand will be maintained within a suitable range. Seedlings grown during the hot summer for your fall garden should be located wherever optimum temperature and light are available. This may be outside in a shady or partly-sunny location.

Table 1. Germination Temperature. Temperature for transplant growth and time necessary to grow various annual flower and vegetable seeds in the home. A. Plants whose seed germinate in 6 to 10 days at recommended temperatures. Seedlings generally can be transplanted outdoors in 5 to 8 weeks.

Plants	Temperature for Seed Germination (degrees)	Temperatures for Transplant Growth (degrees)	
		DAY	NIGHT
Ageratum	70-80	75	65
Alyssum	70	60	50
Aster	70	75	65
Basil	70	75	65
Broccoli	70	60	50
Cabbage	70	60	50
Calendula	70	60	50
Cauliflower	70	60	50
Celosia	70	75	65
Coleus	65-75	75	65
Cucumbers	80	75	65
Dahlia	70	75	65
Dianthus	70	60	50
Eggplant	80	75	65
Gazania	60	60	50
Lettuce	70	60	50
Marigold	70-75	75	65
Melons	80	75	65
Peppers (Ornamental and Edible)	80	75	65
Petunia	70-80	60	50
Portulaca	70	75	65
Squash	80	75	65
Tomato	70-80	75	65
Zinnia	70	75	65

B. Plants whose seed germinates in 10 to 20 days at recommended temperatures. Seedlings generally can be transplanted outdoors in 8 to 14 weeks.

Plants	Temperature for Seed Germination (degrees)	Temperatures for Transplant Growth (degrees)	
		DAY	NIGHT
Begonia	70	75	65
Carnation	70	60	50
Chives	70	60	50
Geranium	70	75	65
Impatiens	70	75	65
Nicotiana	70	75	65
Onion	70	60	50
Pansy	65-75	60	50
Rudbeckia	70	75	65
Salvia	70	75	65
Snapdragon	65-75	60	50
Verbena	65	75	65
Vinca	70-75	75	65

6. Moisture and Humidity Requirements for Seed Germination. Maintenance of a constant moisture level and nearly 100 percent relative humidity is important to successful seed germination. Several methods may be used.

1. Hand Watering. Low relative humidity levels in the home during winter will dry the germination medium out quickly. Adequate moisture can be maintained by hand watering. However, great fluctuations in water content of the medium may occur between irrigation as it is easy to forget to water. Hand watering with cold water also reduces germination temperature.

2. Plastic Covering. Plastic is an excellent way to maintain high humidity and moisture levels. After seed is sown, a piece of clear plastic, placed over the top of the container, will maintain a high humidity level. The container may also be placed inside a plastic bag and sealed to prevent moisture loss. To avoid any problems, the container should not be placed in direct sun because plastic will trap heat and damage the seeds. Secondly, the plastic needs to be removed immediately after emergence of seedlings to prevent leggy growth.

3. Recirculating-Bottom-Irrigation. A recirculating-bottom-irrigation system may be used to germinate seeds. The system has the advantage of maintaining constant moisture content automatically and immediately exposing seedlings to light upon emergence from the medium, which reduces leggy growth. The system is also used to automatically water seedlings that are still in the germination container, until they are ready to transplant. Constant moisture conditions and a more uniform temperature are ideal: seeds germinate very quickly.

a. Description of Recirculating-Bottom-Irrigation System. The recirculating-bottom-irrigation system may be made any size and out of many types of materials. A simple system could consist of a small polystyrene container (cooler) with a small sump pump in the bottom.

The flat surface, where seed flats are set, may be made of 1/2-inch polystyrene, a thin piece of marine plywood, and a piece of glass or other water resistant material. A pad made of 1/4-inch foam or fabric, such as felt, is placed on the flat surface. The pad promotes uptake of water into the germination medium. The flat surface may be placed on the ledge of the polystyrene container, set on jars, or suspended from wires. A plastic tube, which carries water from the pump, is placed under the pad and on top of the flat surface. The flat surface is tilted slightly so water will flow

across the surface and back into the water reservoir in the bottom of the container. The water level in the container may vary and could be maintained within an inch of the flat surface. A plastic lining of polyethylene may be necessary to prevent leaks. Rigid or semi-rigid plastic containers would not require lining. Small sump pumps (1/5 hp) are available from discount stores, garden centers which sell supplies for fountains, or from major retail catalogs. Plastic tubing may be purchased from hobby supply stores or pet stores that sell fish.

b. Operation of Recirculating-Bottom- Irrigation System. It is important that the germination medium, used in connection with this system, be well aerated. If not, air spaces of the medium will be filled with water resulting in poor root growth. Holes in the bottom of the container must be in contact with the pad to assure water uptake into the medium. The pump should be attached to a time clock which turns it on one hour every 4-6 hours. The exact interval between irrigation would depend upon the time required to wet the medium and the rate of water loss from containers. The medium should be damp at all times during the germination period. Water will become too warm for optimum seed germination if the pump runs continuously. The water level in the reservoir should be checked regularly to make sure water is available. Also, because of possible changes in chemical characteristics of water, the water should be changed completely every one to two weeks.

Algae growing on the pad do not hinder germination and growth of seedlings but it may be unsightly and messy. A piece of black plastic could be placed over the pad and holes cut in the plastic to fit the bottom of the germination container. Without light algae will not grow on the pad.

7. Maintenance of Sterile Conditions During Seed Germination. Disease organisms (fungi and/or bacteria) may kill seedlings during germination. Thus the medium, container, tools and even the seed itself should be sterile. Commercial media are usually sterile when purchased. However, if the medium comes in contact with objects which are not sterile, it may become contaminated. Containers and tools can be sterilized by soaking them in a 10% household bleach solution (1½ tablespoon/cup of water) for 5 minutes.

The following suggestions should help prevent disease problems:

1. Use seed treated with fungicide. Seed packets are usually clearly marked when seeds have been treated with fungicides. Seeds are generally brightly colored (pink, purple, and green).
2. Do not plant seeds deeper than necessary.
3. Keep temperature constant.
4. Provide seedlings with adequate ventilation.
5. Avoid over-watering.

GROWING PLANTS AFTER GERMINATION

1. Light. After germination, plants need a maximum of light for optimum growth. Light may be natural or from fluorescent lamps. If sunlight is used, seed flats should be placed as close to the windows as possible without being too cool. If fluorescent lamps are used, an area 2 X 4 feet would require about four 40-watt fluorescent bulbs. Special plant growing lamps may be used, but cool-white or warm-white fluorescent lamps will be satisfactory. Lamps should be placed 6-12 inches above plants and turned on at least 18 hours each day. For most plants, 24 hours of light would be best; however, some plants (tomato, geranium) may develop a light green appearance. A small time clock can be used to turn lights on and off.

2. Transplanting Seedlings. Seedlings should be transplanted to larger containers within a few weeks after germination. Seedlings left in the germination container until they begin to crowd each other, will result in poor quality transplants. The growing medium used for transplants should have the same characteristics as the germination medium. A variety of containers may be used for transplants. Containers should be large enough to allow small plants to grow indoors until ready to be transplanted to the garden. Square pots or cells 1 x 1 inch, 1.5 x 1.5 inch, or 2 to 3-inch round containers are satisfactory. Containers should have holes in the bottom for drainage or for uptake of water. Transplants should also receive a maximum amount of available light for best growth. The same light system described above may be used for transplants. "Stretching" of transplants through weak, spindly growth indicates they are not receiving enough light.

3. Fertilization. One application of a complete fertilizer should be given to seedlings while they are still in germination containers. After transplanting, plants should be fertilized once a week with a complete fertilizer. Water-soluble house plant fertilizers, available at garden supply stores, are convenient to use. Rates will be given on the container.

4. Temperature. The ideal temperature for growth of transplants should be 60-75 F during the time plants receive light and about 5O-65 F during darkness (see Table 1). Excessive night temperatures (too cool or too warm) will result in poor quality growth.

5. Water. The growing medium should be kept damp. If using well-drained, well-aerated medium water may be applied frequently without danger of drowning roots. If you use a heavier growing medium

that includes soil, be careful not to over-water. Enough water should be applied to thoroughly wet the medium and allow some water to drain from the bottom of the container.

The Recirculating-Bottom-Irrigation germination system described above can also be used to water seedlings after they have been transplanted to the final growing container. Again, it is important that the medium drains well so there is sufficient air for roots when the medium is saturated with water. The pump should operate 3-4 times daily for 1 hour each time. A water-soluble fertilizer, as mentioned above, maybe added to the water supply. The rate should be about 1/2 that recommended on the container.

TIMELY SEEDLING PRODUCTION

Plan the seed sowing date carefully so your transplants are ready to go into your garden on time (Table 1). The length of time from sowing seed until plants are ready to be transplanted depends upon the cultivar and the environment available for growing. Records should be kept each year for efficient production and correcting past errors. Plants that are immature should not be transplanted to the garden. Plants that have grown too long in small containers may be stunted and will not grow well in the garden. Broccoli, cabbage, cauliflower and onion seeds should be started between Jan. 25 and Feb. 10 and transplanted to the garden March 10-25. Generally seeds of other plants indicated in Table 1 should be sown between March 1 and April 15 so they will be ready for the garden after the frost free date (April 20-May 10).