

## Department of Horticulture and Landscape Architecture

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### Hotbeds and Cold Frames

Michael N. Dana and B. Rosie Lerner

Hotbeds and cold frames are used for the growing of plants out of the normal season. They are especially useful in early spring, but such structures can also extend the growing season in autumn. With a hotbed or cold frame, Indiana gardeners can get an early start to successfully grow vegetables that require longer growing seasons.

Gardeners find it advantageous to have vigorous, stocky plants ready to plant out as soon as weather conditions permit. Earliness is a particularly important factor for cool season vegetables such as cabbage, cauliflower, lettuce, and spinach.

#### Hotbed or Cold Frame?

The hotbed and the cold frame are identical in structure (see Figure 1). The only difference between them is the source of heat. The sun supplies all the heat in a cold frame, whereas sunlight is supplemented by another heat source in a hotbed. Plant growth is slower in a cold frame than in a hot bed. A cold frame is most suited to use with the cool season crops mentioned above, while peppers, tomatoes, eggplants, and other warm season vegetables flourish in a hotbed.

#### Building the Hotbed or Cold Frame

Especially if you are constructing only a cold frame, subdivide it into at least two sections. When the earlier, cool season crop seedlings are growing they will require ventilation. At the same time, later warm season crop seeds will require warmer temperatures for germination. With two sections, you can ventilate one part while keeping the other sash closed.

#### Location

The plant bed should be placed where it will be well protected from the wind, on a well-drained spot and near a good supply of water. If appropriate, it should be near a source of electricity. A small structure may be built as a lean-to against the house. It should have full exposure to the sun, with a southern orientation preferred. Painting the inside surfaces white or silver will help maximize the light level for the plants.

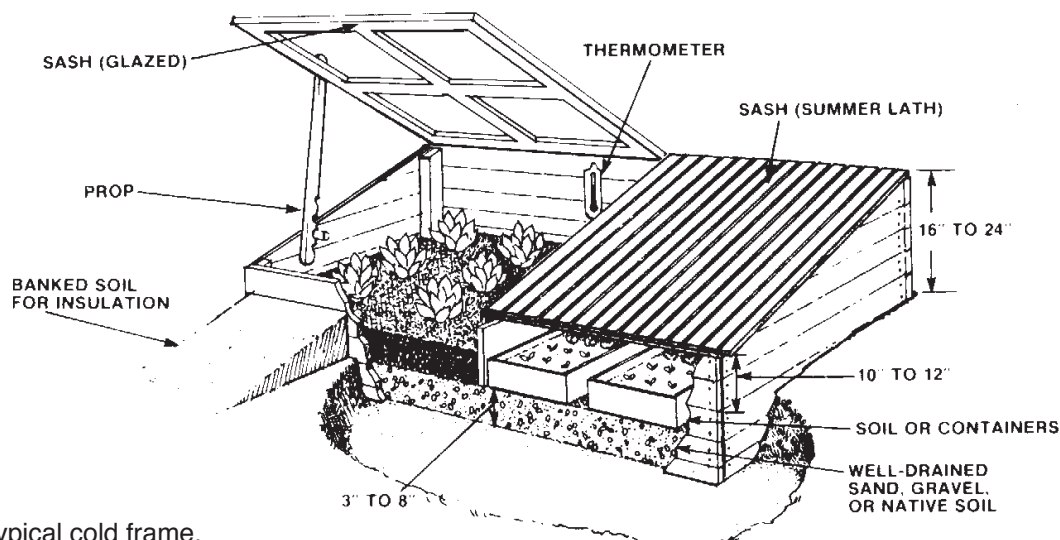


Figure 1. Typical cold frame.

## Construction

Construction of both the hotbed and cold frame begins with excavation to a depth of a few inches to 3 feet depending on type. Bed width depends on the size of sash or top panel to be used, but it is generally 4-6 feet. Length is also determined by the sash dimensions and square footage requirements for the bed. Standard commercial beds are built in multiples of 3 feet.

The framework of the bed can be constructed from wood, concrete, or concrete block. When wood is used, the boards may be 1, or preferably 2, inches thick. Redwood, cedar, or lumber pressure-treated with a preservative is best. The front of the bed, to the south, should be 10 to 12 inches high inside, with 2 inches extending below ground level. The back portion should be 6-12 inches higher than the front, having a minimum slope of 1 inch per foot. Beds made from concrete should extend into the soil 6 to 8 inches, and the wall should be at least 3 inches in thickness. The bed should be true for a snug fit. The soil on the outside should be banked around the frame to conserve heat. Be sure the soil slopes away from the walls to assure good drainage.

Cold frame or hotbed sash may be constructed of glass, Plexiglas, Fiberglass, polyethylene, or other translucent/translucent material. More permanent structures should have glass sash. Frequently, old window frames can be salvaged and reused for this purpose. Standard commercially available sash is 3 feet by 6 feet, and "melon sash" is 4 feet by 10 feet. Additional sash frames covered with lath or fabric may be desirable for extending the use of your plant bed; they will provide shading once temperatures get high enough. Sash may be attached on the high side with hinges or left unattached for easy, complete removal.

## Hotbed Heating Systems

**Pit Hotbed** (Figure 2). When manure is used to supply heat, the soil inside the bed should be excavated to a depth of 16 to 18 inches. A 4-inch layer of coarse cinders or gravel forms the bottom portion for drainage and im-

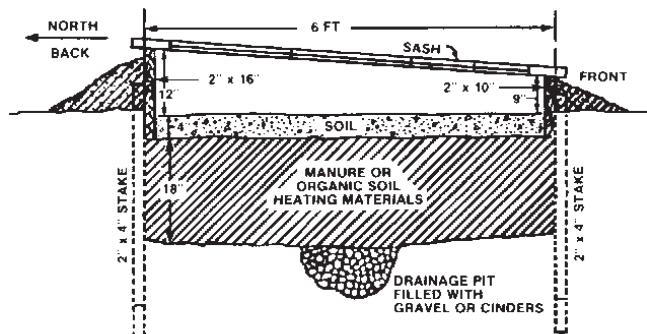


Figure 2. Cross section of a manure-heated pit hotbed.

proving the aeration of the bed. Fill the bed with manure; then tamp firmly and evenly, especially in the corners. The tamped manure should extend an inch or so above the ground level on the inside of the frame. Moisten the manure evenly with lukewarm water to insure uniform heating.

Cover the manure with 3 or 4 inches of good, weed-free garden soil. Soil that is fairly warm when put in the bed permits earlier heating and consequently early seeding.

When the bed is ready, fit the sash over the bed, and insert 2 or 3 accurate thermometers 2 to 3 inches into the soil in representative places to check on the heat. When the soil temperature drops to 75°F or slightly less, the bed is ready for seeding.

**Electric Hotbed** (Figure 3). Electric heating requires an insulated heating cable enclosed in a flexible lead sheath covering. About 2 feet of cable for each square foot of bed area is needed. Excavate the soil 2 or 3 inches below the frame level. Then put down 4 inches of cinders or sand as a base for the cable.

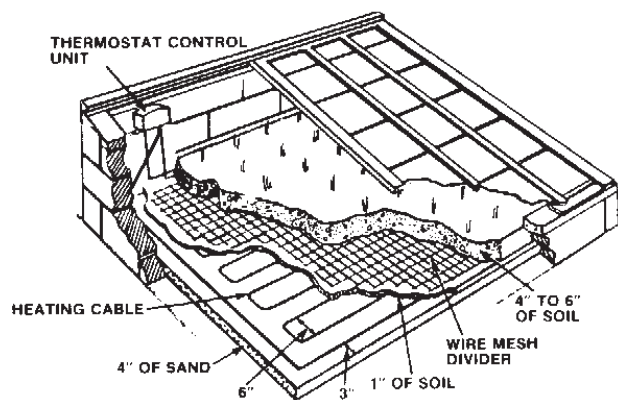


Figure 3. Electric hotbed with thermostatic control.

When you lay the cable, start and end with the outside row 3 inches away from the frame, and make a series of long loops 6 inches apart across the bed. Laying hardware cloth over the cable prior to covering it with soil will help prevent the cable from being pulled out of the soil. A 3- to 4-inch layer of good planting soil, or sand when used for sweet potatoes and melons, should then be put over the cable. The cable, when attached to a thermostat and a 110-volt outlet, automatically controls the temperature in the bed.

**Flue-heated Hotbed.** Furnace firing, the use of dry heat, is a very satisfactory and economical way to heat a hotbed; several fuels, such as oil or coal, can be used.

The heat passes through heat-conducting pipes, generally 4-inch tile, from the furnace to a 6- to 8-inch flue or chimney on the outside of the bed at the opposite end from the heat source.

When constructing the flue-heated bed, it is best to start with the fire box. A pit 3 feet square and 6 feet deep on the inside can serve as the furnace room. A steel drum makes a good stove when laid on the side with a door at the bottom of one end and two outlets at the top of the opposite end. The outlet end of the drum should be 3 to 4 feet away from the front end of the bed.

Connect two lines of heat-conducting pipes to the furnace, and lay them about 18 inches from each side of the bed, slanted upwards to about 6 inches from the surface at the far end.

The frame of the bed, preferably concrete, should be built around the tile, and the pipes should be covered with cinders or clean sand. A bed 6 feet wide and 40 to 50 feet in length is a good size. Use sand for the growing of sweet potato plants or for a base for flats or melon boxes, and use 3 inches of soil for direct seeding.

The fire should be started as soon as the sashes are in place, at least 3 to 4 days ahead of seeding or bedding time. Except during cold weather, one night and one day of firing will generally supply enough heat to keep the bed warm.

**Steam- or Hot Water-heated Hotbed.** The use of steam or hot water circulating systems is practical when the beds are supplementary to a greenhouse operation. The heating pipes may be placed under the soil or around the inside edge near the top of the frame. The heat is turned on or off as needed.

## Hotbed or Cold Frame Operation

### Soil and Planting

The soil or other growing medium that you use in the hotbed or cold frame should be the best you can find, because many weed seeds, insects, and diseases are found in ordinary soil. Table 1 provides a suggested mix for growing medium. The use of fertilizers in the seed bed should be avoided to prevent excessive seedling growth.

Table 1. Suggested soil mixture.

Ingredients	1 gallon	1 bushel
Shredded sphagnum peat moss	2 qts.	1/2 bu.
Vermiculite #3, or 4	2 qts.	1/2 bu.
Limestone, dolomitic preferred	1 Tbsp.	5 Tbsp.
20% superphosphate (powdered)	1/2 Tbsp.	2-1/2 Tbsp.
5-10-5	—	7-1/2 Tbsp.
Iron (chelated such as NaFe, 138 or 330)	—	1/2 tsp.
Wetting agent <sup>1</sup>	—	1/2 tsp. in 1/2 gal. water

<sup>1</sup> Wetting agents or surfactants increase the ease of wetting peat moss and mixes high in organic matter. A small quantity added to water will help to uniformly distribute applied water. Dish detergent may be used as a wetting agent at double the recommended rate. Note: Bushels are level full, not packed. Tablespoons and teaspoons are level amounts.

The heat in the bed will determine, in part, when the seed should be sown. Generally, 30 to 40 days will be required from seeding time to transplanting time. The seed may be sown directly in the soil or in containers such as peat pots, clay or plastic flower pots, milk or cottage cheese cartons, or in flats. As a rule, when young plants receive a double transplanting, 50 to 100 seeds are sown per foot of row in rows 6 to 8 inches apart.

When you use containers, place two seeds in each compartment of the container. Later thin to one plant. After planting the seed, spread a light covering of sand or vermiculite over the surface. When you “bed” sweet potatoes, space the roots an inch or so apart and cover with 2 to 3 inches of good clean sand.

### Temperature Control

The temperature of the bed should be from 70° to 75° F until the young plants are about 1 inch high. Then lower the temperature to 65°F during the day and 55° to 60° F for the night, except for sweet potato plants. Growing the plants cool produces better plants and as a rule results in earlier setting of the fruit, particularly for tomatoes, melons, and peppers.

A straw mat, roofing paper, or tarpaulin should be readily available to cover the cold frame when cold weather threatens to cause freezing temperatures. A 100-watt lamp left burning during the cool nights will aid in keeping the bed warm.

### Water and Ventilation Regulation

Plants grow best with a limited amount of water and with controlled temperatures. Apply water, preferably warm, during the morning when the sun is shining. Over-watering and high temperatures encourage trouble from diseases and can cause spindly growth.

Proper ventilation of hotbeds and cold frames not only controls temperature, but also helps prevent damping-off disease. When ventilating the bed, raise the sash opposite, the direction of the wind. For small structures, automatic thermostatically controlled sash raising devices are available. As the season advances, leave the sash off during the greater part of the day and eventually leave it off entirely—first all day, then all day and all night. This will “harden off” the plants in preparation for transplanting to the garden.

### Fall and Winter Use

The cold frame or hotbed without heat can be used to extend the gardening season well past the normal limit of first frost. Salad greens for instance, can be productive until about Thanksgiving.

Start seeds early in the fall. Use the sash only when night temperatures drop too low. Extra night time insulation can be provided by a tarpaulin or blanket. When seedlings are ready to transplant, space them about 3-4 inches apart each way. With the onset of cold weather, use the sash during the day, but continue to give close attention to necessary ventilation. Harvest as you would from your early season garden.

Storing vegetables is a convenient winter use of a cold frame or hotbed without supplemental heat. Remove 12-18 inches of soil from the frame. Place turnips, beets, carrots, rutabagas, and the like in the hole on a layer of straw. Then, cover the vegetables with an abundance of straw followed by the sash and tarpaulin. Such an arrangement should keep the produce unfrozen all winter.

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For more information on the subject discussed in this publication, consult your local office of the Purdue University Cooperative Extension Service.

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