



B-1151

February 2004

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HOTBEDS

A hotbed for growing plants is a low, covered frame resembling a short greenhouse built partially below ground level. The structure is covered with a light-transmitting material, and provisions are made for heating and ventilation. Hotbeds are used most often for starting and growing young plants in late winter and spring. Seedlings are often started in a greenhouse and moved to a hotbed when they fill the available space. Hotbeds provide an economical way to grow plants until they are transplanted to their permanent outdoor locations.

Construction

A hotbed should be placed in a sunny, well-drained location that is protected from the wind. A good spot is in front of a south-facing wall with electrical and water connections nearby. Hotbeds may be any size, but a 3 by 6-foot bed is large enough for most home gardens. The front-to-back distance should not be more than 3 feet because most of the work must be done from outside the frame (Figure 1). The hotbed itself is a low, bottomless box frame sunk into the ground. The cover should slope toward the south to receive more light and allow rain and irrigation water to run off. A hotbed is cheaper to operate if the frame is as low as possible, reducing surface area exposed to cold air.

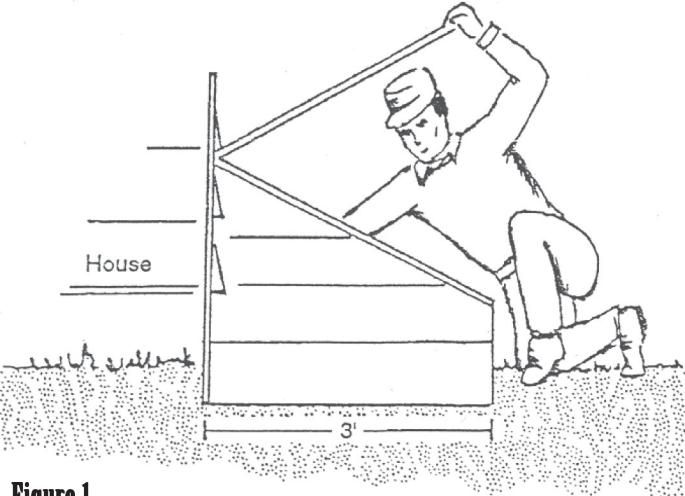


Figure 1

The front or south wall should be no more than 6 to 8 inches above the surrounding ground level, with the back 12 to 18 inches high. The frame below ground should be built of sturdy materials such as 2-inch-thick planks (Figure 2). Wood should be treated with a preservative such as copper naphthenate. Wood that has been treated with creosote or pentachlorophenol *should not be used*. The inside of the frame should be painted white to reflect light to the plants. The above-ground portion of the frame can be built with 1-inch wood. Construction should be tight to prevent air from going through the frame. Temperature control can be improved and the cost of operation can be reduced if the above-ground part of the frame is insulated or has soil banked up around it.

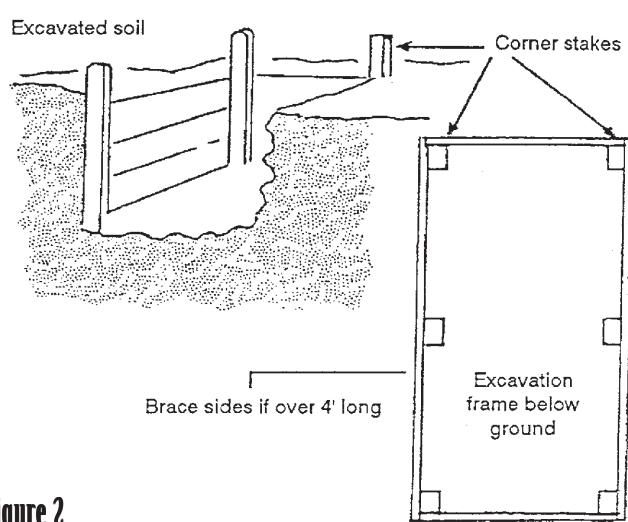


Figure 2

After the location for the hotbed is chosen, the soil should be removed to create an area 1 to 2 feet deep. Prepare the bed below the plants by putting in a 6 to 8-inch layer of crushed rock or gravel for good drainage. Cover the rock with a 2-inch layer of coarse sand. Lay electric heating cable or mat on the sand and cover with an-

other inch of sand. Place a $\frac{1}{2}$ -inch mesh hardware cloth over the heating cable or mat to protect it from damage. Add a 1 to 2-inch layer of sand over the hardware cloth. The top level of this bed should be below the surrounding ground level. For tall plants, the excavation will have to be deeper to provide the necessary height.

Covering

Glass or plastic can be used to cover the hotbed although glass is not recommended in areas where hail can be a problem. Window sashes, storm windows, or plastic-covered frames are satisfactory. The frames should be small enough to be handled easily and should be hinged at the back wall so they can be partially opened for ventilation. Polyethylene plastic, 4 to 6 mils thick, is a good economical cover. Double layers of the covering material will reduce the cost of heating. Polyethylene can be stretched over window sash or storm

window frames, or it can be wrapped around both sides of a frame of 1 by 2-inch lumber (Figure 3). The 1 inch of dead air space is a good insulation. Attach polyethylene to the frames or sashes in a warm workplace as it will shrink in cold outside air. Ordinary polyethylene should last four to six months.

Heating

Hotbeds are efficiently heated by electric heating cable or mats underneath the plants. Twelve to 16 watts of heating capacity are needed per square foot of a hotbed. Lay the cable carefully in a back-and-forth pattern. Keep the cables separated and do not allow one cable to cross another. Heating mats are also available in various sites.

A good thermostat is necessary to control the heating. It should be adjustable, and the sensing element should be as close to the plant roots as possible. The air above the plants can be heated in cold weather by electric heaters. They should be controlled by a thermostat and must be far enough from plant leaves to avoid burning them. All electrical connections must be made in a weather-tight box mounted on the upper back part of the frame. Use a dependable thermometer to check both the temperature of the air and the soil around the plant roots.

Management

A hotbed requires regular care several times a day to provide the best conditions for growth. The bed is ventilated by raising the covers to reduce the temperature on sunny days (Figure 4). Most plants will be damaged if the air temperature is more than 90° F.

Be sure the covers can be latched so they will not be blown off by gusts of wind. At night the covers should be closed and the air temperature kept in the 55 to 70° F range. The minimum temperature will depend on the crops being grown. Cool-season crops such as cabbage and lettuce can withstand night air temperatures as low as

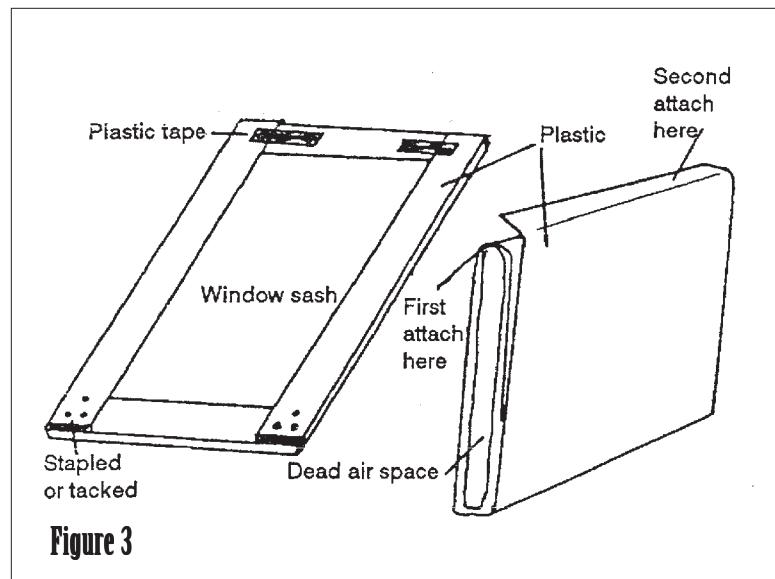


Figure 3

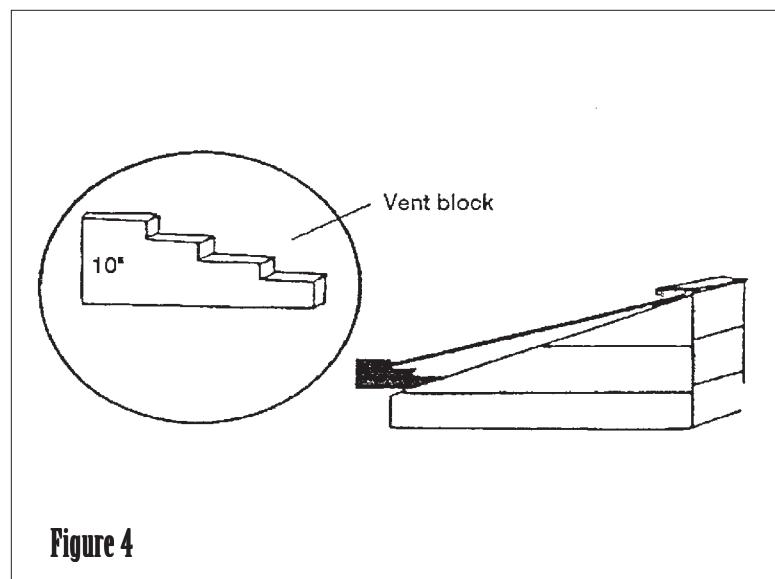


Figure 4



50° F. Air temperature for warm-season crops such as tomatoes and peppers should not be below 60° F at night. Soil temperatures in the 65 to 70° F range are optimum.

Always water hotbeds in the morning, allowing the leaves to dry before dark. It is not necessary to place insulated covers over a hotbed at night, but doing so will reduce heating costs. Old rugs, burlap sacks, straw mats, or insulation boards work well as a night cover. Remove them in the morning.

Plants handle easily when grown in containers set on the heated sand of a hotbed. Some growers prefer to use a 4-inch layer of well-prepared growing medium instead of an upper 2-inch layer of sand. Seeds or seedlings are then planted directly in the medium, and plants are carefully dug when they are removed from a hotbed. When plants are grown in beds containing growing medium, the medium should be replaced annually to reduce soil-borne diseases. Always use good quality, clean growing medium from a reputable manufacturer.

Hotbeds can also be used to grow plants during summer. The frame, with covers removed and heat turned off, gives wind protection and some heat retention at night.

COLD FRAMES

A cold frame is a portable, easy, and effective way to lengthen the growing season. In extremely cold weather there is no heat source other than the sun, and a cold frame is not suitable for use. However, during late fall and early spring it works as a solar heat trap to warm the soil and the plants growing in the frame. Cold frames can also improve the growth of cold-sensitive crops such as tomatoes when they are grown in areas with low summer temperatures. The warmer environment inside a frame often makes it possible to grow crops that otherwise would not mature.

A cold frame is a bottomless box with a light-admitting cover. The cover usually slopes toward the south to intercept more sunlight (Figure 5). A cold frame may be any size, but about 3 feet from front to back is convenient. The size is often chosen on the basis of the size of the covering sash or frame.

Cold frames are often used to harden vegetable and flower plants for seven to 10 days before they are transplanted to their permanent outdoor locations. The plants are then better able to withstand outdoor conditions than they would be if brought directly from a greenhouse. Cold frames are sometimes used to overwinter perennial plants of borderline hardiness.

Construction

A cold frame is a box without a bottom. The north side should be higher than the south side so the cover will slope and receive more sunshine. A frame should be strong enough to withstand wind and being carried from one location to another and should be insulated with waterproof insulation boards. Soil can be banked against the outside walls to reduce air leakage and heat loss. The corners of a frame should be attached to stakes which are driven into the ground. Any wood used in building a cold frame should be treated with a preservative such as copper naphthenate. *Do not use* wood that has been treated with creosote or pentachlorophenol because these materials emit fumes which kill plants. A frame should be tightly constructed to keep out cold air.

Covering

A covering material should be transparent or translucent and should hold as much heat in the frame as possible. A single layer of plastic or glass may be sufficient, but a double layer is better and provides additional safety for plants. Glass window sashes or storm windows may be used if available. If not, a double layer of polyethylene plastic 4 to 6 mils thick stretched on both sides of a wooden frame will do well. Frames 2 by 3 feet or 2 by 4 feet are easy to handle. Attach any covering securely to a frame to avoid wind damage. Plastic attached to a frame in a warm room will shrink when moved to cooler outdoor air. Covers should be removed to ventilate a cold frame during warm, sunny days.

Extra covering is often needed to hold heat in a cold frame overnight. These temporary covers may be blankets, canvas, old rugs, or burlap sacks. Loose straw can be spread over the frame for emergency protection. Always anchor covering materials securely against wind.

Management

A cold frame needs frequent attention during changeable spring weather. The temperature inside a cold frame rises rapidly when the sun shines. Ventilation will be necessary to keep the temperature below 90° F. The temperature can also drop very rapidly at sunset if ventilators are left open. Try to trap as much heat in a cold frame during the day as possible without letting the temperature get too high. Be aware of expected nighttime minimum temperatures and be ready to cover a cold frame with emergency covering material.



Figure 6

Cold frames are useful for placing over garden plants. Cold-resistant crops can sometimes be grown to transplant size in a cold frame before the outdoor planting season begins. The frame can then be moved and placed over cold-sensitive crops to speed their growth. The same system can be used in the fall to lengthen the end of the growing season of cold-sensitive crops and later of cold-resistant crops. Tomatoes, peppers, and vine crops such as cucumbers and muskmelons are often grown in a cold frame all summer. The cover can be removed if the plants grow too large, or a light frame with a tall plastic cover can be constructed (Figure 6). Be sure to provide for ventilation under a covered frame.

Remember cold frames may take many shapes and forms. Their purpose is to help grow better gardens by trapping the heat from the sun and protecting plants from excessive wind and cold temperatures.

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Layout: Tana Stith, College of Agriculture, Office of Communications and Technology

Issued in furtherance of cooperative extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Glen Whipple, director, Cooperative Extension Service, University of Wyoming, Laramie, Wyoming 82071.

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