

## Season Extenders

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To get the most out of a garden, you can extend the growing season by sheltering plants from cold weather both in early spring and during the fall. Very ambitious gardeners harvest greens and other cool-weather crops all winter by providing the right conditions. There are many ways to lengthen the growing season, and your choice depends on the amount of time and money you want to invest.

### Cold frames and hot beds

Cold frames, sun boxes, and hot beds are relatively inexpensive, simple structures providing a favorable environment for growing cool-weather crops in the very early spring, the fall, and even into the winter months.

Some are elaborate and require a large investment, but are reasonable for those who are serious about having homegrown fresh vegetables during the winter.

Cold frames and sun boxes have no outside energy requirements, relying on the sun for their source of heat. Hot beds are heated by soil-heating cables (Fig. 1); steam-carrying pipes; or fresh, strawy manure buried beneath the rooting zones of the plants. All of these different types of structures collect heat when the sun's rays penetrate the sash, made of clear plastic, glass, or fiberglass.

The ideal location for a cold frame (Fig. 2) is a southern or southeastern exposure with a slight slope to ensure good drainage and maximum solar absorption. A sheltered spot

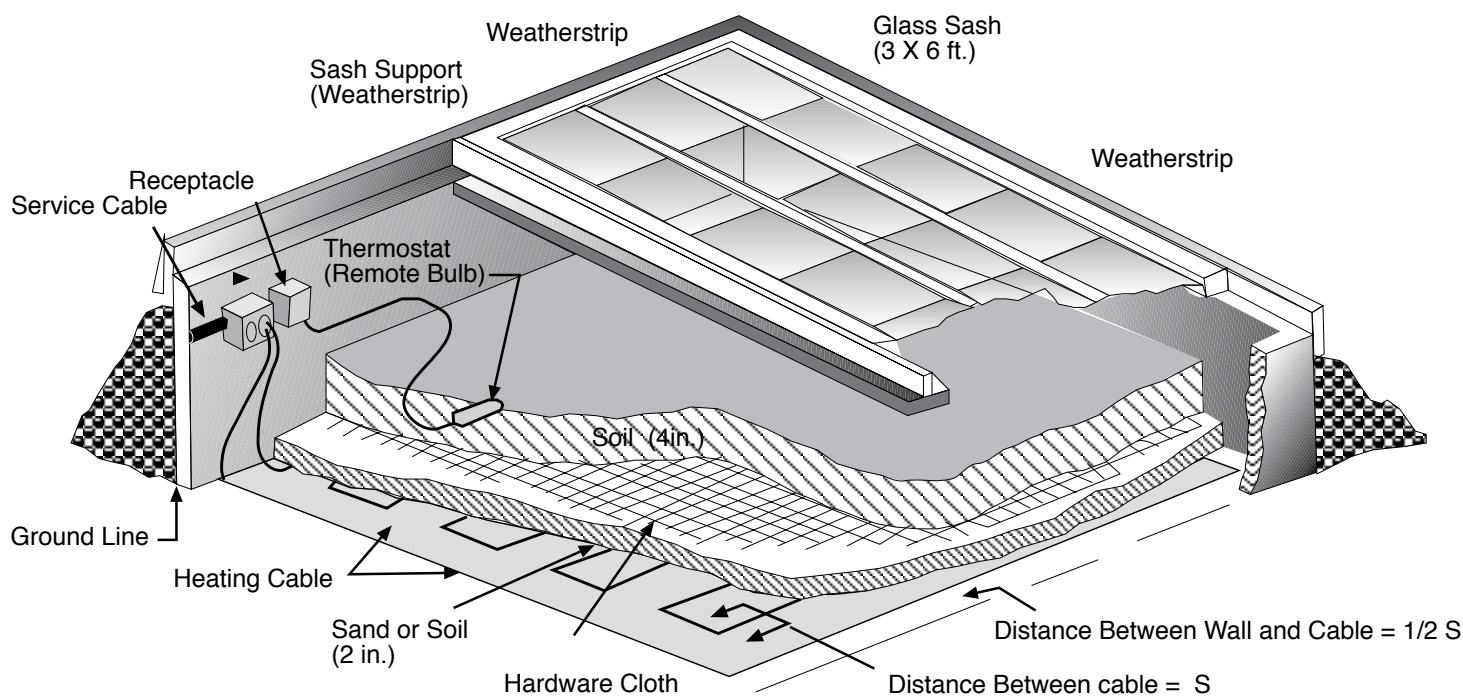


Fig. 1. Construction of an electrically heated hotbed.

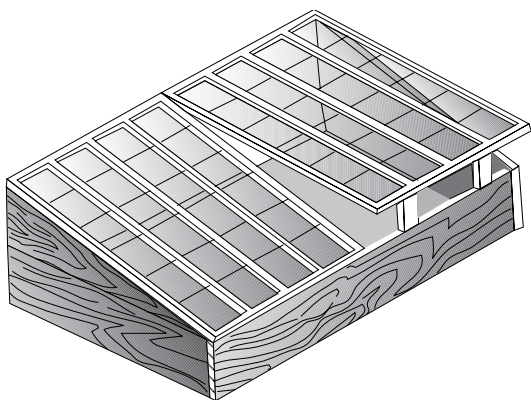


Fig. 2

with a wall or hedge to the north will provide protection against winter winds. Sinking the frame into the ground somewhat will also provide protection, using the earth for insulation. To simplify use of the frame, consider a walkway to the front, adequate space behind the frame to remove the sash, and perhaps weights to make raising and lowering of glass sashes easier. Some gardeners make their cold frames lightweight enough to be moved from one section of the garden to another. Another possibility is the Dutch light, which is a large, but portable, greenhouse-like structure that is moved around the garden.

New designs in cold frames include passive solar energy storage. For example, barrels painted black and filled with water absorb heat during the day and release it at night. The solar pod (Fig. 3) is one design that provides for this type of heat storage. Other new cold frames are built with a very high back and a steep glass slope and insulated very well; these may also include movable insulation that is folded up during the day and down at night or during extremely cold weather.

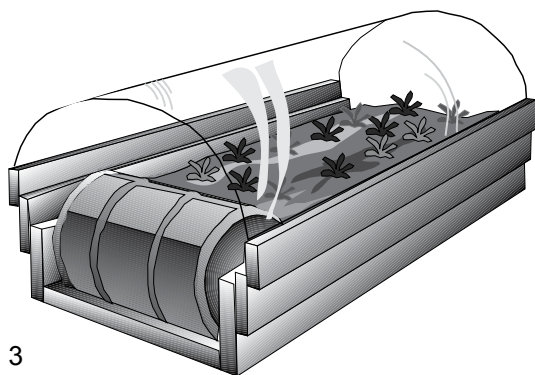


Fig. 3

You may convert your cold frame to a hotbed (Fig. 4). For a manure-heated bed: 1) dig out to 2 feet deep (deeper to add gravel for increased drainage); 2) add an 18-inch layer of strawy horse manure; and 3) cover with 6 inches of good soil. For an electric heated bed: 1) dig out an area 8 inches deep; 2) lay down thermostatically controlled electric cable in 6- to 8-inch long loops, evenly spacing cable, but never crossing; 3) cover with 2 inches of sand or soil; 4) lay out hardware cloth to protect cable; and 5) cover with 4 to 6 inches of good soil.

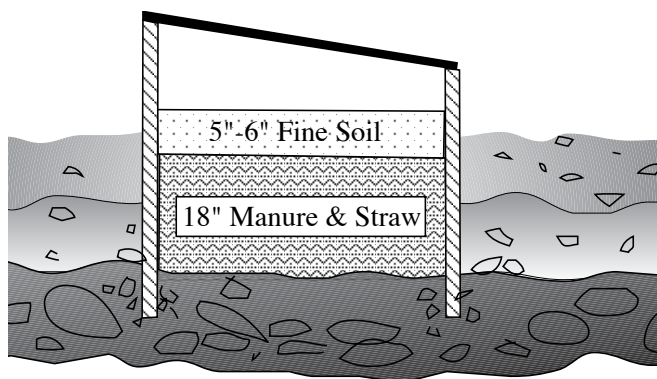


Fig. 4. Hotbed using manure

## Building a Cold Frame

Growing frames can be built from a variety of materials; wood and cement block are the most common. If you use wood, choose wood that will resist decay, such as a good grade of cypress or cedar. Wood frames are not difficult to build. Kits may also be purchased and easily assembled; some kits even contain automatic ventilation equipment.

There is no standard-sized cold frame. The dimensions of the frame will depend on amount of available space, desired crops, size of available window sash, and permanency of the structure. Do not make the structure too wide for weeding and harvesting; 3 to 4 feet is about as wide as is convenient to reach across. The sash of the frame should be sloped to the south to allow maximum exposure to the sun's rays.

Insulation may be necessary when a sudden cold snap is expected. A simple method is to throw burlap sacks filled with leaves over the sash on the frame at night to protect against freezing, or bales of straw or hay may be stacked against the frame.

Ventilation is most critical in the late winter, early spring, and early fall on clear, sunny days when temperatures rise above 45°F. The sash should be raised partially to prevent the buildup of extreme temperatures inside the frame. Lower or replace the sash each day early enough to conserve some heat for the evening.

In summer, extreme heat and intensive sunlight can damage plants. This can be avoided by shading with lath or old bamboo window blinds. Watering should be done early so that plants dry before dark, to help reduce disease problems.

## Using Your Cold Frame

In early spring, a cold frame is useful for hardening-off seedlings that were started indoors or in a greenhouse. This hardening-off period is important as seedlings can suffer serious setbacks if they are moved directly from the warmth and protection of the house to the garden. The cold frame provides a transition period for gradual adjustment to the outdoor weather. It is also possible to start cool-weather crops in the cold frame and either

transplant them to the garden or grow them to maturity in the frame.

Spring and summer uses of the cold frame center on plant propagation. Young seedlings of hardy and half-hardy annuals can be started in a frame many weeks before they can be started in the open. The soil in a portion of the bed can be replaced with sand or peat moss or other medium suitable for rooting cuttings and for starting sweet potato slips.

Fall is also a good time for sowing some cool-weather crops in frames. If provided with adequate moisture and fertilization, most cool-season crops will continue to grow through early winter in the protected environment of the cold frame. Depending on the harshness of the winter and whether or not additional heating is used, your frame may continue to provide fresh greens, herbs, and root crops throughout the cold winter months.

## Cloches, Tunnels, and Row Covers

The cloche (pronounced klosch) was originally a bell-shaped glass jar set over delicate plants to protect them from the elements (Fig. 5). The definition has expanded, however, to include many types of portable structures that shelter plants from drying winds and cold air.

The idea is to provide a greenhouse-like atmosphere for seeds and small plants in order to get an early start on the season or to extend the fall garden as long as possible. Cloches are set out over individual plants or are made into tunnels for whole rows. They trap solar radiation and moisture evaporating from the soil and plants. The hotcap is a simple form. More elaborate ones are fiberglass tunnels, special plastic cloches, row covers (Fig. 6.) with slits in them to allow some aeration, and panes of glass connected by specially designed hinges to form a tent. There are a variety of forms on the market now, some work, some don't, and some are easily constructed from materials around the home.

Cloches are generally lightweight, portable, and reusable. It is preferable to

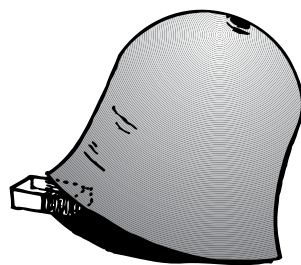


Fig. 5

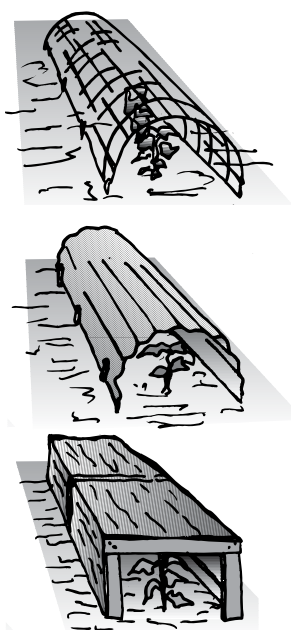


Fig. 6

have a design that can be closed completely at night to prevent frost damage and opened or completely removed during the day for good air circulation. Cloches should be anchored or heavy enough that they don't blow away.

## Floating Row Covers

Row covers are a more recent development in extending vegetable production past frost dates. They are simple devices, pieces of material (in spunbonded polyesters) laid over transplants in the field. As the plants grow taller, the plants push up the material. Row covers retain heat and protect against frost so crops can be planted earlier in the spring and harvested later in the fall. They have demonstrated insect and vertebrate pest protection while also protecting plants from wind damage. Row covers generally provide 4 to 5 degrees of frost protection, so cool-season crops can be planted in air temperatures as low as 28°F. Covers should be removed from the crops when air temperatures beneath the cover reach 80°F. Problems associated with row covers are lower light transmission, as nonwoven materials allow 75 to 80% transmission of light to the crop. The fabric covers can be extended through two seasons if treated with care. If used in conjunction with other season-extending techniques, row covers can mean earlier harvests with greater yields in addition to extended harvests.

## Hotcaps

Hotcaps (Fig. 7) function as miniature greenhouses, trapping the heat from solar radiation. An effective hotcap transmits sufficient solar energy for photosynthesis and for warming the air inside, but not so much that overheating damages the plant. Hotcaps also must retain sufficient heat throughout the night to protect plants against low-temperature injury. Hotcap designs vary from wax paper cones to water-filled, plastic tepees (Wall-O-Water™). All hotcap designs are most effective during sunny weather and have little effect on temperature during cloudy periods. The greatest temperature differences occur during sunny days and clear nights. However, hotcaps transmit less than 70 and 50% of the available solar energy and photosynthetic photon flux, respectively. The reduced light transmittance contributes to poor plant development inside hotcaps. Low light transmittance may lead to stunted and/or chlorotic plants. Using hotcaps, the mean time to first ripe fruit can be decreased by as much as five to ten days.

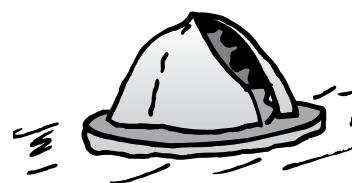


Fig. 7

Although the Wall-O-Water™ is reusable, cleaning is time consuming, and the Wall-O-Water™ is quite expensive compared to other hotcaps. However, research has shown

them to be more effective than other materials and can add several weeks growth to the early part of the season. Wax paper hotcaps are easy to install and disposable. Plastic jugs may be difficult to secure in the field and can only protect small plants; they do not retain sufficient heat to provide frost protection. They can delay fruit development unless ventilation is provided and can become hot enough to kill plants. For most gardens, simply cover plants overnight if there is a danger of frost. Be sure to remove the covering during the day.

## Greenhouses

There is an almost overwhelming selection of greenhouses on the market, and plans for building even more types are available. If you intend to purchase or build a greenhouse, it is wise to investigate the alternatives thoroughly, preferably visiting as many operating home greenhouses as possible. List your needs and wants ahead of time, and determine how you will use your greenhouse. Then compare on that basis. Many companies will send free specifications and descriptions of the greenhouses they offer; look in gardening magazines for their ads.

The conservation-minded person may find a solar greenhouse desirable. The initial cost is generally higher for a solar greenhouse than for the simpler, free-standing, noninsulated types, but for maximum use with lower heating bills, one can insulate north and side walls, provide liberal glass area for winter sun-catching, and make use of some type of solar radiation storage. When attached to a house, these greenhouses can be used for supplementary household heating, but there is a trade-off between heating the home and growing plants (especially heat-loving ones) in the greenhouse. Some researchers have concluded that a good compromise is to forget winter tomatoes and grow cool-weather crops during the winter in a solar attached greenhouse. In addition, they may retain excessive amounts of heat from late spring to fall and can make cooling the home more difficult.

## Shading

It is not always easy to start seeds or young plants for fall crops in the hot and dry conditions of August. One simple way to provide shade in otherwise exposed conditions is to build a portable shade frame for placing over rows after seeds are sown or transplants are set out. This can be the same type of frame used for starting early seeds, but using lath strips or an old bamboo shade instead of plastic.

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