

# UNIVERSITY OF KENTUCKY

COLLEGE OF AGRICULTURE

Extension Division

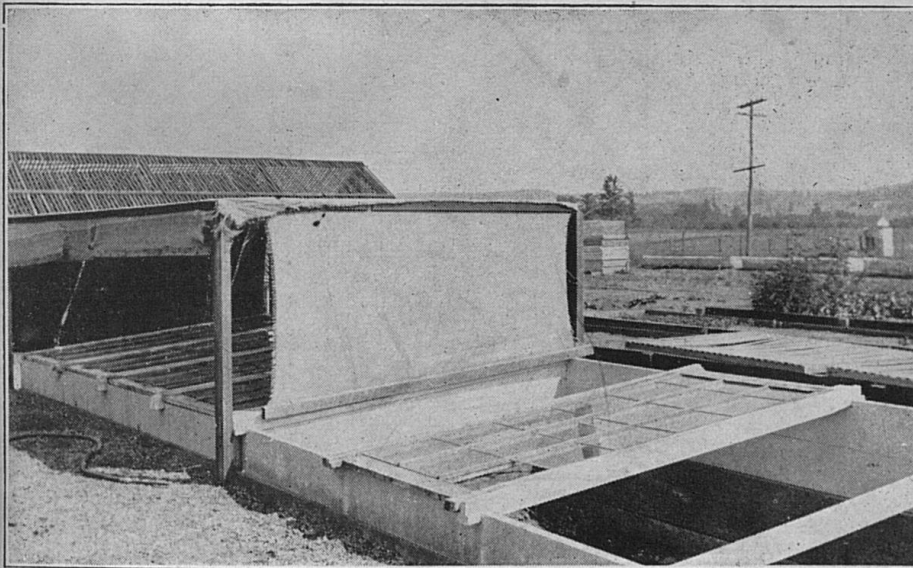
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CIRCULAR NO. 276

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HOTBEDS AND COLD FRAMES



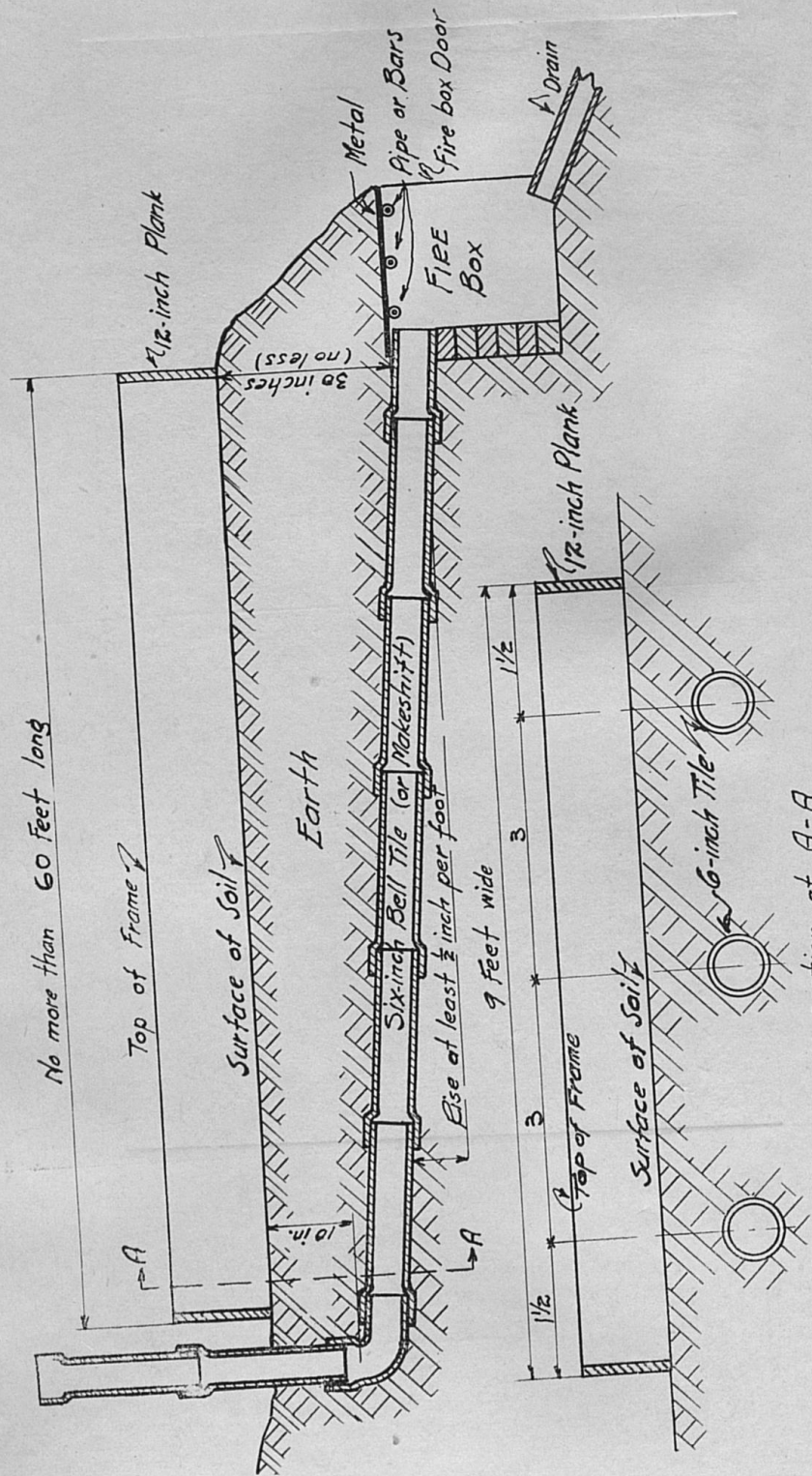
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Cross-section at A-A

Fig. 1. A flue-heated hotbed.



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**HOTBEDS AND COLD FRAMES**

By **JOHN S. GARDNER**

Hotbeds and cold frames are important adjuncts to any garden because they provide protection for plants before the weather is warm enough to grow them in the open. They are low, box-like structures, covered with glass or a glass substitute, enclosing plots of soil. A hotbed differs from a cold frame in that a means of heating is provided. Usually this is fermenting manure. In some of the more pretentious hotbeds, steam or hot-water systems are used, and sometimes electric heating elements are employed. Another kind is heated by means of underground flues from wood or coal fires. A cold frame may collect some heat from the sun; its chief function is to provide protection over cold periods.

**HOTBEDS**

A hotbed is used for forcing flowers and vegetables, for producing plants to be transplanted to the open ground, and sometimes to grow crops to maturity. Radishes, lettuce, onions, spinach, carrots, beets, and even beans, may be raised in a hotbed ready for the table; and the earliness of cabbage, cauliflower, tomatoes, peppers, egg-plants, cucumbers, and sweetpotatoes, in the open, may be increased by starting the plants in a hotbed.

As to flowers and ornamentals, the seed of scarlet sage, petunia, zinnia, marigold, cosmos, ragged robin, snapdragon, sweet alyssum, candytuft, and others, may be sown in a hotbed early, so that one may have plants ready to set out at the time usual for seedsowing in the open.

The best site for a hotbed is on ground that slopes moderately to the southeast, so that the bed may have the utmost advantage of the winter sun. The bed should be protected from north and west winds, by buildings, trees or shrubbery, or by a tightly built fence. Complete drainage must be assured. It is advantageous to have a

Fig. 1. A flue-heated hotbed.

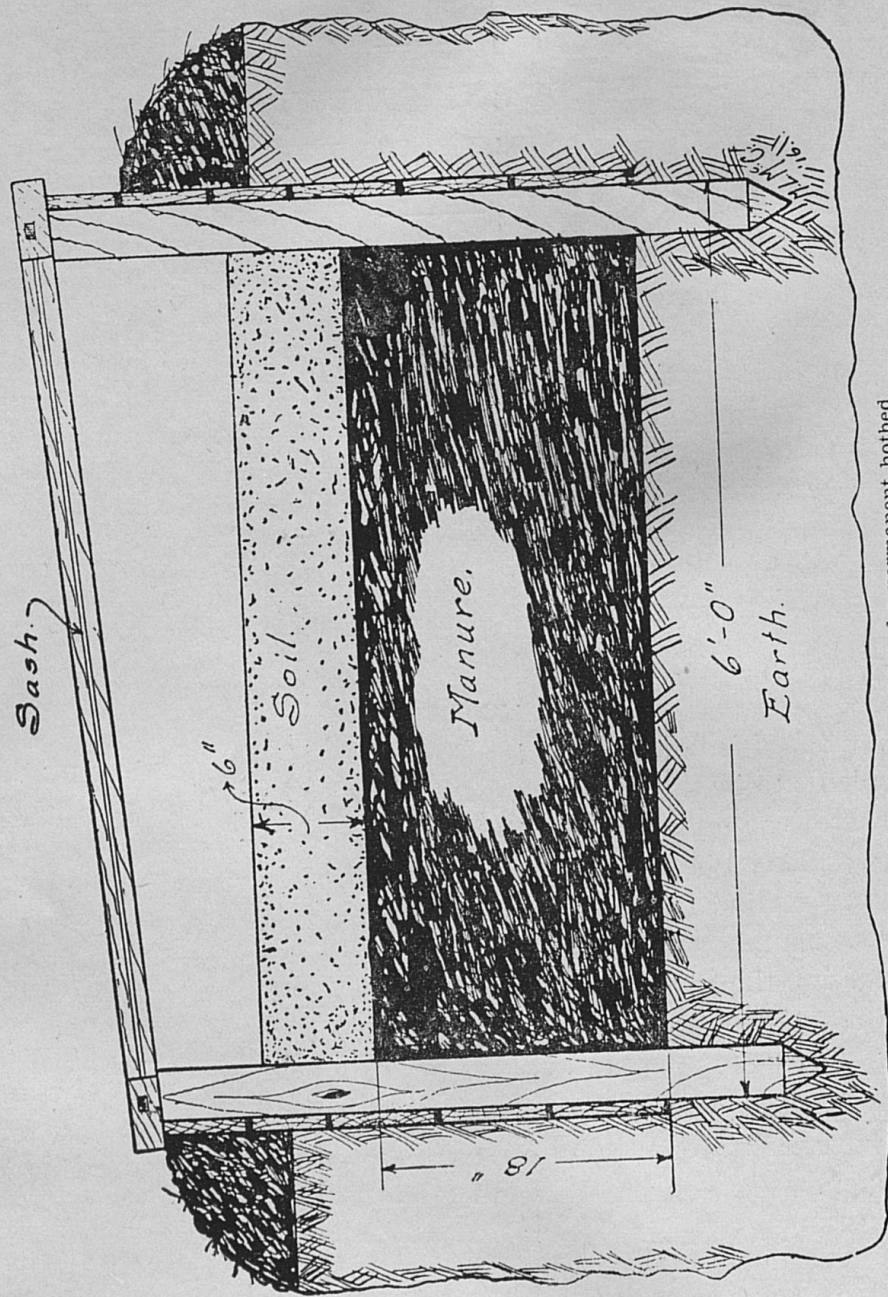


Fig. 2. Cross section of a permanent hotbed.



water supply close by and to locate the bed conveniently for frequent observation and care.

The type of construction of the bed depends on whether it is to be permanent or only temporary. A farm owner may well afford the initial expense for the construction of a permanent hotbed made of durable materials, such as concrete or brick, and actually save money thereby. However, a renter of uncertain tenure would find it more economical to construct a bed of a temporary type.

#### THE PERMANENT HOTBED

A permanent hotbed consists of three parts: the pit, the frame and the sash.

*Pit.* The depth of the pit should be 24 inches, to accommodate 18 inches of manure and an earth cover of 6 inches. Thus the bed is suited to growing the "warm" vegetable seedlings: tomato, pepper and eggplant, as well as the more hardy: cabbage, lettuce and cauliflower. The size and shape of the pit should be such as to fit the sash that is to be used to cover it.

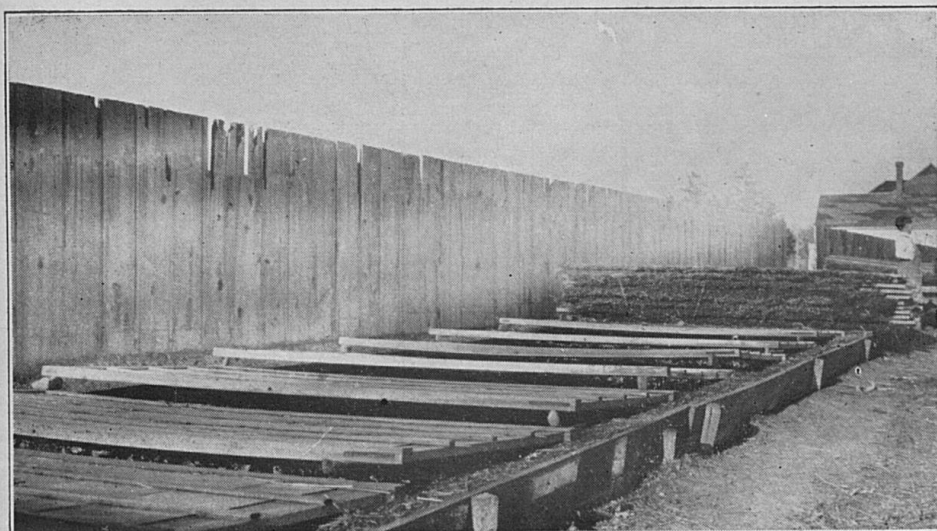


FIGURE 3. A permanent hotbed. Note double walls, fence windbreak, pile of broom-sedge mats, and method of ventilation.

*Frame.* The frame may be made of concrete, brick, or lumber. For ordinary purposes a lumber frame is satisfactory. Almost any of the woods may be used, but oak and cypress are best because of

their resistance to rotting. Two-inch stock should be used in preference to lighter weights. It is not necessary to extend the frame to the bottom of the pit if the earth is of a nature to support itself, but it is generally better to do so. The frame should be 15 to 18 inches high on one side and 9 to 12 inches on the other; thus the sash is sloped to shed water. The slope should face south so that a maximum amount of winter-sun heat and light may be absorbed. The sides of the frame should be held in place by 2" x 4" posts driven into the bottom of the pit at its corners and along its edges, spaced 3 or 4 feet apart. Cross-bars should be provided to support the sash at their edges. In Figure 2, a permanent hotbed is shown in cross section.

*Sash.* The sash should be made of the most durable wood, preferably cedar or cypress. It may be bought glazed or unglazed; sometimes there is economy in the gardener doing the glazing himself. Standard sash is made in two widths, 3 and 4 feet; the narrower size is generally used because it is easier to handle. Sash come in several thicknesses; the thicker kind is more durable but also heavier to move. Whether to select single-glass or double-glass sash is a matter of choice. Double-glass sash furnish more protection, but there is difficulty in keeping the inner surfaces of the glass clean; more weight is involved as well. In severe weather, it may be necessary to provide additional covering of mats especially manufactured for the purpose or made at home of broom sedge or straw.

In recent years, several substitutes for hotbed glass have come on the market. Some are made of fine-mesh wire screen treated with clear varnish and some of muslin impregnated with paraffin. They are light in weight and can be made into sash easily by stretching them over frames of light strips of wood. Objections to glass substitutes are that they do not pass light so well as glass and that they are short-lived. Frames covered with glass substitutes may serve as valuable accessories to the conventional hotbed.

#### PREPARATION OF MANURE

Horse manure is the best heating material to use in a hotbed but it must be properly prepared for it to function satisfactorily. It should be fresh and should contain no more than one-third bedding. The nature of the bedding is important; straw is best because it



permits the manure to be packed closely enough to prevent its becoming fire-fanged. Coarse litter may make the texture of the manure so loose that fermentation may proceed at a rapid rate impossible of regulation. Shavings or sawdust are objectionable because they may contain or produce compounds that may interfere with or prevent fermentation.

To prepare manure it should be put into a compact, flat-topped pile and, if it seems dry, wet down. In 3 or 4 days, after the pile has begun to steam, it should be turned inside out, mixing it so that fermentation is uniform thruout. After 3 to 5 days more, the manure will be ready. Inasmuch as cold weather may retard fermentation, it is well to begin preparing the manure 12 days to 2 weeks before it is planned to sow seed.

#### FILLING THE PIT

The manure should be put into the pit in layers of 5 to 6 inches and each tramped firmly, especially in the corners and along the edges. Even tho tightly packed it will settle several inches, so

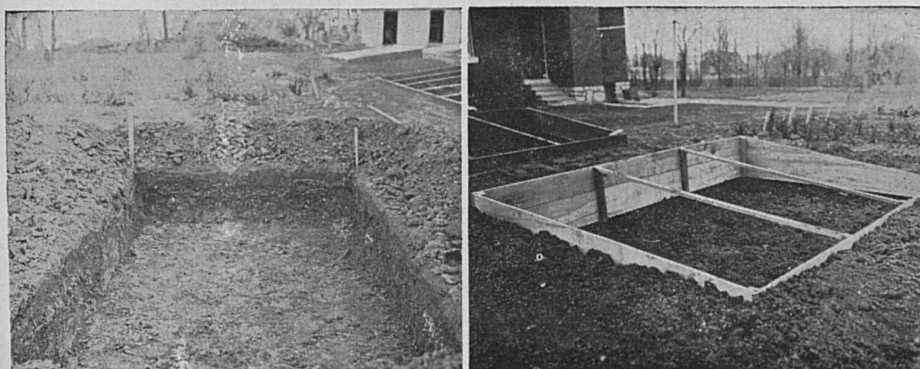


FIGURE 4. Pit for a temporary hotbed

FIGURE 5. Pit filled with manure.  
Frame in place.

allowance must be made. When the pit is well filled and tramped, it is ready to receive the soil. If the bed is to be used for flats or pots, 2 inches of soil is enough, but if seed is to be sown in it direct, 4 to 6 inches is required. The soil should be made up of good garden loam, two parts, and one part of well-rotted composted manure. It should be screened, and the particles broken up as fine as the smallest seed to be sown.

### THE TEMPORARY HOTBED

A temporary hotbed, to be used for one season only, may be made easily and at small expense, and should give good service if properly managed. One type (Figure 5) is made by digging a pit one foot longer and one foot wider than the frame to be used, but omitting the lining. Into it the manure is packed until it is completely filled; then, the frame is set thereon and banked on all sides with manure. Such a hotbed requires more manure than the permanent form described, but the ease of building it may recommend it in some instances.

Another type of temporary hotbed (Figure 6) is one in which no pit is used, but the manure is piled on the ground to a depth of 18 to 24 inches and the frame placed upon it. Altho wasteful of manure, so little labor is needed to construct such a bed that it may have a real use, particularly in emergency.

### CARE AND MANAGEMENT

*When to Start.* The time for making the hotbed depends upon the purpose for which it is intended. For growing a winter crop of lettuce and radishes, the time is about Christmas. For producing cabbage, cauliflower and lettuce plants to be set in the garden about March 15, the bed should be started between January 15 and February 1. For the more tender vegetables, tomatoes, cucumbers, peppers and eggplants, that cannot be set safely until after May 1 or perhaps May 15, the hotbed should be made March 1 to April 1. If cold frames are to be used in conjunction, the hotbed may be started from 10 days to 2 weeks earlier than the dates just given.

*Seed Sowing.* For the first day or two after it is made, a hotbed tends to heat vigorously; the temperature often reaches 125 degrees, but after it cools to 90 degrees seed may be sown safely. To use the space most economically, seed sown direct in the soil of the hotbed should be put in drills 4 to 6 inches apart, rather than broadcast. Besides giving the seedlings more uniform spacing, drill-sowing enables the gardener to estimate how many plants he has. Seed of the slowly-germinating vegetables, tomato, pepper and eggplant, preferably is sown in flats because it is easier to plant it at the proper depth. For cucumbers and related crops, it is best to sow in pairs of seed in pots and move the mass of earth and roots unbroken, for



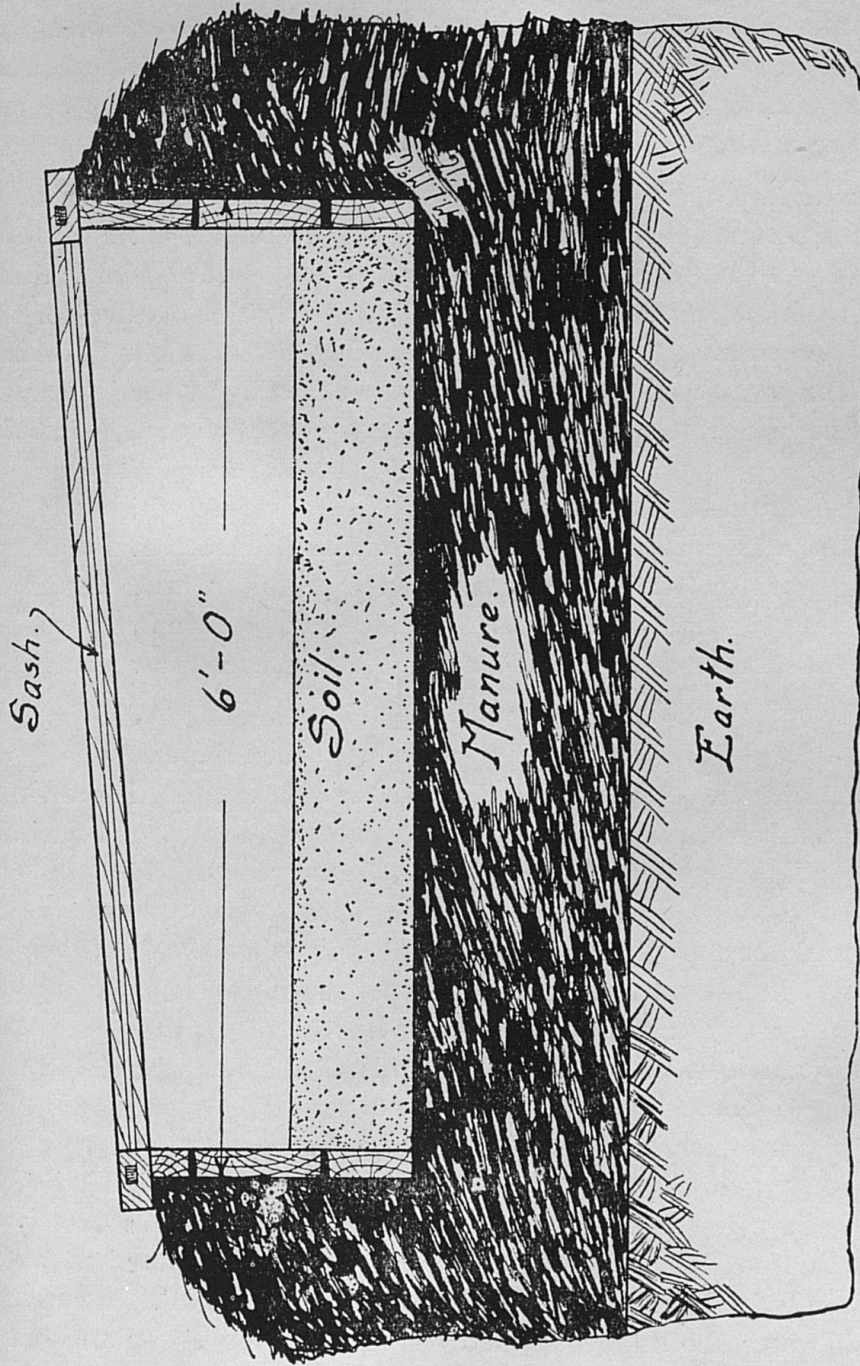


Fig. 6. Cross section of a temporary hotbed.

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this family of vegetables is particularly sensitive to root-disturbance. No matter how the seed is sown, watering should follow immediately. With small seed that must be sown shallow, it is best to cover with muslin or burlap and water thru it. This cover may be left until the first sign of sprouting is seen; then it should be removed.

*Ventilation.* This is one of the most important items in management because, if proper ventilating is not done, trouble may follow. No set rules can be laid down, but there is one sign to indicate when fresh air should be admitted. This is the "sweating" of the glass. Ventilation may be given by sliding the sash partly off the frames or by propping up the ends or the edges of the sash away from the wind, to prevent direct drafts from blowing over the plants.

Care should be exercised to keep the temperature within the bed as uniform as possible and never to let chilling occur. Plants requiring warmth, such as tomato, pepper, eggplant and cucumber, do best at 75 degrees, Fahrenheit, but the more hardy kinds, including cabbage, cauliflower, onion, and lettuce, grow well at a temperature 15 degrees lower.

*Watering.* Results obtained from the hotbed depend greatly on how watering is done. The amount of water to apply is governed by the outside temperature and by the weather, whether bright or cloudy. During the cold months, February and March, the bed needs little water, because evaporation is slow. Watering every 10 days should be enough. It is best to water only when the day is bright, and early in the day, so that the plants may have time to dry off before the frames must be closed for the night. In the warm days of April and early May, evaporation is rapid and more frequent watering is needed. Overwatering at this season may result in spindling, overgrown plants. To keep them in check, water should be applied in quantity only sufficient to keep the plants barely turgid, above the wilting point. Either a sprinkling can or a hose with a fine nozzle, or a hose with the stream manipulated with the thumb in order to break it into a fine mist, may be used. In general, enough water should be applied to penetrate to the plant roots, rather than merely to wet the surface; if plants are to be held in check, light watering should be the rule.



*Transplanting.* Seedlings that have been started in flats in the hotbed should be transplanted to other flats or pots, or back into the bed, but at wider spacing to give each plant opportunity to develop symmetrically and in stocky fashion. Cold frames may be used for the first or a second transplanting. Immediately after plants have been reset, they should be watered thoroly to help them to recover quickly. The result of transplanting is improved thrift and stockiness.

#### THE FLUE-HEATED HOTBED

Inasmuch as manure of the right kind and in sufficient amount is becoming increasingly difficult to get, gardeners are turning to the use of beds heated by flues thru which warm gases from wood or coal fires are led. This type of hotbed is illustrated in Figure 7 and in diagram in Figure 1. The best location for such a bed is on a slight slope to the south. It should run up the slope, with the fire-box at the lower end so that drainage is assured, to keep it dry.



FIGURE 7. Flue-heated hotbed, showing fire-box end.

In the diagram the flues are shown as 6-inch bell tile, but ditches boxed with stone, tin or in part with wood may be used instead; in tight soil, the sides of the flue may stand without being lined. The

standard width of the bed is 9 feet, and three flues are needed to spread the heat uniformly. At the firebox end there should be as nearly as possible 30 inches of soil over the flues, and at the upper end, 10 inches. The flues should rise at least half an inch to the foot so that draft is assured. This type of hotbed may be built any length under 60 feet; beyond that, heating may be uncertain, unless the construction is air-tight thruout. The surface of the bed may be built up level, as shown in the diagram, or it may take the slope of the adjacent soil. The excavations for the firebox and for the flues should be made accordingly.

The size of the firebox depends on the fuel. If coal is to be used, a firebox 2 feet square and 2 feet high is large enough. Six inches from the bottom, a grate made of pipe or bars should be built in, or a grate from some old stove may be used. If wood is to be burned the firebox should have dimensions ample to handle quite large pieces and a grate is not needed, altho having one may prove of advantage. The best material for the sides of the firebox is brick or suitable stone laid in mortar or in good native clay; the more airtight the construction, the better the fire can be controlled. The top may be made of arched masonry, or sheet metal resting on pipe or bars laid across. The best way to close the firebox (to control the fire) is with a well-fitted iron door, a door from a cast-off furnace, for example, but a piece of sheet metal propped against the opening will do.

The flues should leave the firebox at its highest point. If they do not draw evenly, owing to imperfect construction or to direction of the wind, the trouble usually can be remedied by adding height to the outlet stack of the faulty flue. Generally, the outer stacks should be taller than the middle one so that more heat is drawn to the edges of the bed. No set rules can be given for firing a flue-heated hotbed, but after a little experimenting any gardener may work out a system to suit his conditions.

#### **THE COLD FRAME**

In order to get the most usefulness from hotbeds a cold frame should be used in connection, for, by the time the first transplanting of the semi-hardy vegetable and flowering plants is made, a cold frame gives adequate protection and leaves the hotbed free to be



made over with a fresh lot of manure, for raising another lot of seedlings.

The specific uses of a cold frame are several. In it may be set the transplants from the hotbed to be hardened off. It may serve as a place in which semi-hardy flowers and vegetables are started, or, after the season has advanced, for starting the more delicate mid-season vegetables. A spring crop of lettuce and radishes may be produced in a cold frame much earlier than in the open garden. Late fall crops of these vegetables can be produced, and held for use as needed, quite late into the winter. The flower gardener may use a cold frame for sowing pansies, delphinium and columbine in the fall, and for holding over the plants for early spring blooming. If it is not to serve for any of these purposes, it may be used as a storage pit for cabbage, root crops or potatoes or for "trench" storage of celery.

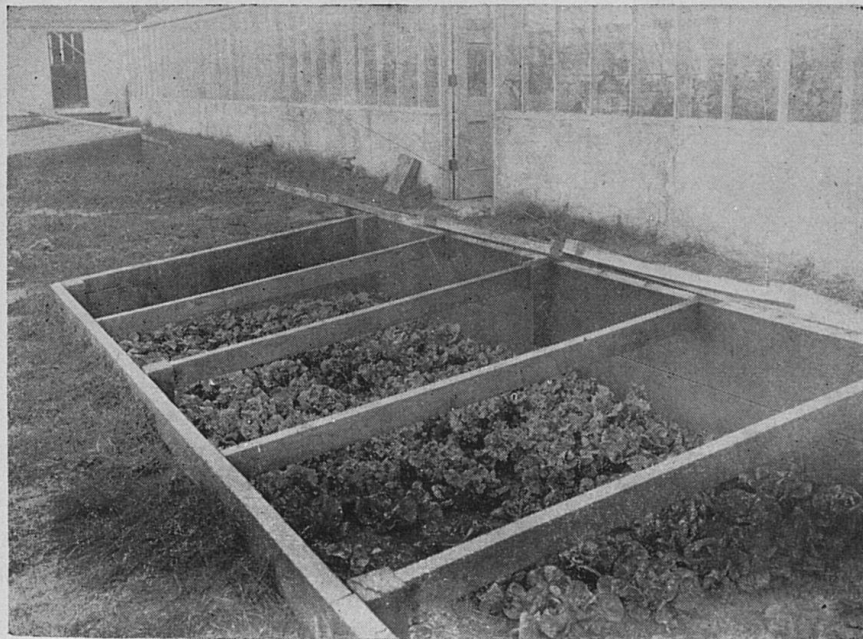


FIGURE 8. Fall-sown lettuce maturing in a cold frame.

The construction of a cold frame is essentially the same as that of a hotbed. The frame may be permanent or temporary. Permanent construction should be of brick or concrete, but heavy plank

of a durable wood serves well. Altho no pit is needed for the ordinary use, it is well to provide one, perhaps not so deep as for a hotbed except that if a pit deep enough to hold the amount of manure to be used under a hotbed is provided, the structure may serve interchangeably as a hotbed, a cold frame and a storage pit. To prevent its caving in, the pit should be lined thruout. If seed is to be sown in it, such a frame should have the pit partly filled with coarse material, or a false bottom may be put in, and 5 or 6 inches of good soil, like that recommended for a hotbed, placed upon it.

A temporary cold frame may be merely a frame of light lumber set on top of the ground over soil to which plenty of organic matter has been added. Whichever type of cold frame is made it is of advantage to cover it with the sash a few days before it is to be put in use, so that sun heat may be stored in the soil and the germination of seed hastened.

*Management.* Seed is sown in the same manner as in a hotbed. For the first few days, a close atmosphere should be maintained so that sprouting may take place promptly. When the seedlings are up, more air should be given, but carefully, so that chilling does not occur. It is well to be provided with mats with which to cover the frames during cold nights and on cold, overcast days. One should endeavor to maintain a temperature not lower than 50 degrees for the semi-hardy vegetables and flowers, and 65 degrees for the more tender group.

Hardening off is accomplished by giving the plants more air gradually and by withholding water. Thus growth is checked, the tissue toughened, and the plants are prepared to withstand the weather when they are set in the field. It should be kept in mind, however, that even the semi-hardy vegetable and flower plants should not be subjected to temperature below freezing, and that tomatoes and the other "warm" crops may be harmed if the temperature of the frame is permitted to drop below 50 degrees.