

UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE

Extension Division

THOMAS P. COOPER, Dean and Director

CIRCULAR NO. 120

Hotbeds and Cold Frames



By The
Department of Horticulture
Lexington, Ky.

FEBRUARY, 1922.

Published in connection with the agricultural extension work carried on by cooperation of the College of Agriculture, University of Kentucky, with the U. S. Department of Agriculture, and distributed in furtherance of the work provided for in the Act of Congress of May 8, 1914.

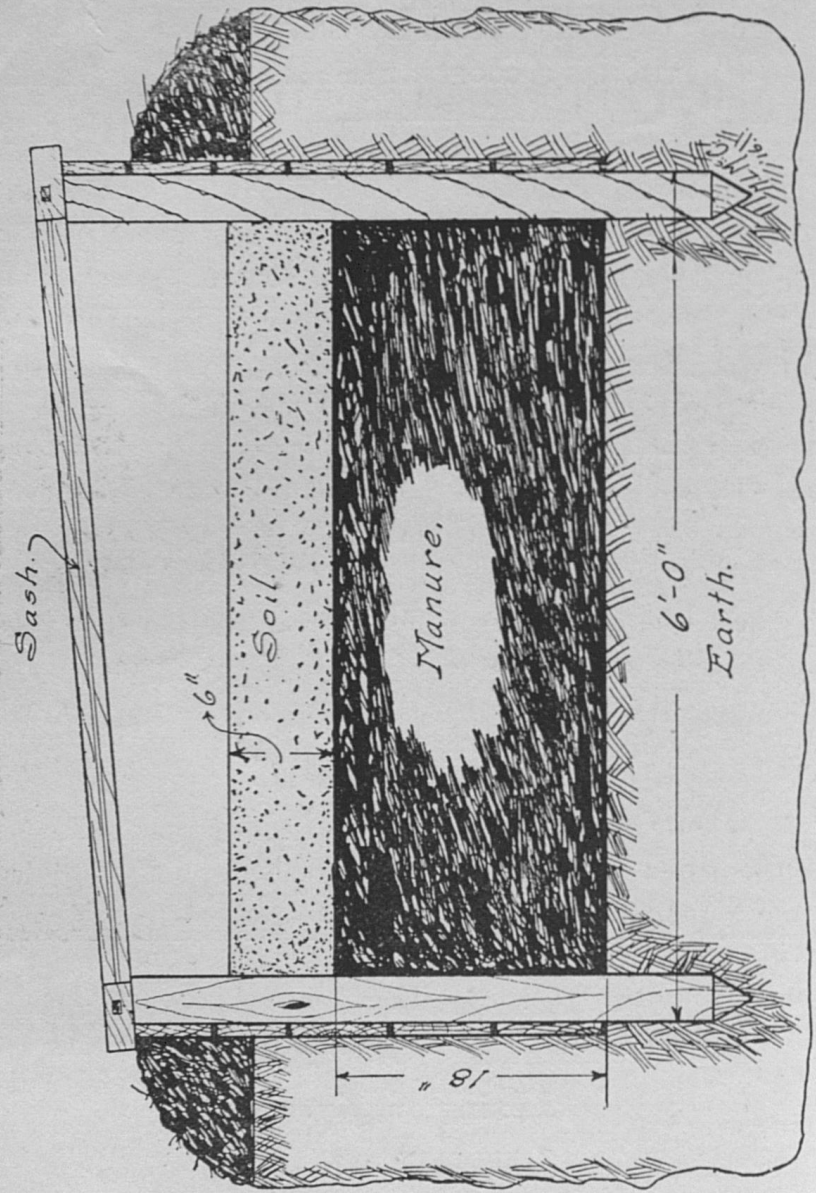


Fig. 1. Cross section of a permanent hotbed

CIRCULAR NO. 120

HOTBEDS AND COLD FRAMES

A hotbed is an enclosed plot of earth covered usually with glass and provided with some artificial means of heating, such as fermenting stable manure. The cold frame differs from the hotbed chiefly in that it is not provided with any means of artificial heating.

Such conveniences as hotbeds and cold frames are so suggestive of early spring garden activities that we sometimes forget that both may be used the year round for a great variety of purposes other than those for which they are primarily intended.

These uses include growing again in the fall such vegetables as lettuce, radishes, etc., and the wintering in cold frames of all sorts of half-hardy plants.

HOTBEDS.

The hotbed is used primarily for forcing plants, out of season, either to maturity or for transplanting to the cold frame or open ground. Such plants as lettuce, radishes, onions, beans and spinach can be grown to market size, while tomatoes, cabbage, cauliflower, peppers, cucumbers, melons, sweet potatoes and some others can be started early, thereby enabling the grower to mature these crops earlier than could be done normally.

The hotbed should be located on a much frequented line of travel to insure against neglect, because a successfully managed hotbed requires frequent attention. It should be on a well drained soil and in a place more or less protected from north and west winds. It is essential that it have a

full southern exposure and be near a water supply.

The construction of the hotbed depends on whether it is to be permanent or only a temporary structure. The man who owns his farm can well afford to incur a larger initial cost and thus equip himself with structures which will last for several years. The tenant, however, does not wish to install equipment which cannot be removed easily, so for him the temporary hotbed often will be more practical.

PERMANENT HOTBEDS

The permanent hotbed consists of three parts; the pit, frame and sash. The pit is dug eighteen inches deep, six feet wide and as long as desired, a convenient length being twelve feet. A bed of this size requires four sash three feet wide and six feet long. The depth of the pit may vary and should be governed by the time of year, the severity of the weather, and the kind of crop to be grown. Such crops as radishes and lettuce do not require as much heat as tomatoes, cucumbers and peppers. For general purposes in this locality eighteen inches is a good depth.

The frame may be made of brick, cement or plank; if of the latter, two-inch stock is to be preferred. If plank is used any kind will do, but the most satisfactory kinds are oak and cypress. The plank frame will serve the purpose of the average farmer. It may or may not extend to the bottom of the pit, but in any case it should extend about twelve or fifteen inches above the surface of the ground on the north side and six to eight inches on the south side, thus affording a slope to the south. The boards are held in place by two-by-four-inch stakes driven into the ground at the corners. Every three feet a cross-bar should be placed for the sash to rest upon. Figure 1 shows a permanent hotbed in cross section.

Sash should be made of the most durable woods, preferably cedar or cypress. They may be bought glazed or unglazed, it being much cheaper for one to do his own glazing. The standard and most convenient size of sash for ordinary use is three by six feet. They vary in thickness but the most common is one and three-eighth inches. Of course the heavy sash are more durable but the lighter kinds are easier to handle.

Double-glass sash are offered for sale by certain firms and great advantages are claimed for them, but these advantages are offset to some extent by their increased cost and weight, and the trouble of keeping the glass clean on the inner surfaces.

The use of double-glazed sash undoubtedly does insure greater uniformity in temperature and also obviates in many instances the necessity for providing a covering of mats or other forms of protection. In the warmer weather of April and May other materials such as oiled paper and waterproof cloth may be used as substitutes for sash, but due to shading they are apt to induce a spindling growth unless properly managed. The single-glass sash are less expensive at first but in severe weather require some additional cover to insure sufficient protection. Home-made covers may consist of straw or burlap mats.

PREPARATION OF MANURE.

Horse manure is the best heating material for use in the hotbed and for most satisfactory results requires careful attention in its preparation. It is desirable that the manure be not too compact or too loose tho as a rule the presence of considerable litter is beneficial. Two parts of solid excrement to one part of litter is a good mixture. Manure containing shavings should not be used. The manure is taken fresh from the stable and placed in a flat-topped pile 5 feet

high, of any length and width desired. If dry at the time of piling it should be moistened in order to start fermentation. Ordinarily the pile will begin to steam in two or three days. When fermentation is well under way the pile should be turned so that the interior will form the exterior of the new pile. This will insure uniform heating and the entire mass will, after three or four days more, be ready for the pit. From the time of piling until it is ready for pitting requires from ten to twelve days. The preparation should begin about two weeks before the time planned for sowing seed.

FILLING THE PIT. Before putting the manure into the pit it is advisable to cover the bottom with straw or litter to make it more heat tight. The manure is then thrown into the pit in successive layers of 5 to 6 inches and tramped firmly, especially in the corners and around the edge. The manure will settle several inches, so allowance should be made for this.

The pit well filled and packed is then ready for the soil. If the bed is to be used for flats or pots, two inches of soil will be sufficient, but if it is to be used as a seed bed, from 4 to 6 inches will be necessary. In the latter case, good soil consisting of one-third well-rotted manure and two-thirds good garden loam should be used.

TEMPORARY HOTBEDS.

A temporary hotbed is one constructed for use during a single season. These are easily put up with small expense and give good results if properly managed. One way is to dig the pit about a foot wider than the frame is to be made and not line it as in the case of the permanent hotbed. A light portable frame like the one shown in Fig. 5, is then placed on top of the manure, which should fill the pit completely, and it is then banked with manure. This method requires more manure, but at the same time furnishes heat

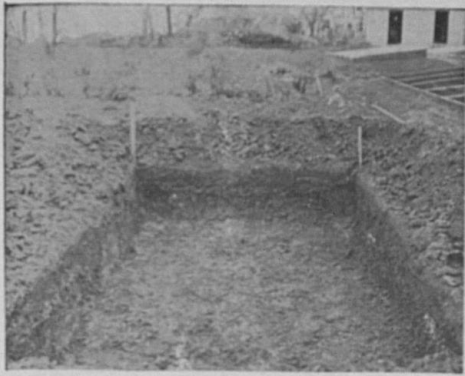


Fig. 2. Pit.



Fig. 3. Pit and manure.



Fig. 4. Pitting manure.

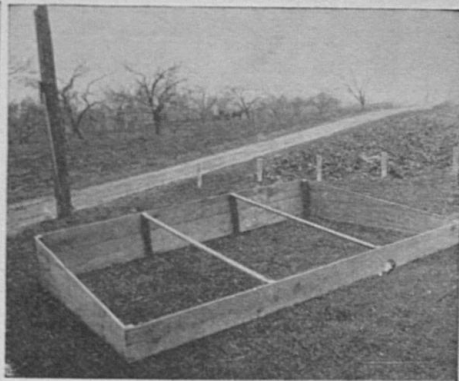


Fig 5. Frame.

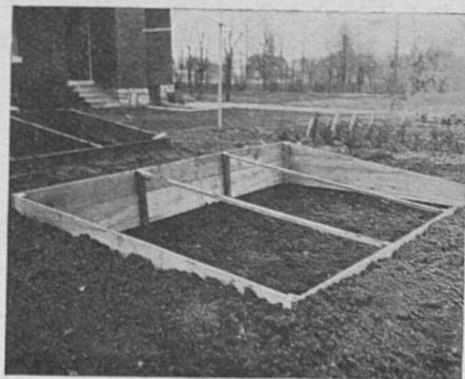


Fig. 6. Frame in place ready for sash.
Successive steps in construction of a temporary hotbed.

for a longer period.

A still simpler method, illustrated in Figs. 7 and 8, which eliminates the pit may be followed. In this case manure is piled on top of the ground and the frame set upon it. This takes considerable space owing to the fact that it is high above the ground and necessitates much banking. This plan also requires more manure than either of the others and it is the least efficient. The manure soon gives off its heat and becomes dead. In late spring such a hotbed might be used to advantage, but for early spring use when a long heating period is necessary, it would not be entirely satisfactory.

CARE AND MANAGEMENT.

TIME TO START HOTBED. The time for starting the hotbed depends upon the purpose to which it is to be put. It may be used for forcing lettuce and radishes during the winter months. The time of planting is governed by the type of plant to be grown and its treatment previous to setting in the field. Tender plants like tomato, pepper and eggplant can not be put out safely in the open before the first or middle of May, in Kentucky, so that it will not be necessary to sow the seed in the hotbed until the first week in March. The half-hardy plants such as cabbage, lettuce, cauliflower, etc., which can be put in the open ground by the last of March or the first of April should be started in the hotbed about the first week in February. If cold frames are used in connection with the hotbed, the seeds may be sown still earlier. By transplanting to the cold frames the plants will harden gradually and will suffer less when transplanted to the field.

SOWING SEED. The hotbed will heat vigorously for about three days and the temperature will rise to 125 degrees, after which time it will gradually cool to about 90 degrees

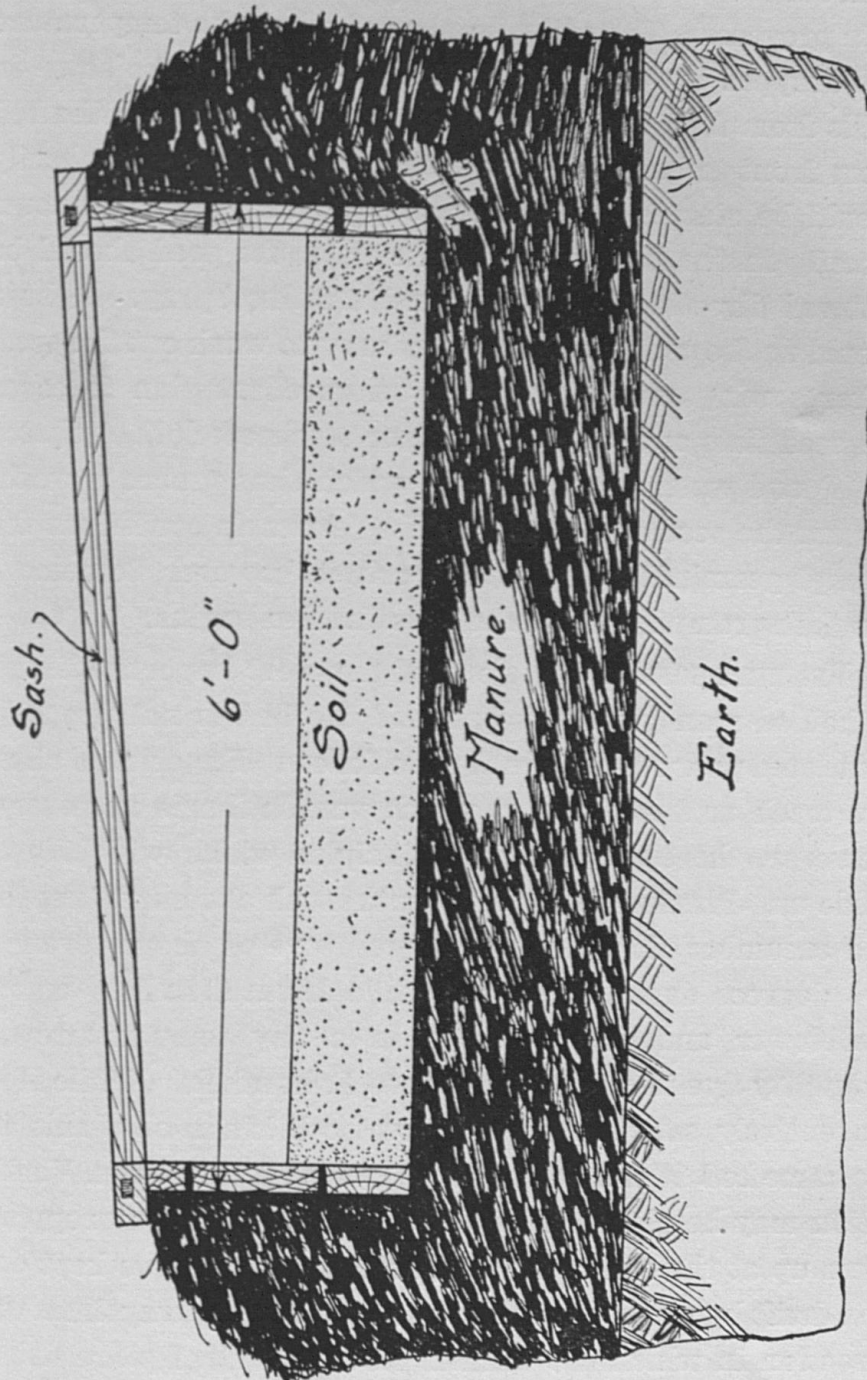


Fig. 7. Cross section of a temporary hotbed.

Fahrenheit. No seed should be sown while this first heating is in progress. They may be planted when the temperature has dropped to 85 or 90 degrees. Seed should be sown in drills from four to six inches apart, running across the bed from front to back. Plants which do not transplant easily should be started in flats or seed boxes. Whether sown directly in the hot bed or in the flats, the seed should be watered directly after sowing with a fine spray. A hose should not be used as it has a tendency to wash out the seed. After sowing small seeds it is an excellent plan to cover the seed flats or beds with a layer of cheesecloth (tobacco cloth) and water thru the cloth which thus prevents washing out the seed and also provides favorable conditions for prompt germination. It is important, however, to remove the cloth promptly as soon as germination begins.

VENTILATION. This is one of the most important items in hotbed management because if the bed is not properly ventilated poor results are sure to follow. Experience alone can teach us the times at which ventilation is necessary. However, there are general principles which will help to guide us. Plants requiring warmth, such as tomato, pepper and cucumber, do best in a temperature of about seventy-five degrees during the day, while lettuce, radish, onion, cauliflower and others thrive in a day temperature of from fifty-five to sixty-five degrees Fahrenheit. While it is not entirely satisfactory to grow both kinds of plants in the same bed, it can be done by the use of partitions. Ventilation may be obtained by sliding the sash or by propping them up at the end or side. The plants should be kept out of a draft by propping up the end of the sash away from the direction in which the wind is blowing. Drafts are detrimental to the growth of the plant, as they check plant activity and induce disease. As the weather becomes milder more ventilation may be given until about two weeks before

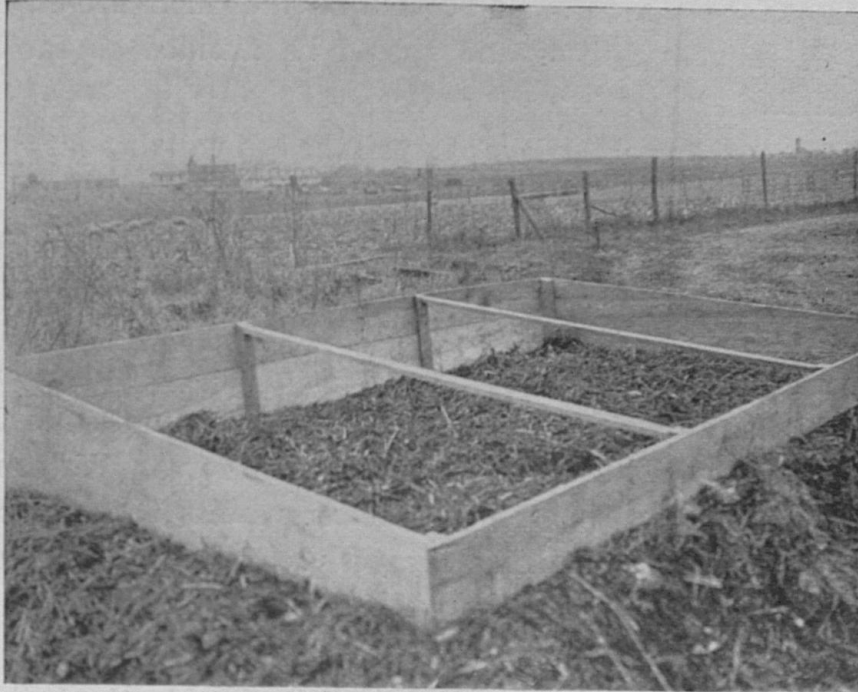


Fig. 8. Same type of hotbed as shown in Fig. 7.

time for field setting, when the sash may be left off entirely. The plants will then gradually become hardened to outside conditions and will suffer but little from transplanting. In ventilation the aim of the gardener should be to keep the temperature as uniform as possible, which condition can be maintained by proper manipulation of the sash.

WATERING. Careless watering of the hotbed will not result as disastrously as inattention to ventilation, but if it is continued for any length of time the plants surely will suffer. The amount of water which should be applied depends upon the season and the kind of weather, whether bright or cloudy. In the cold months, February and March, the bed will require very little water because evaporation is at the minimum and during this time an application about every ten days or two weeks will suffice. Watering then should be done only on bright days and early in the morning in order that the plants may have time to dry off before closing the

frames for the night. An accumulation of moisture on the plants induces disease and should be avoided as far as possible.

In the warm, mild days of April the bed will dry out very quickly, which will necessitate watering on alternate days or daily. Watering may be done with a hose or a watering can. The former can be closed partly with the thumb so as to produce a fine spray and, if so manipulated, is satisfactory, otherwise the soil is apt to puddle. For best results a can with a fine rose sprinkler should be used, for with this the water is applied uniformly and with little force. Watering thoroly at intervals gives far better results than merely moistening the plants daily, for it is the tendency in the latter way to wet only the top soil and the plants, and not to apply a sufficient quantity to reach the roots.

TRANSPLANTING. Plants started in flats in the hotbed



Fig. 9. Permanent cold frames on Experiment Station Farm.

should be transplanted to other flats or pots or, if desired, may be set directly into the bed. This affords each plant ample space for development and promotes a stocky growth. If cold frames are used in connection with the hotbed, the seedlings can be transferred to them before setting in the field. Transplanted seedlings may be checked slightly by the operation, but they soon become established and produce far better plants than those left in the original seed bed.

COLD FRAMES.

The cold frame is closely related to the hotbed and in order to get the largest returns from the garden one should have both. It is thru the use of the cold frame that the growing season is lengthened, inasmuch as it gives the plants an early start in the spring and a late finish in the fall. By properly manipulating these two contrivances the garden

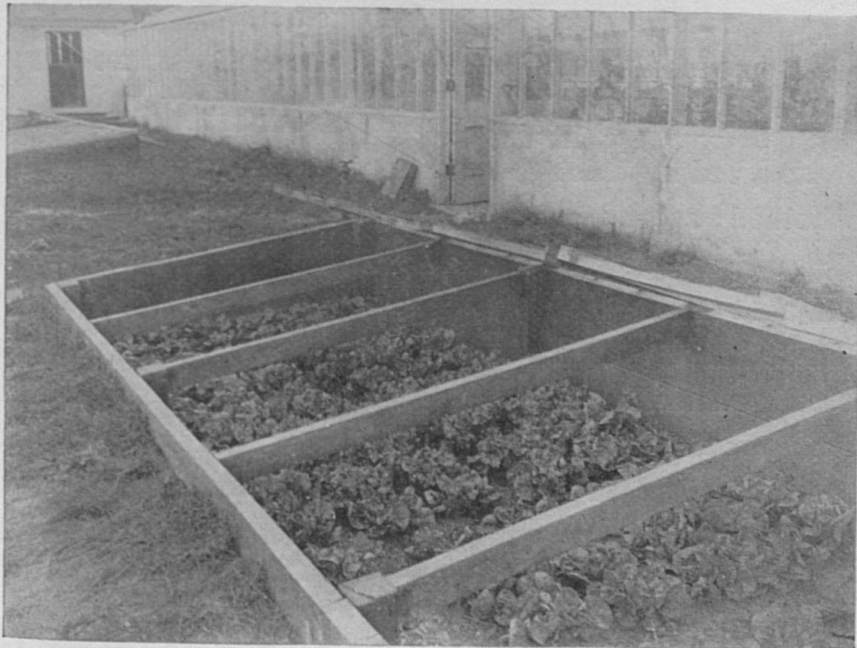


Fig. 10. Fall sown lettuce maturing in cold frame.

space is practically doubled and the highest garden efficiency attained. The cold frame is very easily managed and is a

great factor in the production of vegetables especially adapted to it.

The terms "hotbed" and "cold frame" are used synonymously by uninformed persons and for this reason they are often confused. The cold frame differs from the hotbed in that it is not heated by manure and is therefore merely a sash-covered frame without bottom heat.

The cold frame is used much more extensively than the hotbed altho in this state neither is in as general use as it should be. For Kentucky conditions the cold frame is well suited and can in a large measure be substituted for the hotbed as our weather during March and April is hardly severe enough to demand other than good protection for early plants. Plants started in February however will require some bottom heat so that the hotbed cannot be dispensed with entirely if very early plants are desired. A hotbed can be used as a cold frame by removing some of the manure and mixing the remainder with about six or eight inches of soil.

In Kentucky the cold frame is used for several purposes; first, as a bed in which to harden off early plants started in the hotbed; second, as a place in which to start medium early and late vegetables and flowering and bedding plants; third, as a means by which early spring and late fall crops of lettuce and radishes may be brought to maturity; fourth, for carrying over winter the hardier plants like cabbage, kale and cauliflower; fifth, for flowering pansies, violets and English daisies. If not used during the winter for any of the above, it can be utilized as a storage pit for celery, parsley, or some of the root crops.

Cold-frame construction is essentially the same as that of the hotbed. The frame may be permanent or temporary. The permanent frame should be made of brick, cement or heavy plank and should extend to the bottom of the pit. The

pit for ordinary purposes need not be as deep as that for the hotbed, since no heating material is required. However, if it is desired to use it as a storage pit for half-hardy flowers, an excavation of three feet is necessary, which should be lined on sides and bottom. A few inches of sawdust or cinders should then be put in and the plants in pots plunged into it.

The temporary cold frame does not require a pit and can be constructed of one-inch stock; the frame is simply set on top of the ground on soil which has been supplied with plenty of organic matter. It may or may not be of the same dimensions as the hotbed, but since the standard size of sash is six by three feet it is more convenient to make the frame of the same width. The length, however, is not arbitrary and can be made to suit conditions. Ordinarily, for a fifty by fifty foot garden, two sash will suffice.

MANAGEMENT

SOIL. If the frame is to be used as a seed bed in which to raise plants for transplanting to the open it should have preferably a rather light sandy loam soil, but if it is to be used for maturing early spring or fall crops, the soil should contain an abundance of organic matter. A soil for maturing crops usually is too rich to be used as a seed bed. The soil should be well smoothed with an iron-toothed rake in order to make it as fine as possible. The sash, if put on for a couple of days before the seed is planted, tends to warm up the soil and greatly assist the germination of the seeds. The cold frame in Kentucky should be started about the first of March for the more hardy vegetables and flowers.

SOWING SEED. The seed are sown in the same manner as in the hotbed and the sash may be left on and a close atmosphere maintained until the seedlings appear, which will be in about ten days or two weeks. The sides and ends of

the frame should be well banked with manure and the sash should be covered with boards or mats at times when the outside temperature is below the freezing point.

VENTILATION. Ventilation for the cold frame is not as urgent as for the hotbed but, nevertheless, should not be neglected. In seasonable weather the seedlings should be given as much air as possible without danger of drafts or frosts. A temperature of about fifty-five to sixty-five degrees should be maintained while the seedlings are small.

WATERING. If the soil in the bed falls apart when squeezed in the hand it needs watering. The upper side of the frame always dries out quickly and so should be watered thoroly. A fine rose watering can is most satisfactory for wetting young plants, as watering with a hose tends to wash out the seedlings.

TRANSPLANTING. With the appearance of the first true leaves the seedlings should be transplanted to another part of the frame or to other frames. By so doing each plant is given more space and will not be as crowded as if left in the original seed bed. Stocky, healthy plants will result. They should be shaded for a couple of days until they become established. Always water thoroly after transplanting.

HARDENING OFF. Before transplanting the young plants to the open ground they must gradually become acclimated to outside conditions. This can be done by admitting more air daily until the sash are removed entirely during the day. The same thing may be done at night until the plants are thoroly hardened.

Such plants as lettuce, cabbage, cauliflower, onions and leeks will stand a much cooler temperature than will egg-plants, tomatoes and peppers.