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Hotbeds and Coldframes—Their Preparation and Management,

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HOTBEDS AND COLD FRAMES—THEIR PREPARATION AND MANAGEMENT.

(By W. L. Howard, Professor of Horticulture, University of Missouri.)

A hotbed is a device for furnishing bottom heat from fermenting manure, for the purpose of growing plants out of their natural season or for forcing them into quick growth. If course, there are hotbeds, heated by steam, by hot water, and in other ways, but these will not be considered here. A hotbed adapted to the needs of the farmer or city man is simple of construction, and can be made complete, at a cost of only a few dollars.

While it is possible to make a hotbed in October, sow the seed, and have young plants like lettuce large enough for transplanting by December, and then make up a new bed in which they are to be grown to maturity; it would be much better in most cases to use the ordinary hotbed for growing such crops as lettuce, radishes, cauliflower, etc., beginning about the first of March. The hotbed is especially useful for starting many plants in very early spring, expecting to transplant them to the field when the weather is warm and settled. Another use to which a hotbed might be profitably put is the growing of violets. For this crop no bottom heat is needed, and hence these plants should be grown after the bed has been used for forcing purposes.

It is just as easy and costs not a great deal more to have a "range" of three frames instead of one. This arrangement makes it possible to grow different kinds of crops under different conditions. The following description, supplemented by the photographs, will enable anyone to make a hotbed.

The best location for a hotbed is on the south side of a building or high board fence. It would also be better if the ground slopes toward the south. Under these conditions the fullest amount

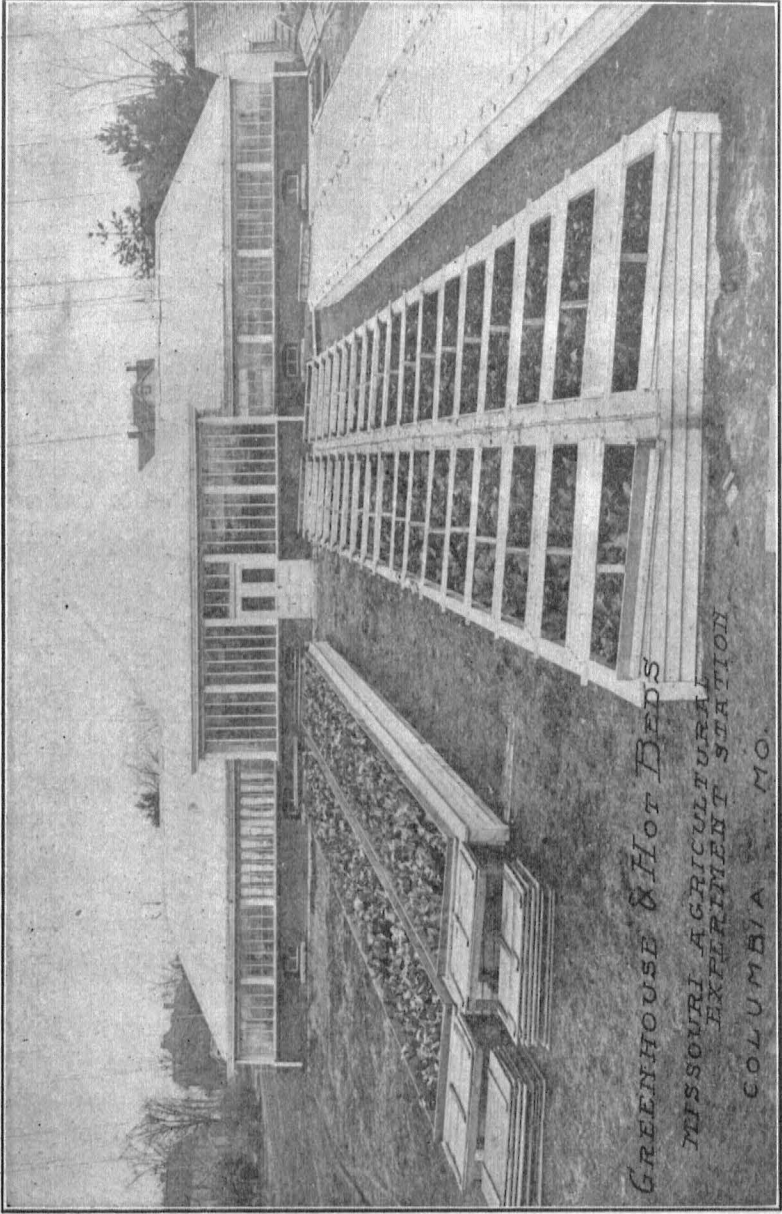


Figure 1. Greenhouses and hotbeds, Missouri Agricultural Experiment Station, Columbia, Mo.

of sunlight will be secured. As will be seen in the figures, this description is for a range consisting of three sashes. The size of each sash is 4x6 feet, hence the space to be staked off would be 6x12 feet. For Missouri conditions excavate to a depth of from 6 to 10 inches, throwing the earth out on all sides. Next prepare the framework for the bed, which is made of pine boards 12 inches wide. In the corners are nailed pieces of 2x4 pine, which serve not only as braces for the frame but as legs for it to rest upon. These, of course, should be long enough to reach to the bottom of the pit, but allowing the framework itself to be level with the ground. Two 2x4 pieces should be fitted across the frame to correspond to the widths of the sashes, that is, the first piece should be 4 feet from the end and the other one half way between this and the other end. If the ground slopes four or five inches in six feet, the beds, when finished, will have about the proper slope, but if this is not the case, two of the legs of the frame (those on the north side) should be a few inches longer than the other two.

After the frame is fitted into place, the earth should be banked around it. One load of fresh manure will be sufficient to make up the range. The best material for this purpose is that secured direct from the stable, the material itself consisting largely of the bedding from the stalls. Material which has been exposed to the weather for a time is worthless, as it will not heat. The manure is thrown into the pit, distributed evenly over the space and tramped down firmly, by having a man constantly walking over it. After being filled to the top of the pit, and perhaps a couple of inches higher, the whole is nicely leveled. It is then necessary to water the bed thoroughly. Emphasis should be laid on this part of the work, as it is necessary that the manure be thoroughly soaked before the proper fermentation will take place.

A layer of rich, porous soil, about 2 or three inches thick, should be spread over the manure. After a hotbed has been in use for a year or two, the old manure, which has previously furnished the heat, but which has now thoroughly decayed, makes a most splendid soil when thoroughly mixed with the dirt that is upon it. In the absence of this, however, good soil may be prepared by using equal parts of garden loam and thoroughly rotted manure and mixing with the mass enough sand so that the particles can be seen throughout when handling it. Two or three shovelful should be sufficient. The bed is now complete and ready for the sashes to be placed upon it.

This form of bed is a compromise between the old fashioned

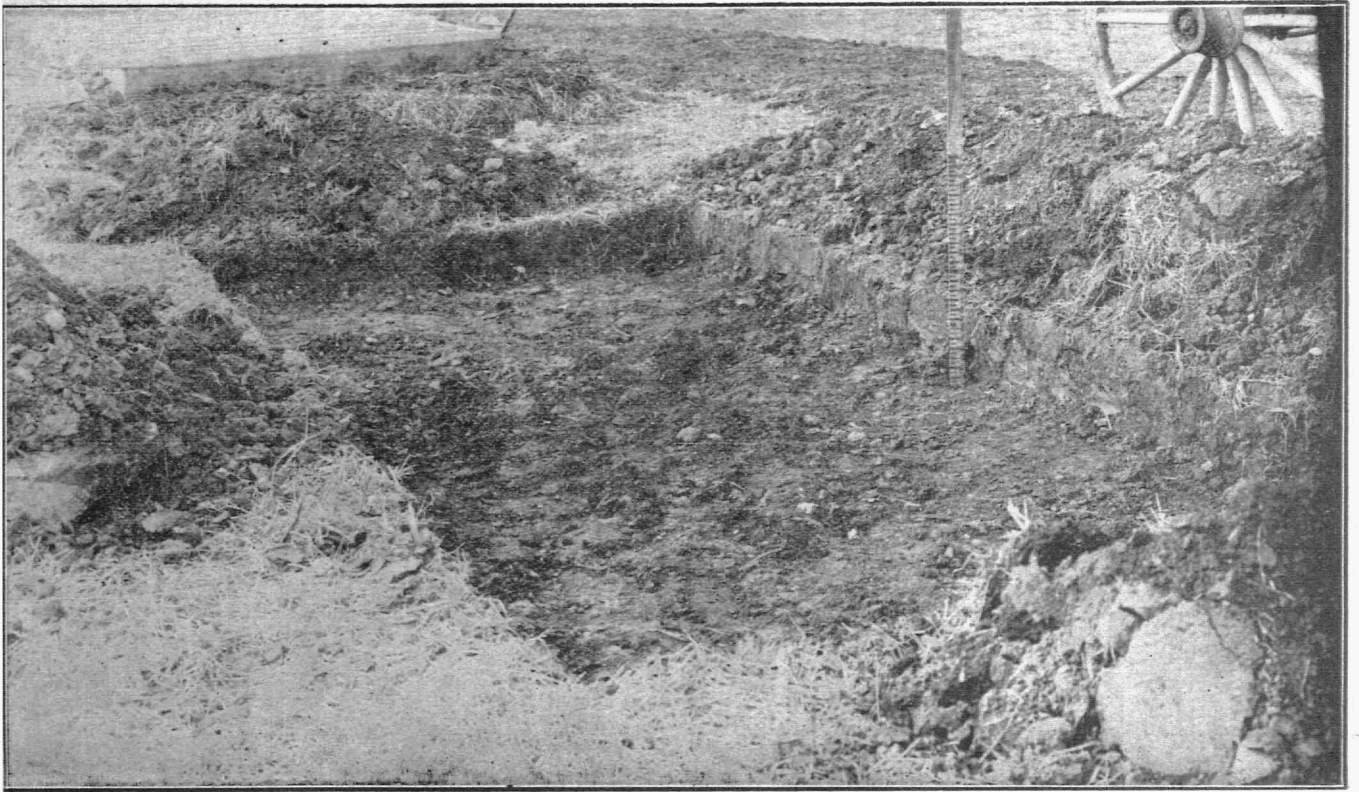


Figure 2. The first step in making a hotbed. Pit 6x12 feet in size (for three sashes), excavated to a depth of 6-10 inches.

regular form with a pit 18 inches deep and the kind which is made wholly above ground, no excavation being employed at all. This raised kind is, of course, a temporary bed, but it often serves a useful purpose for growing early spring crops and can indeed be used throughout severely cold weather by heaping manure around the outside.

The following details show the various items of expense in making a hotbed:

Three sashes (without glass), at \$1.00 each.....	\$3 00
One box glass, size 8x12 inches.....	3 00
Paint for sashes	1 00
Glazing points	05
Putty	15
Three pieces pine lumber 1x12x12, two pieces pine lumber 2x4x12.....	1 30
Time of one man glazing and making frames, 10 hours.....	1 50
Time of one man hauling manure, digging pit, preparing frame for use, 10 hours	1 50
Total	\$11 50

Of course, if a man can do all of the work himself, three dollars may be subtracted from this amount. If only one frame is desired, it could be made at a cost of a little more than one-third of the three here described. The items for labor, the cost of manure and hauling the same, of course, will vary under different conditions, but these things may be easily estimated by anyone interested.

The figures given are for sashes or frames, 4x6 feet in size, which size is largely employed, but for the amateur, it is recommended that smaller ones be used, say 3x6 feet. Sashes of this size are made in large numbers and kept in stock by some of the big manufacturing companies, and are quoted as low as \$1.60 each, complete with glass.

If the frames are to be used during cold weather and are expected to be kept for a number of years, it will pay to make covers for each of the sashes out of good pine lumber one inch thick. There are on the market specially prepared mats or rugs for covering hotbed sashes. A cheaper way than either, which is quite effective in severely cold weather, is to cover the sashes over with fresh manure to a depth of six inches. Beds treated in this way come safely through a temperature of 20 degrees below zero.

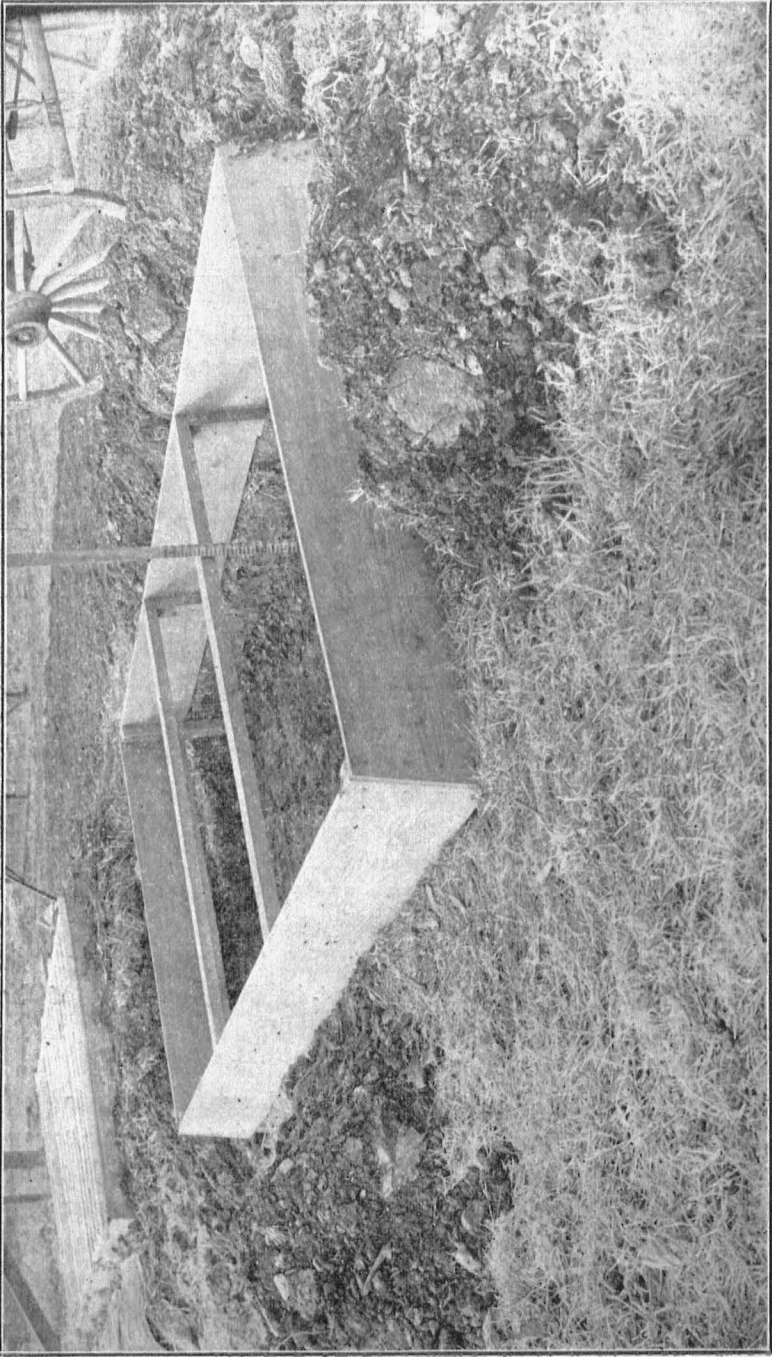


Figure 8. A "range" of three frames or sashes for the earth to be banked around the outside.

USES OF HOTBEDS AND COLD FRAMES.

Every person who raises garden truck should make use of glass in his work. It costs so little to equip a hotbed or cold frame that these conveniences are within the reach of all. They are easy of construction and not as troublesome as many seem to think. While their management is not a formidable matter, it should be stated that the highest success in growing some of the hotbed crops can only come after much practice. Still the beginner can accomplish a great deal the first year and the satisfaction that follows having produced fresh vegetables out of season or beautiful flowers earlier than would otherwise be possible, is ample pay for the time and thought that have been expended upon the work, to say nothing of the money value of the things produced. Furthermore, there are certain crops, such as celery, cauliflower, sweet potatoes, etc., the successful growing of which at all times demands that they be started under glass. Finally, the work is exceedingly interesting and will, for many people, furnish a pleasant and healthful diversion from their regular duties.

At the outset, it should be distinctly understood that the term "hotbed" has different meanings, depending upon the part of the country where it is used. For instance, at the north a hotbed is pretty generally understood to mean a pit from thirty to forty inches deep, while in the latitude of Missouri, it might have reference to a pit only eight or ten inches deep, but usually, for permanent use, from 18 to 30 inches deep, and in the far South, simply a mass of fermenting manure enclosed by a frame, but wholly above ground. Again, hotbeds may consist of long, double ranges built of wood or brick and of varying depths; where the heat from the fermenting manure is supplemented by warmth from steam pipes running around the sides of the bed above ground. See figures 1 and 9.

As here used, it is intended that the discussion shall apply to the commoner forms of hotbeds, in which the heat is supplied by fermenting manure and with pits excavated to such depth as may be necessary to supply the necessary heat for running from one to two months without renewal. At the north, pits will have to be from two and one-half to three and one-half feet deep, while in the latitude of Missouri, twelve to eighteen inches will be sufficient, and farther south even less. For late fall or early spring use, temporary beds almost or wholly above ground, may be made and successfully maintained through unexpected cold snaps by banking up



Figure 4. Earth banked around framework and the pit filled with fresh stable manure. The manure must be wet down thoroughly.

the sides with fresh manure and covering over the sashes with the same material, or with blankets, if desired.

Hotbeds are used for several distinct purposes:

First—For starting from seed such plants as cabbage, cauliflower, sweet potatoes, tomatoes, etc., for transplanting to the open field in spring or early summer.

Second—Growing vegetables out of season, that is, growing them to maturity in the beds. This may occupy all the winter, merely the first part, or only the latter part.

Third—For starting plants from seeds, to be transplanted later to other hotbeds or to the garden. This part of the work may begin in early fall and during mid-winter, when another crop is taken up and carried through until spring, or it may begin in fall and last continuously until warm weather. Under this heading would be included both vegetables and flowering plants.

Fourth—For the rooting of both soft and half-ripened wood cuttings, as roses, geranium, abutilon, lantana, etc.

Fifth—For the growing of many plants which require little or no heat. This would not be a hotbed in the full sense of the word, but a cold frame. However, no sharp line can be drawn between the two, as the hotbed that has almost lost its heat is made use of for certain plants, with the expectation that they will be continued in it after the heat is entirely gone. The cold frame is, in fact, almost as useful as the hotbed, but the two must be employed together, as both are necessary.

PLANTING AND MANAGEMENT.

To take up the various crops grown in hotbeds and discuss in detail their management would require pages of space. A few general hints, however, may be given which may be helpful to the beginner. The principal vegetables grown to maturity in hotbeds are lettuce, radishes and cauliflower, although such things as egg plant, melons, cucumbers, and many others are grown to maturity. The beginner should start with lettuce and radishes and perhaps cauliflower. Start a mild hotbed not later than the middle of October for the latitude of Missouri. When the temperature has come down to about 65 F. the lettuce seed may be sown in flats. These are shallow boxes 12x18 inches in size, and 2 to 4 inches deep. The soil should be rich, fine, and contain enough compost and sand to prevent it from baking, and at the same time furnish good drainage. Germination may be greatly hastened by soaking

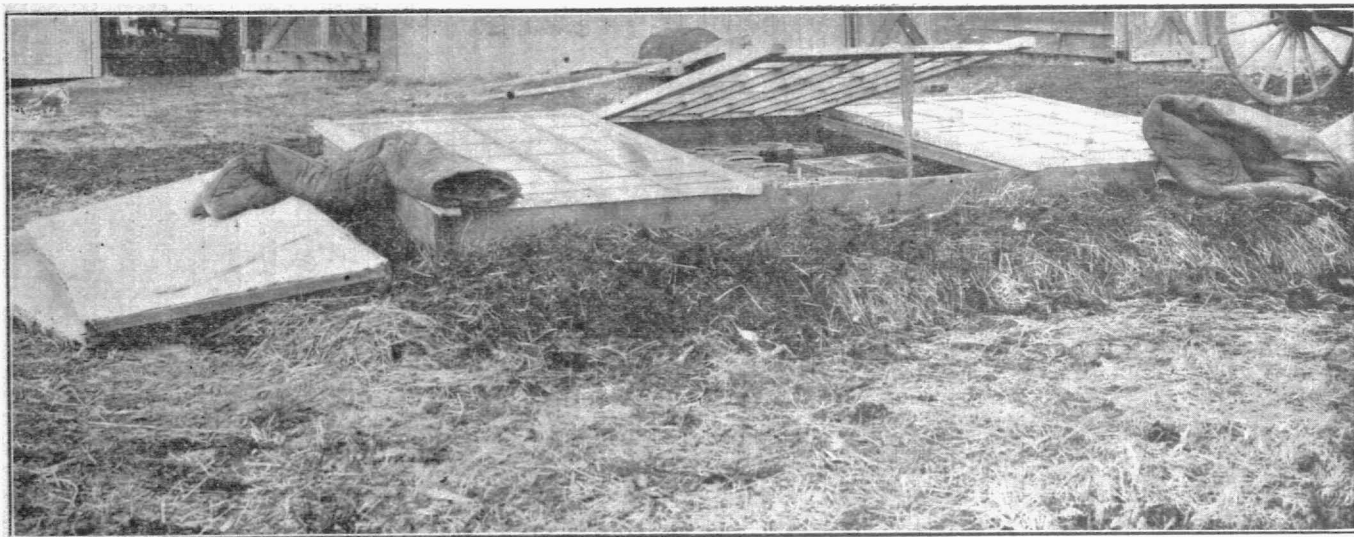


Figure 5. The finished hotbed containing growing plants. At the left are shown a mat used for protecting frames during severely cold weather, and some cloth sashes, used instead of glass in late spring.

the seed before planting in lukewarm water for from twelve to twenty-four hours. This will cause them to come up in four days. Place the flats on the beds and give close attention to the ventilation and watering. The soil in the boxes should be kept moist but never soaking wet. See figure 6. Since the temperature must be kept comparatively low, it will be necessary to ventilate during the day when the sun is shining, by raising the sashes from two to six or eight inches, and propping them up with blocks. See figure 8. Of nights the bed should be protected according to the weather. If below freezing, it would be well to cover the sashes with boards or mats. After the seedlings have grown two leaves, they should be transplanted to other flats, setting them one inch apart each way. Here they are grown until they have formed three or four leaves or until they are crowding each other, when they are to be transplanted to a fresh hotbed, which has been prepared to receive them, where they are set 8x8 inches apart. This distance is necessary for head lettuce. Immediately after setting out the lettuce, a row of radish seed may be sown in the spaces between the lettuce rows. This will be in early November, and in four weeks, if all goes well, the radishes should be large enough for table use, and the lettuce should be ready by Christmas. The best varieties of lettuce for forcing are St. Louis Butter and Big Boston. Radishes—Early Scarlet Globe and White Tip. In figure 10 are shown several varieties of head lettuce grown in a hotbed in winter.

When the lettuce has been harvested, which will be early in January, clear the ground, smooth the soil, and sow lettuce seed broadcast, mixing in a sprinkling of radish seed. Keep the bed cool, and about the middle of February the seedlings may be transplanted to a new frame. The old one that they came out of may be renewed for this purpose, as the radishes will have been harvested before this. With reasonable attention to watering and ventilation the lettuce should thrive and make a good crop for spring use.

The beginner had perhaps better not try to grow cauliflower the first year. If this vegetable is grown in the hotbeds the plants should have been started a month or so previously. The cauliflower should be set out first, setting the plants about eighteen inches apart each way, and with two rows of lettuce in between. Radishes may be sown between the lettuce rows. Both the radishes and lettuce will come out long before the cauliflower has

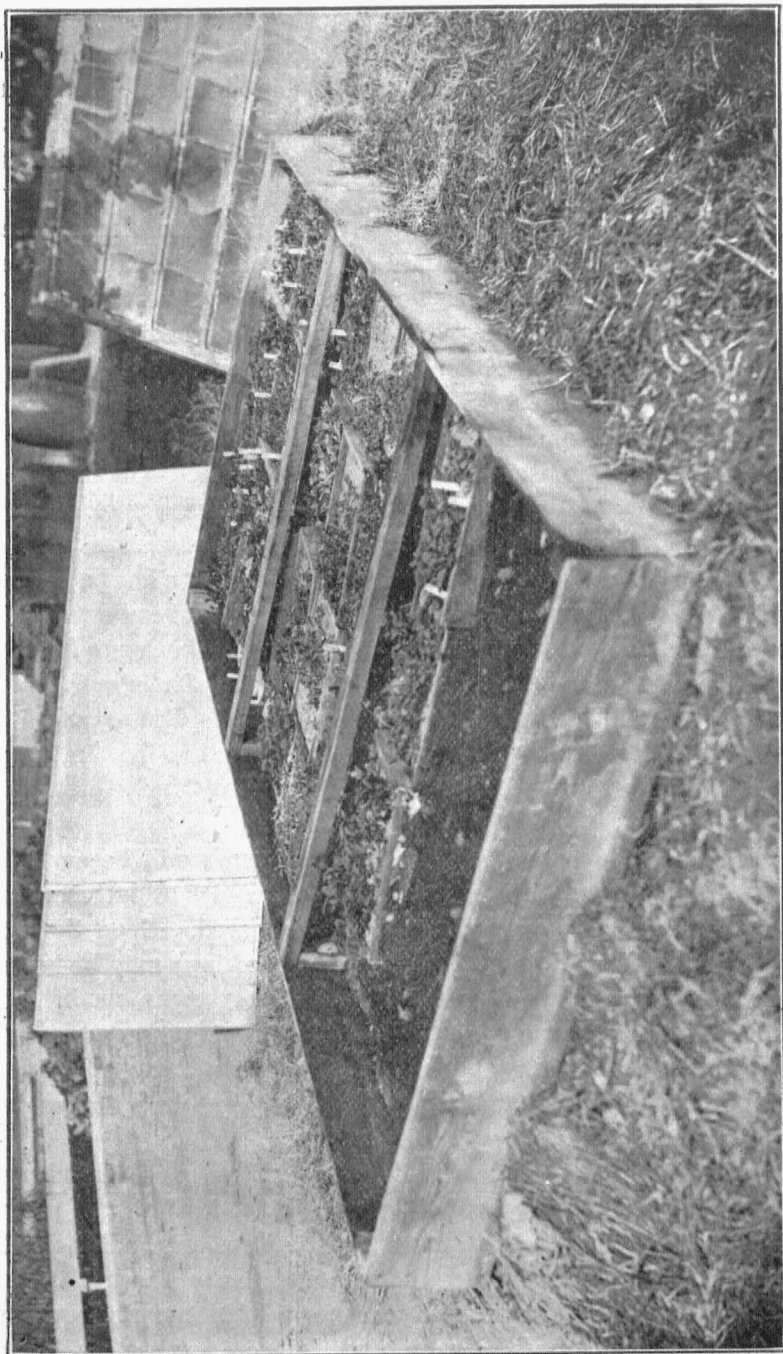


Figure 6. An inexpensive 8-sash range of hotbeds for spring use.

matured. The latter will not be ready for use until well along in April.

Since only about eight cauliflower plants can be grown to each 3x6 sash, it may not be profitable in most cases to have the ground occupied so long by this crop. With no cauliflower the beds may be renewed the 15th or 20th of March and used for starting such plants as tomatoes, cabbage, onions, cauliflower and egg plant from the seed, to be transplanted to the open field in spring. See figure 8. Sweet potato plants may also be grown in these beds. It would perhaps be best to sow the tomato seed in shallow flats, as it may be necessary to move them to other frames where it is cooler, if the spring is late and it is seen that the plants will be too large before they can be transplanted. Tomato plants should be low and stocky, and it would not be possible to regulate conditions well where they are grown in the soil in the bed. It would not be so necessary to have the cabbage and cauliflower in boxes.

VENTILATING AND WATERING.

In the management of hotbeds in winter the matter of ventilation and watering should be emphasized. When the beds are very warm the growing lettuce will require a great deal of fresh air. Refer to figure 8. At the same time it must be remembered that under such conditions the plants are very tender and sensitive to cold. A slight chilling, either from ventilating when the air is too cold, or from chilling the plants by watering with water that is too icy will check them and greatly retard growth, if they are not more seriously injured. There are so many sunny days in winter that it will be possible to raise the sashes from one to four inches for at least an hour about noon or a little later every day. The main difficulty will come when the weather is too cold to prop up the sashes at all. Even then they should be raised up high some time during the middle of the day and then quickly lowered again. This may be necessary during cloudy days when the weather is not so cold. This will at least change the air. A need for fresh air is always indicated, at least when it is badly needed, by condensation of the moisture on the glass. When this "sweating" takes place fresh air must be given at all hazards.

The beds will require comparatively little watering. Too much water will drown out the fermenting manure and cause the heat to die out. The soil, however, should never be allowed to be-

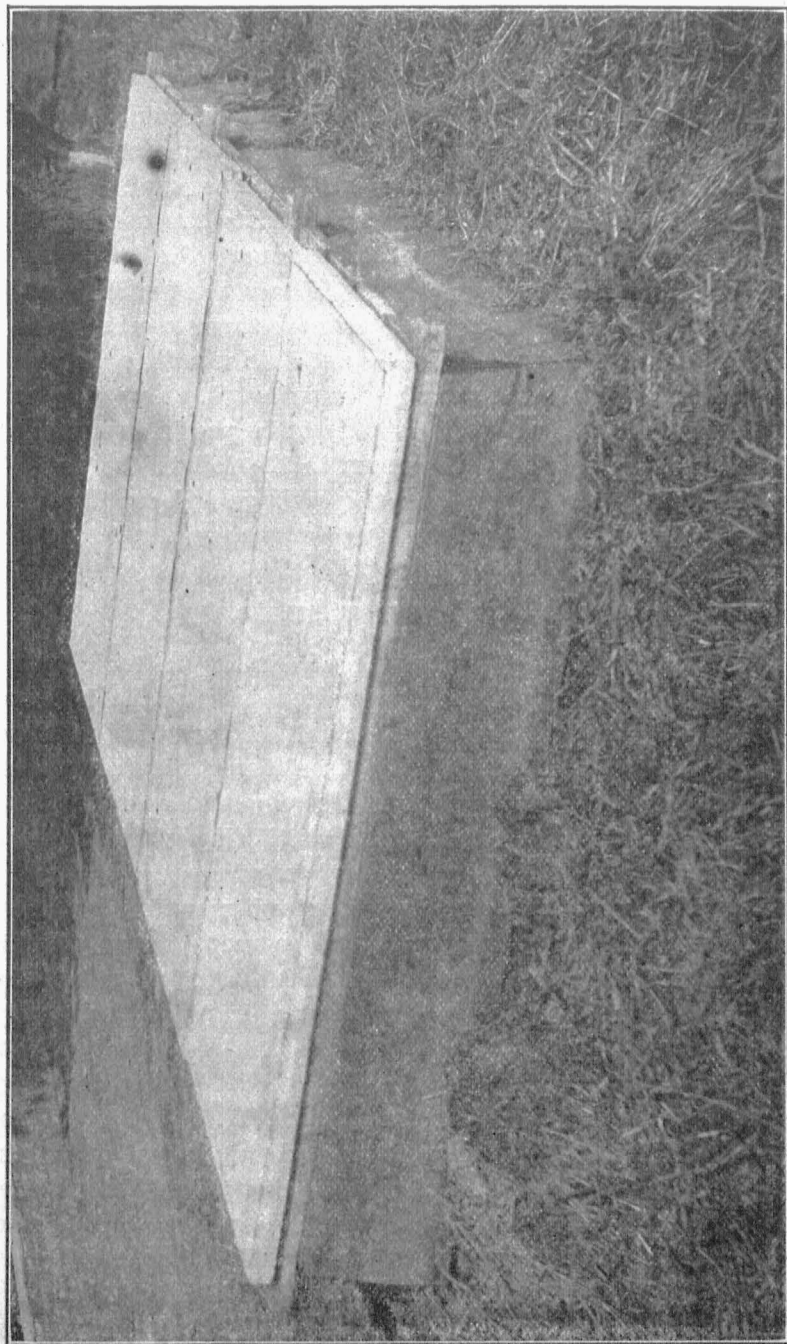


Figure 7. [Same as Fig. 6, covered with both glass and cloth sashes, the latter being used for shading.

come dry. The water should be of about the temperature of well or cistern water. Ice cold water would certainly injure the plants. Watering should be done early of mornings when there is prospect of sunny weather. Never water on a cloudy day. When watering is done see that the soil is wet down at least three inches, but not much farther. Moistening the surface only would be very injurious.

SUMMER HOTBED CROPS.

The hotbed space may be used again as soon as the spring crop is out of the way. More lettuce may be grown in the beds without renewing them if there are facilities for watering and shading during the summer. Since there is no heating material to be drowned out, the beds may be soaked down thoroughly when watered. In the pits the heat from the sun will be so intense that there would have to be some protection. Cheesecloth or light domestic, soaked in linseed oil, tacked to a light wooden frame and supported several inches from the ground would make a good shade. Lath screens could also be used. Even brush would help some. Besides lettuce, other warm weather crops, such as egg plant or peppers, could be grown to maturity. A late crop of bush beans could also be produced. Instead of vegetables, flowering plants, like asters, may be successfully grown during the summer. Asters particularly, would furnish cut flowers for a comparatively long period. In mid and late summer, the beds may be used for receiving various kinds of potted house plants needing recuperation. Seed boxes will begin to go in the beds in early fall.

Going back to the middle of the winter, another line of procedure may be followed. When the first lettuce is harvested early in January, celery seed may be sown broadcast without renewing the bed. Under these cold frames, the celery will germinate and grow off very slowly, but the plants cannot be hurried. About the middle of March they should be taken up and replanted on the same ground, setting 4x4 inches apart. They should be caused to make a low, stocky growth and form good root systems. This is brought about only by shearing them two or three times to keep them low. The plants should be transplanted to the field about July 1st.

Perhaps the most important use for hotbeds by farmers would be for growing spring crops of lettuce and radishes and starting tomato and cabbage plants, as well as sweet potatoes. For these

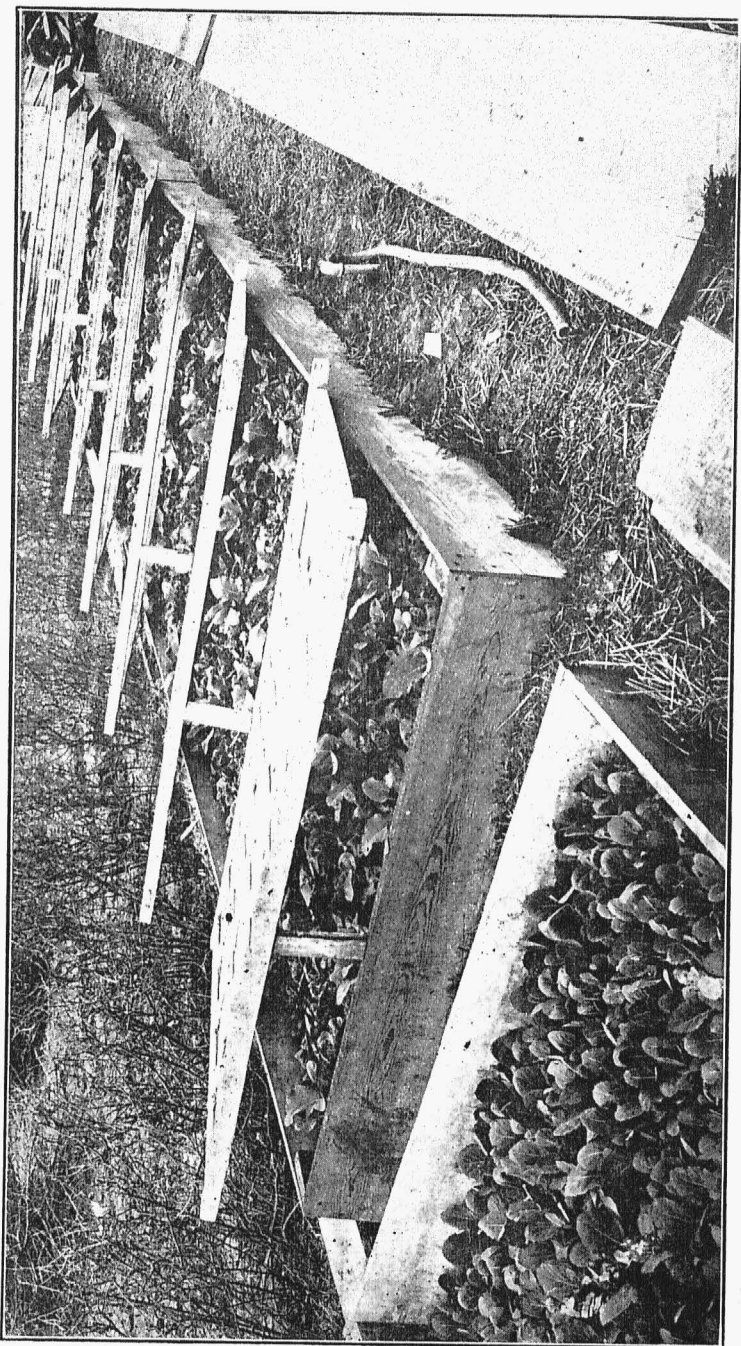


Figure 8. Cabbage and cauliflower plants growing in a coldframe in early spring. Radishes for table use among the other plants.

purposes the beds need not be started until well along in March. Refer to figure 8.

Another use for hotbeds, or rather cold frames, is the growing of plants from cuttings. The cuttings of geranium and roses and many others may be made in September and October and planted in the cold frame. The rose cuttings should contain at least two eyes. The Crimson Rambler, one of the finest of climbing roses, which is readily propagated in this manner, has its buds usually very close together so that the cuttings containing two eyes would be about two and one-half inches long. Any of the ordinary hardy roses may be propagated from these fall cuttings provided they are made before frost. In the north and northeast the cuttings would perhaps have to be made in August, and in the south perhaps not until as late as November. After becoming rooted, or at least well calloused, it would perhaps be best to pot the cuttings and plunge the pots in the soil. This, however, is not positively necessary. The beds should be kept cold all winter, and they will even stand considerable freezing. In spring the plants should be transferred to the open. For best success the cuttings should be potted off when calloused or beginning to root, and placed in a greenhouse.

Many flowering plants may be successfully grown from the seed in cold frames. The beds should be prepared to receive them in late autumn. Seed may be sown either directly in the beds or in flats. The following may be grown in this way: Pansies, English daisies, snap-dragon, fox-glove, hardy asters, hardy poppies, forget-me-nots, hardy primrose, sweet william, larkspur, lobelia, nasturtium, and others. Keep the soil only slightly moist all winter but give much ventilation. When very cold, cover the sashes with old carpet, hay, etc. The plants can withstand considerable freezing, even down to 10 degrees above zero. In severe weather these cold frames must not be opened. In marked contrast to the hotbeds, they require very little air during cold weather. When it is very cold the beds can go for two weeks without being uncovered.

In March more flowers may be sown in the cold frame. At this time should be sown marigold, verbena, zenias, asters, annual phlox, China pinks, single petunias, sweet alyssum, and other plants which are adapted to transplanting. For a list of these, consult the florists' catalogs. Most all of these, but especially those that were grown all winter, should be set in the garden or flower border as early in spring as the ground will do to work. It should

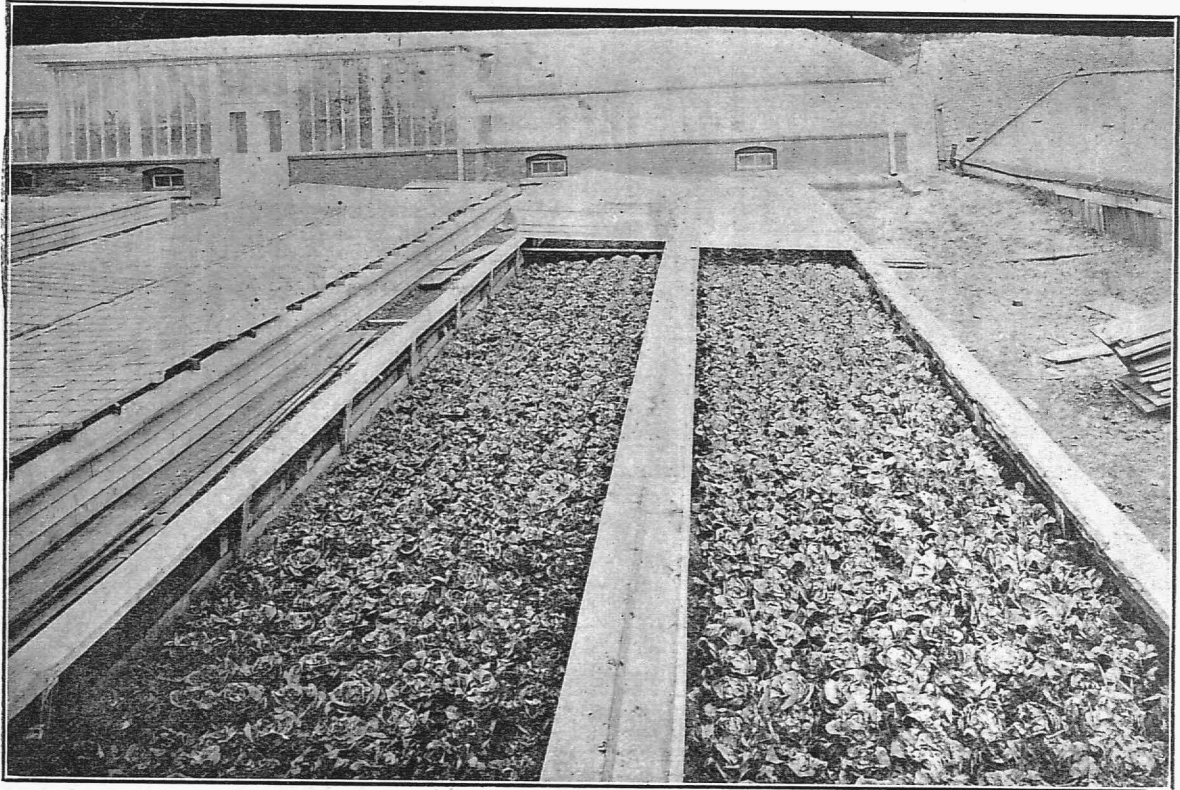


Figure 9. Double range of hotbeds, showing St. Louis butter-head lettuce growing in midwinter.

be remembered that the hardy things will not be injured by the late spring frosts.

GROWING VIOLETS.

This discussion should not be closed without a few words on violet growing. With a little practice, sweet violets are easily grown by anyone. Buy violet runners from a floral establishment and plant in the garden in April. Cultivate well all summer and cut off all the runners that form. In late August, in the latitude of Missouri, transplant to the cold frame, setting about ten inches apart each way. The beds should be well watered after planting and occasionally afterward, doing the work well when it is done, and then not watering again until the soil begins to get dry at the surface. The plants will begin to bloom toward the last of October, and continue until the middle of March, provided:

First, that the runners are kept off.

Second—which is even more important—that the temperature in the beds is all the time kept between 35 degrees and 45 degrees F. Under no circumstances should they become warmer than 45 degrees, even though it be necessary to take off all the sashes throughout the day. The temperature may go as low as 28 degrees without injury, but the flowering will be stopped if they get warmer than 45 degrees. The plants must be kept well aired at all times, propping up the sashes daily unless there is danger of freezing. If possible, remove the sashes entirely for a part of each day. Observe figure 9. Violet growing is very profitable when it is understood.



Figure 10. Individual heads of lettuce of the following varieties adapted to forcing: Big Boston, Grand Rapids, St. Louis Butter and Black Seeded Simpson.

Figure II. Heads of cauliflower grown in hotbeds—variety, Dwarf Erfurt.

