Extension Circular 343

January
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THE FLUE-HEATED HOTBED IN GROWING EARLY VEGETABLE PLANTS

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Horticulturist (Vegetable Crops)

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Oregon State College
Corvallis

Cooperative Extension Work in Agriculture and Home Economics
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Oregon State College and United States Department of Agriculture, Cooperating
Printed and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914

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There are various means of heating beds for growing of early vegetable plants such as of cabbage, onions, lettuce, tomatoes, peppers, melons, celery, and eggplant. Formerly the most common method of heating these beds was by means of fermenting horse manure placed in a pit and covered with a few inches of soil on which were placed standard frames and sashes. Due largely to the scarcity of manure this method is being replaced by other means which not only require less work in installation but are also capable of furnishing more uniform heat. Nowadays hotbeds are being heated by hot water, hot air, and electricity.

The flue hotbed, providing warm air in plant beds, is one of the oldest and most satisfactory methods of hotbed operation. After the first installation there is no annual excavation or pit digging, as in the case of the manure hotbed.

The principle of the flue hotbed is the same as in heating a residence with warm air. A fire box is provided to which a tile flue is connected, warming the soil in the frame, with a chimney provided at the far end of the flue to provide the proper draft and allow the smoke to escape. The soil in the bed is heated by the drain tile through which the warm air passes to the chimney. The bed is covered with regulation sized frames and sashes of glass or glass substitute. The heat provided by the flue bed is comparatively uniform, certain, and supplied at a small cost of maintenance. In view of the fact that a smoldering instead of a blazing fire is sufficient, the fuel cost is small. In addition to these advantages, the bed can be used as a cold frame simply by discontinuing the firing, thereby permitting the plants previously grown under heat to be slightly hardened before they go into the field. The flue hotbed can be started at any time desired -- late winter, spring, or fall depending on the use for which it is operated, but it is generally in the spring during plant growing season that the bed would be most useful.

Location of the bed. Any hotbed should be handy for operation and maintenance, particularly during the spring months when the weather is variable and the plant-growing bed may require frequent attention in the raising or lowering of the protective sashes over the bed. A southeast exposure is desirable and in the case of the flue hotbed, a well drained area is particularly necessary on account of the depth at which it is desirable to put the firebox and the tile leading from it. If the soil is sloping, the lower end of the area should be used for the firebox so as to give a rise of the flue for better draft to the chimney.

Materials for the flue hotbed. The furnace or firebox providing the heat should be set at the lower end of the bed if there be any variation in the contour of the ground. The firebox may vary in material from a permanent brick furnace to the use of a 30 to 50 gallon drum, which makes an inexpensive firebox and will last quite a number of years. In any event the firebox should be set in the ground about 24 inches so that the tile connected with it, serving as a flue, will be 18 inches or so below the soil at the furnace end and rising to

about 12 inches or so at the chimney end. This slope will permit of a better draft.

For a single line of frames accommodating standard 3 x 6 feet sashes, two rows of 4-inch tile evenly spaced between the front and the back border of the frame should be laid with the joints of the tile tight so as no smoke can escape. Back draft can also be thus prevented. Each line of tile at the end of bed opposite the firebox connects with a chimney, which will be 10 to 12 inches square and 6 to 8 feet high. It can be made out of four boards of the suggested dimensions. Stove pipe should not be used for inserting in the ground for the flue as it will rust out and the escaping heat and smoke may ruin the plants in the bed. An opening in the front of the firebox will permit of opening and closing the draft. Once the bed is well warmed, the fuel used should make a smoldering fire rather than a blazing one. It is desirable to maintain a temperature of about 60 or 70 degrees F. in the bed.

Growing plants in the bed. Young plants of early cabbage, lettuce, celery, onions, tomatoes, peppers, eggplants, melons, and cucumbers will grow to good advantage in the flue hotbed. Due to the uniform heat provided seeds will germinate readily and plants will grow gradually if not rapidly to a size desired for field setting. In fact, care should be taken that the plants do not grow too fast and become too succulent and spindling. The bed should be heated in time so that the proper temperature may be obtained for sowing the seed by February 1 or later, depending on the kind of plants to be grown. (See table on last page). For example, cabbage and other plants of similar nature will grow to a desired size for field settings in about seven weeks from seeding; onions in two and a half months; tomatoes, peppers and eggplants will take about eight to ten weeks. Celery plants usually take from ten to twelve weeks, but melons and cucumbers take only about three and one-half to four weeks. These are approximate times based on normal growing temperatures of between 62 and 72 degrees, which would be suitable for the growing of various young vegetable plants until they are large enough to be hardened. (See Circular 342 on growing early vegetable plants under glass).

The soil should be at a suitable temperature for seeding. Temperatures of from 60 to 70 degrees F. are favorable for a good germination of the seeds of the vegetables named. Cabbage, lettuce, onions, and cauliflower prefer a temperature of 60 to 65 degrees F., whereas seed of tomatoes, melons, eggplant, peppers, cucumbers, etc., germinate better in a slightly warmer soil.

It is important to maintain the proper temperature in the beds during the growth of the plants, especially to prevent too rapid a growth of the plants, and softness which will be undesirable in the development of a good plant. Hardening of these young plants will, of course, be necessary in all cases where they have been first grown in the flue hotbed. This can be done by discontinuing the firing of the bed thus transforming the hotbed into a cold frame.

Flue beds require more or less constant and careful attention. Instances have been observed where flue beds were maintained at too high a temperature without a sufficient amount of aeration, with the result that some plants grew too rapidly and were also more susceptible to damping off. In some cases, even, the temperature was high enough to do the plants actual harm.

In growing young plants in any heated or unheated frame, one 3 x 6 ft. sash, whether it be of glass or glass substitute, is capable of covering some 600 plants or so when the plants are set at a distance of 2 x 2 inches, or 162 plants when they are set at 4 x 4 inches. The 2 x 2 inch distance is the one at which it is customary to transplant such plants as cabbage, lettuce, cauliflower and celery, whereas the 3 x 3 or 4 x 4 inch distance is oftentimes used in growing plants of the tomato, eggplant and pepper, especially when these are grown in individual containers. Young plants of onions are not transplanted but remain in the bed until the time of transferring them to the field. Cucumber and melon plants must be started in individual containers so that the plant can be transplanted to the field with the least disturbance of the root system.

(This is a revision of Extension Circular 274)

Table of Seeding and Transplanting Dates

Vegetable	Date of Seeding	Time of Transplanting	Distance Between Plants Inches	Date of Transplanting to Field	Distances of Field Planting	
					Rows Inches	Plants Inches
Cabbage	1/15-3/1	After 12-14 days	1 1/2-2	3/10-4/15	30	18-24
Lettuce	1/15-3/1	After 12-14 days	2	3/10-4/15	18-24	12-15
Cauliflower	2/15-3/10	After 12-14 days	2	4/10-5/1	30-36	24-28
Tomato	2/15-3/15	After 18 days	2 1/2-4	4/25 After Frost	60-72	48-72
Pepper	2/15-3/15	After 18-21 days	2 1/2-4	5/1-20 After frost	30	24
Eggplant	2/15-3/15	After 21-26 days	3" or 4" bands or hallocks	After frost	30	24
Onion	2/1	No trans-planting		4/10-25	18	3-4
Celery	2/20 & in succession	After 30 days	1 1/2-2	4/25 onward	30-36	6
Melons	4/1-10	None	Grow plants in 3" or 4" hallocks	5/10 After frost	72	60-72
Cucumbers	4/1-10	None	Grow plants in 3" or 4" hallocks	5/10 After frost	72	60-72
Squash	4/1-10	None	Grow plants in 3" or 4" hallocks	5/10 After frost	84	84