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SMALL GREENHOUSES FOR GROWING
VEGETABLE PLANTS AND CROPS

by

A. G. B. Bouquet

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Federal Cooperative Extension Service
Oregon State College
Corvallis

Cooperative Extension Work in Agriculture and Home Economics
Wm. A. Schoenfeld, Director
Oregon State College and United States Department of Agriculture, Cooperating
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OREGON AGRICULTURAL COLLEGE -- EXTENSION SERVICE

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VEGETABLE PLANTS AND CROPS

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The growing of young vegetable plants such as tomato, pepper, eggplant, early cabbage, early lettuce, summer cauliflower, celery, melons, onions, summer squash, and cucumbers is an important operation in the production of these vegetables. In the case of the first three crops it is essential that the plants be grown in the spring under artificial conditions in order that the vegetable may mature at the proper season of the year. Of the remaining vegetables mentioned, growing the young plants in greenhouses or frames hastens the date of maturity and enables the grower to harvest the product earlier than otherwise, such as in the case of early cabbage, lettuce, celery, and melons. Onions are grown for transplanting in the production of Bermuda onions, while in less frequent instances plants of summer squash and cucumbers are grown and transplanted to produce an unusually early crop.

During recent years there has been an increasing interest in the use of small greenhouses for plant growing. There are several advantages to the grower in having such equipment compared with hotbeds, among which are; (1) complete protection of the plants and the grower himself in operating during unfavorable weather; (2) satisfactory light, temperature, and air conditions readily provided; (3) easiness of handling plants through the use of benches, affording more convenient and rapid work; (4) possible use of greenhouse for production of crops between plant growing seasons; (5) durability of the structure, and (6) comparative inexpensiveness and possibility of soon paying for the original investment.

Requests are frequently made for information concerning the construction of a greenhouse which can be used for growing young plants or for growing crops to maturity. These requests vary in the size of the house desired and it is impossible to furnish specifications for each individual case. The specifications listed below for a small greenhouse 16 by 20 feet, outside dimensions, will serve as an example or type from which deduction can be made as to the relative cost of a house of smaller or larger size. In general, the size of the house will depend on the amount of money the operator desires to invest in such a house and the number of plants to be grown.

Concerning the specifications of the small greenhouse listed herewith and as shown in the blueprint, the following explanatory details are stated: Foundation: The total concrete base is 30 inches deep, 18 inches below grade level and 12 inches above. The cement is 6 inches thick. Into the cement are set 1/2-inch iron anchor bolts spaced every 6 or 8 feet to which the bottom sill is attached.

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Side-wall structure: The wall consists of 2-inch black iron posts or 4-by-4-inch cedar posts set into the concrete to provide rigidity. On the concrete is a 2-by-6-inch sill above which are 2-by-4-inch studding for the sheathing and a 2-by-6-inch plate below the side-wall glass. The latter consists of two lines of 16-by-18-inch glass laid the 16-inch way between the side-wall sash bars. At the eave is a 2-by-4-inch plate to which the base of the roof bars and a gutter are attached.

The side-wall structure consists, therefore, of 1 foot of concrete, 2 feet of sheathing and 3 feet of glass.

Roof construction: Sash bars should be as narrow as possible consistent with strength and the 1 3/8-by-2 1/4-inch bar is a standard size. It should preferably have a drip gutter on the lower side to take care of condensation water inside the greenhouse. Cedar is desirable for all wood parts, but the lumber prices here quoted are for fir with the exception of the sash-bar prices quoted for cedar. If cedar is to be used elsewhere throughout the structure, one should figure about \$5.00 additional cost per 1000 bd. ft. or add one-fifth more cost to each of the wood items in the specifications except the sash bars.

A 16-by-18-inch glass is the standard size and is usually laid the 18-inch way lengthwise of the greenhouse or the 16-inch way between the sash bars. Glass should be laid beginning at the eaves and going upward to the ridge and should be lapped no more than 1/4 inch. Prices of glass are variable but are based on present values of \$3.00 per box of 50 sq. ft. or 25 panes per box of 16-by-18-inch glass.

The roof support consists of two center posts of 1 1/4-inch black pipe set under the ridgepole, two purlins of 1 1/4-inch pipe running lengthwise of the house to which are attached 2 tie rods of 1-inch pipe to each of the center posts as indicated in the accompanying blueprint. The ridgepole consists of a piece of 2-by-6-inch material to which is hinged four ventilators, two for each side of the house. Standard roof ventilator sash are usually made 1 3/8 inches thick and 28 3/4 inches deep, using 5 lights of 16-by-24-inch glass in length.

Benches: The bench material consists of 2-by-12-inch lumber for sides, ends, and bottoms with either pipe or 4-by-4-inch lumber for legs and bottom supports and 2-by-4-inch material for braces. The boards for the bottom of the benches should be treated before soil is placed on them. Iron braces are also included to keep the side boards and corners of the benches from warping or buckling.

Miscellaneous Materials: Sufficient paint is included for three coats and quoted at \$3.50 per gallon. One gallon of paint should cover about 550 square feet of glass area with three coats.

Provision is made for one door, but in some cases two may be desirable.

No estimate is made for necessary additional carpenter labor.

This may amount to possibly \$12.00 to \$15.00 depending upon the skill of the greenhouse operator and help obtainable in the immediate family. All other labor including laying of concrete, glazing, bench construction, etc., can be satisfactorily done by the operator himself.

Heating Arrangements: These may or may not be provided at the time of construction but some form of heating the house will be necessary if plants are started early in the year. If the house is heated by radiation from hot-water pipe, 160 lineal feet of 1 1/2-inch pipe would supply sufficient radiation to keep the greenhouse at 60°F. when the temperature was 20°F. above zero. A 3-inch flow pipe located under the ridgepole will connect with the eight 1 1/2-inch return pipes along the wall. The hot-water boiler should be set in a pit in the service room in order to provide proper gravity of the water to the boiler.

Modification of Interior Construction: In some greenhouses, especially in those of larger width, it may be desired to use a part of the greenhouse for growing tomatoes or cucumbers to maturity instead of using the entire house for plant growing. If tall growing crops are produced it is much easier to grow them in ground beds than to set the plants to produce a crop in a bench 3 feet high. A modified interior of the house might then consist of a bench on one side of the house next to which is a 24-inch walk with a ground bed occupying the remaining space of the width of the house.

Use of Area Under the Benches: If desired, rhubarb or mushrooms can be grown under the benches of the greenhouse. Circulars on the forcing of these two crops are available on request.

Workroom: It is desirable to have in conjunction with a greenhouse a workroom wherein may be carried out various operations such as seed sowing in flats, transplanting plants, potting, etc. This room may also house the hot-water boiler as well as supplies such as soil, pots, etc.

Materials in Greenhouse 16' x 20' (outside dimensions. See blueprint)

Foundation - cement 15 sacks @ \$1.00	- - - - -	\$15.00
River-run 4 1/2 yards @ \$1.25	- - - - -	5.62
Glass 16" x 18" 14 boxes @ \$3.00	- - - - -	42.00
Sash bar 500 linear feet @ 4 1/2¢	- - - - -	22.50
Pipe for posts - - - - -	- - - - -	12.00
Plates and studs 260 board feet	- - - - -	5.50
Sheathing 175 board feet	- - - - -	4.80
Bench material: legs and braces 210 board feet	- - - - -	5.80
bottoms and sides 624 board feet	- - - - -	14.35
Corner and side braces	- - - - -	3.50
Paint and putty - - - - -	- - - - -	14.00
Miscellaneous - door, hardware, nails, tacks, bolts	- - - - -	10.00
		<u>\$155.07</u>

Estimating the percentage cost of these items, the figures are approximately as follows: Foundation 13%; glass 27%; sash bars 14%; lumber 22%; paint and putty 9%; pipe 7.6%; miscellaneous 6.4%.

Estimates of the cost of a small greenhouse 20 feet wide by 50 feet long having similar construction material as that previously described total about \$350.00, the items being as follows:

Foundation - cement 30 sacks @ \$1.00	- - - - -	\$30.00
river-run 6 2/3 yards @ \$1.25	- - - - -	8.45
Glass 36 boxes @ \$3.00	- - - - -	108.00
Sash bar 1230 linear feet	- - - - -	59.35
Lumber including sill, plates, siding, bench material	- -	70.00
Pipe for side wall and roof support posts and purlins	- -	25.00
Paint, putty, tacks	- - - - -	25.00
Miscellaneous - doors, hardware, nails, vents, bolts	- -	25.00
		<u>\$350.80</u>

Approximate estimate of materials in a pipe frame greenhouse 28 feet by 100 feet; 16 feet to ridge, 8 feet to eaves; wall construction, 54 inches glass, 32 inches sheathing, and 10 inches concrete, exclusive of foundation.

No provision is made in these estimates for benches. If tomatoes or cucumbers are grown, they would be grown on ground beds and, therefore, the expense of putting in benches would be eliminated. There would be a change in the side-wall construction, however, provided ground beds are used. The side wall would then consist of two or two and one-half feet of concrete above the ground line and the remaining space to the eaves would be occupied by glass. Larger pipe for wall and roof support must necessarily be used in this house than for the first small house mentioned in this circular. The figures named below are for the construction as mentioned above; namely, with sheathing and glass.

Foundation:

Cement for walls and post supports	- - - - -	\$100.00
Glass 80 boxes	- - - - -	250.00
Sash bar 3400 lin. feet	- - - - -	153.00
Iron pipe for wall and roof supports and purlins	- - - - -	115.00
Sheathing	- - - - -	30.00
Lumber for sills, eaves, studding, etc.	- - - - -	30.00
Paint, putty	- - - - -	50.00
Miscellaneous - doors, hardware, nails, tacks, bolts	- - - -	35.00
		<u>\$763.00</u>

To heat this house having approximately 4,500 square feet of glass surface and using hot-water radiation a 3 1/2-inch flow pipe would be required in the house with approximately 20 lines of 2-inch pipe to supply sufficient radiation to keep the temperature in the greenhouse at 60°F. when it was 20°F. above zero outside.

Circulars available on plant growing and greenhouse crops from the College Exchange, Corvallis, Oregon or from county agents:

The flue-heated hotbed in growing early vegetable plants.

Growing vegetable plants in the manure-heated hotbed.

Electric Hotbeds and Propagating Beds.

Construction and operation of the coldframe.

Growing early vegetable plants under glass.

Treating soil for control of the Damping-off disease in growing vegetable plants.

Greenhouse vegetables - Tomatoes.

Greenhouse vegetables - Cucumbers.

Suggestions for the Control of Tomato Mosaic and Streak.

Forcing Rhubarb.

Mushroom Culture.

Growing & Forcing Witloof Chicory or French Endive.