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Estimating Construction Costs for a Low-Cost Quonset-style Greenhouse

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Double polyethylene Quonset-style greenhouses offer growers and farmers a more cost-effective structure than glass- or acrylic-covered structures for growing plants off-season. These greenhouses are especially applicable for producing off-season high value crops such as fruits and vegetables for local markets. To support this production alternative, this publication contains a list of greenhouse components, the start-up costs associated with these items and an estimate of the number of person hours required to assemble and outfit a 24-foot-by-72-foot double polyethylene, air-inflated greenhouse structure. As there are many options available for building double polyethylene greenhouses, the main purpose of this publication is to identify the initial capital it would take for a low-cost start-up greenhouse. Depending upon the variables associated with each constructed greenhouse (grower skill level, access to utilities, etc.), costs may vary significantly between projects, so a range of costs has been identified.

When planning a greenhouse, the first consideration is the site. It is desirable to select land:

- where the floor of the greenhouse will be slightly higher in the center than the edges,
- where utilities such as water, electricity and natural gas (or easy propane setup and delivery) are nearby and accessible,
- that has good vehicular access and is proximal to roadways,
- that is not desirable for growing field crops, and
- that is not shaded by adjacent buildings or vegetation.

The orientation of the length of the greenhouse should be north-south so that the long side walls allow for maximal sunlight on the plants inside. A main entrance door (sometimes a garage door) needs to be on the south end. The south end may be closed or made of polycarbonate to allow light penetration. It will contain vents or louvers with multiple stage motors linked to a temperature sensor to regulate air movement through the greenhouse. Typically, the north end also will have a door and two exhaust fans.

In a double polyethylene Quonset structure, a metal pipe frame forms a large half circle or dome (*Figure 1*). It is anchored on the bottom to boards on which polylock® has been fastened (*Figure 2*). The two layers of polyethylene are inflated by a small squirrel cage fan in which outside air is drawn into the space between the layers (*Figure 3*). A furnace (*Figure 4*) complete with blowers and flashing to each poly tube is mounted near one of the end walls. Interior benching and irrigation can vary depending on the crops grown and available materials. The costs cited in this publication are for a greenhouse geared to using minimal heat by channeling it under two long benches and watering via a capillary mat system (*Figure 5*) linked to a time clock. Estimated costs for each of phase of construction can be found in *Tables 1-6*.

Given a total capital investment of \$22,000-26,000, construction of this type of greenhouse can occur over a matter of weeks or one could first put up the structure and work on the interior components as time and money allow. This estimate does not include direct crop production costs, such as plants or plant-specific items, including pots, flats, seeds, fertilizers, and pesticides. Careful consideration of these up-front production costs is also an important step in the planning and budgeting process.



Figure 1. Double poly Quonset-style greenhouse with solid north end wall.



Figure 2. Close-up of solid cement footing into which structural posts are set. A 2-by-6-inch board is affixed to the posts, and polylock is attached to the board.



Figure 3. Small squirrel cage fan (A) taking outside air in (B) and blowing it between the layers of polyethylene.



Figure 4. Interior of greenhouse north wall with exhaust fan (lower left) and furnace (upper right).

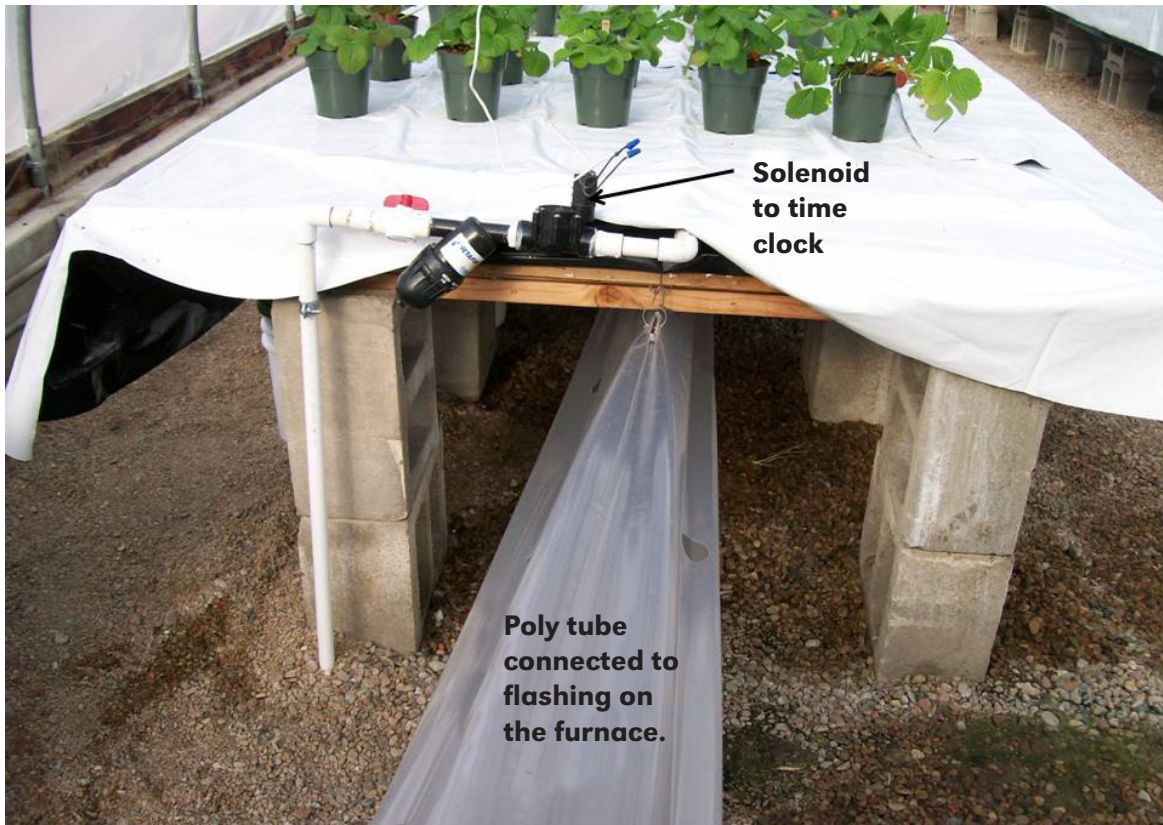


Figure 5. Simple benching system consisting of cement blocks and bench fabric. Capillary mat system consists of a sandwich of one layer of black plastic, the mat, drip tubes on the mat, and white top/black bottom plastic on top.

Table 1. Start-up costs for the shell of a Quonset-style greenhouse

Greenhouse: Quonset-style frame (Approximate size – 24 feet by 72 feet)		
<i>Item</i>	<i>Cost</i>	<i>Details</i>
Frame and double layer poly	\$7,500-8,500	
Inflation kit for double poly air insulation (includes fan and all equipment)	\$120-140	
Polylock	\$503-570	\$1.90/ft - 265-300 ft
End Walls:		
North end plywood/corrugated metal with 1-inch foil wrap	\$600-800	
South end clear polycarbonate	\$400-600	
Pedestrian doors 3 feet by 6 feet 8 inches	\$300-360 (2)	\$150-180 each
Wood framing around perimeter of the greenhouse (includes hardware)	\$250-300	2 x 8's
Footings at each pier — 4 feet on center, assume depth to frost line (36-inch depth for Lincoln, Neb.; deeper footings will be more expensive where required)	\$3,000-3,800	includes labor
Labor for setup:		
80 person hours @ \$12.00 per hour	\$960 - (frame)	
15 person hours @ \$12.00 per hour	\$180-230 (poly roof and ends)	
Total cost of greenhouse structure	\$13,813 - 16,260	\$7.99 – 9.41 sq ft

Table 2. Estimated heating costs

Heating		
<i>Item</i>	<i>Cost</i>	<i>Details</i>
Natural gas furnace	\$1,000-1,200	(150K) includes flashing
or		
Propane furnace	\$1,000-1,200	(150K) includes flashing
Jet tubes	\$128-150 (2)	\$64-75/18 inches by 100 feet, each
Motorized shutters – 3-inch	\$795-900	\$265 each (need 3)
Gas line and electrical costs – immediately adjacent to greenhouse	\$2,000-2,400	includes labor
Labor	\$72	6 person hours @ \$12.00/hr
Skilled labor for hookup	\$420	6 person hours @ \$70.00/hr
Total cost of heating	\$4,415 - 5,142	\$2.55 – 2.98 sq ft

Table 3. Estimated air circulation costs

Fan system		
<i>Item</i>	<i>Cost</i>	<i>Details</i>
Fan jet — 24-inch	\$1,700-2,000 (2)	
Insect screen for fans	\$50-74 (2)	
Labor	\$24	2 person hours @ \$12.00/hr
Total cost of fan system	\$1,774 - 2,098	\$1.03 – 1.21 sq ft

Table 4. Estimated flooring costs

Flooring		
<i>Item</i>	<i>Cost</i>	<i>Details</i>
Weed barrier	\$150-176	2,100 sq ft
Flooring — pea gravel 1 inch deep	\$485-520	9.3 tons
Labor	\$36	3 person hours @ \$12.00/hr
Total cost of flooring	\$671 - 732	\$0.39 - 0.42 sq ft
Note: Floor should be higher in the center and slope to the sides of the greenhouse so water drains from the floor.		

Table 5. Estimated benching costs

Benching Two benches (6 feet by 65 feet)		
<i>Item</i>	<i>Cost</i>	<i>Details</i>
Lumber	\$111-180	2-foot by 4-foot by 10-foot
Cinder blocks	\$353-395	144 standard size
Bench fabric	\$170-190	6-foot by 50-foot — 3 rolls
Hardware, nails, etc.	\$18-24	
Labor	\$60	5 person hours @ \$12.00/hr
Total cost of benching	\$712 - 849	\$0.41 – 0.49 sq ft

Table 6. Estimated irrigation costs

Irrigation		
<i>Item</i>	<i>Cost</i>	<i>Details</i>
Cap mats	\$443-500 (2)	
Time clock (24 hour)	\$140-150 (1)	
Fertilizer injector	\$276-325 (1)	.02 to 11gpm —Dosatron
Panda plastic	\$200-250	
Hardware	\$60-100	fittings and piping
Labor to set up	\$120	10 person hours @ \$12.00/hr
Assume hydrant on site		
Total cost of irrigation	\$1,239 - 1,445	\$0.72 – 0.84 sq ft

Total estimated cost of this structure: \$22,624 - \$26,526

or

\$13.09 – 15.32 sq ft for this particular greenhouse setup

Note: Sales tax will vary from region to region. A good estimate is 6.5 percent to 7.5 percent of the total materials. Shipping costs will be 10-12 percent of the total cost of the materials. Before purchasing any greenhouse equipment, check the local, county, and state zoning regulations, building and fire codes, and if the structure will be deemed permanent or temporary depending on the way it is constructed.

Prior to purchasing a greenhouse structure of this kind, consult the governing authorities in your area for proper tax, safety, and building codes.

Other greenhouse construction extension guides available include:

Plastic Greenhouse Manual – Planning, Construction, and Operation. Sheldrake and Sayles, Cornell University, Ithaca, NY 14853.

Greenhouse Construction. West Virginia University Extension Service.

Starting in the Greenhouse Business. Fact Sheet 593, University of Maryland, Maryland Cooperative Extension.

Physical Greenhouse Design Considerations – Florida Greenhouse Vegetable Production Handbook, Vol 2. Bucklin, HS776, University of Florida.

Reducing Energy Costs in California Greenhouses. Bond, Gilroy, Thompson, and Hasek, University of California, Berkeley CA 94720.

Starting a Greenhouse Business – A Commercial Growers Guide. Stevens, Stevens, Albrecht, Gast. MF1157, Cooperative Extension, Kansas State University.

Applying Sustainable Methods to Greenhouse/Nursery Production. Benco. Cooperative Extension, Kansas State University.

Greenhouse Heating Requirements. Texas Greenhouse Management Handbook, Texas A&M Cooperative Extension, College Station TX 77843.

This publication has been peer reviewed.

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