Plastic Greenhouses
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Plastic Greenhouses

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Flexible plastic film can be used for many types of greenhouse construction.

Greenhouses covered with plastic films have been used successfully to raise a wide variety of vegetables, flowers, and transplants. Although this bulletin is based on experience with polyethylene-covered houses, you can use other suitable plastics. Polyethylene offers some advantages: it is low in cost, it stands up well under weather, and it lets through enough light to produce good plant growth. The main drawback of clear polyethylene is that it deteriorates and must be replaced each year. Plastic films that will last longer than 1 year are being developed and tested.

In general a plastic greenhouse can be built for less than one-fourth the cost of a glass greenhouse. Material costs (not utilities) range from 20 to 40 cents per square foot of floor area. Two mil (0.002 inch) polyethylene for covering an 18 by 48-foot house with two layers will cost about $40.00.

*Originally written by Edward A. Kazarian, former Instructor in Agricultural Engineering.

USES

Plastic greenhouses will not replace glass houses, but they have many uses:

1. As extra space for a permanent building.
2. As temporary space for starting plant sets.
3. As a seasonal unit for flowers or vegetables.
4. As a hobby house to grow flowers or vegetables for the home.

CONSTRUCTION

Plastic film is flexible enough to use for many types of construction. Rigid frame, panel, and laminated rafter construction have proved satisfactory. These types of construction are easy to precut and preassemble, which cuts down on erection time.

Rigid Frame

This type of construction uses glue-nailed rigid frames to form the basic framework of the green-

house. These frames are spaced at 8-foot intervals. Additional studs and rafters are spaced at 2-foot intervals between the rigid frames. The rigid frames, shown in Fig. 1, are built of 2 by 4's with 1 by 8-inch braces at the heel and ridge joints. The braces are glue-nailed to give top strength and rigidity to the joints. The frames, spaced 8 feet on center are imbedded in concrete and support the sidewall and roof framing. Sidewall studs, plates, and end framing are 2 by 4's; 1 by 4's are used for the rafters. A spacing of 2 feet is used for the studs and rafters.

The rigid frames, as well as other framing members, can be precut and put together before erection. The pieces used for an 18 by 96-foot house are shown in Fig. 2. End walls are completely framed and ready to be set in concrete. The rigid frames are made in half for easier handling and erecting. The side walls and roof are made in 8-foot sections that fit between the rigid frames.

The first step in erecting the house is to locate and drill the 12-inch holes for the end sections and the rigid frames. A tractor-mounted post hole digger will do the job. After the end section is put up, set the rigid frames in the holes and join them at the ridge. Put up the side wall sections at the same time to act as spacers for the rigid frames. Plumb and block the framework before pouring concrete into the holes. Figure 3 shows the framework just before pouring the concrete. When the concrete has hardened, make the glue-nail joint at the ridge, and put the roof sections in place. The final step is to install the vent frames in the side wall and roof.

The polyethylene film is put on parallel to the rafters and fastened with nailed batens or wood strips.

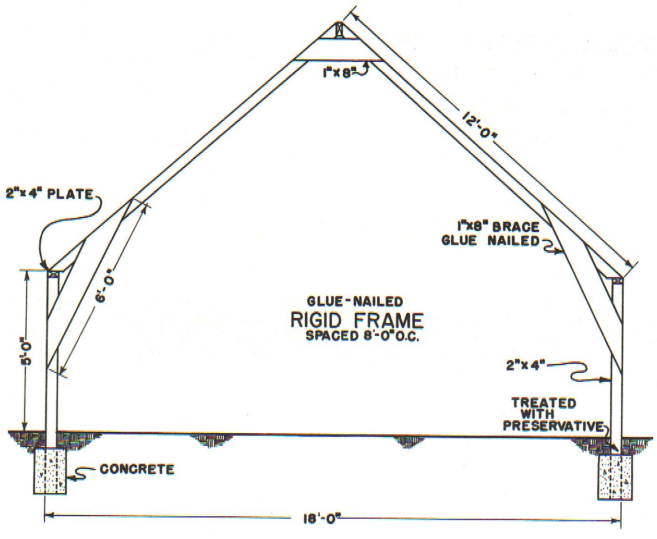


Fig. 1 Detail plan of the rigid frames which form the basic framework for the greenhouse.

You must fasten the plastic at all the supports to keep it from whipping in the wind too much. Fasten the second layer of film the same way, but on the underside of the framework, leaving an air space between the layers.

Figure 4 shows a finished rigid frame greenhouse built at a material cost of 25 cents per square foot of floor area.

Panel

If you use panel construction, you can cover the panels while indoors and replace them easily if the plastic is damaged. You can store the panels when not in use to let the polyethylene last longer. Panel construction costs more than rigid frame because you use more material. Material cost is about 35 cents per square foot of floor area.

Fig. 2 Precut and prefabricated members for an 18 by 96 feet rigid frame greenhouse.

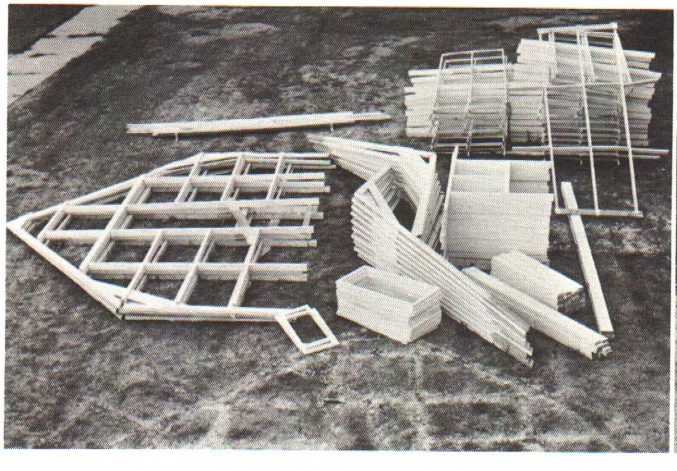
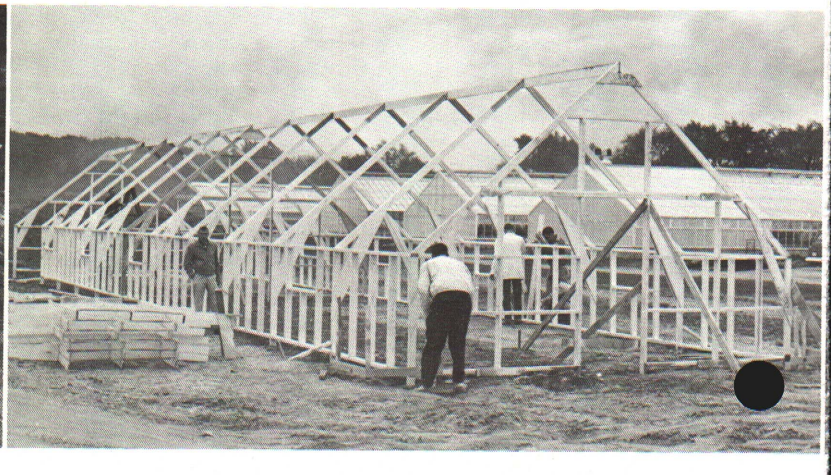


Fig. 3 Framework of the greenhouse prior to pouring concrete around the rigid frames.



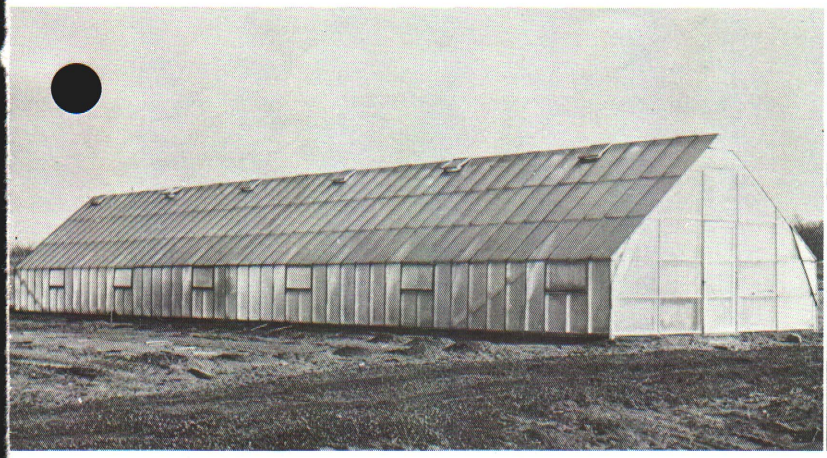


Fig. 4 Completed rigid frame greenhouse.

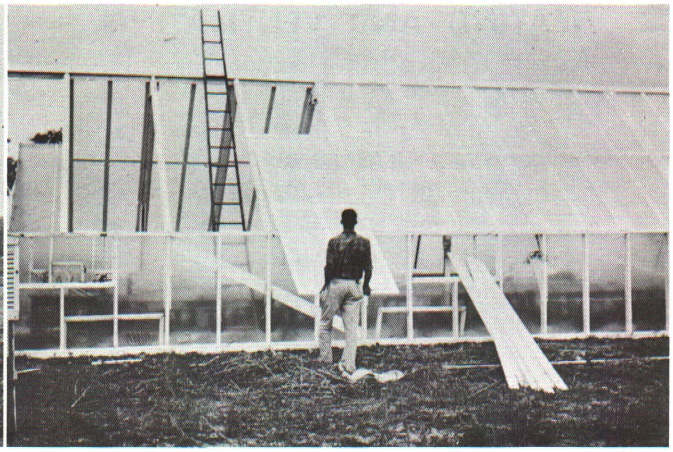


Fig. 5 Installation of the panels that rest on the sash supports.

The basic framework for the panel house is similar to rigid frame construction. Use panels (4 by 12 feet) made of 1-inch lumber instead of rafters. Place the panels on sash supports as shown in Fig. 5. The supports are made of 2 by 4 material with 1 by 2's nailed on each side. Ridge caps and sash caps hold the panels firmly in place.

You can give the panel house some ridge ventilation by having sliding panels every 12 or 16 feet, as shown in Fig. 6. The 2 by 4 top plate will have to be beveled so that the panels can slide.

Figure 7 shows an efficient one-man setup for putting the polyethylene covering on the panels. Place the panel on a table which has a roll of plastic mounted at one end. Unroll the plastic and fasten it to one side of the panel. Then turn the panel over and cover the other side. Store the panels away from sunlight until you are ready to put them on the house.

Laminated Rafter

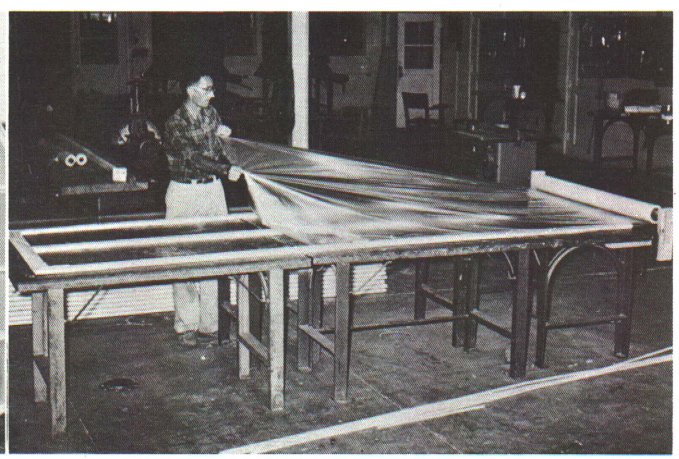
You can make an attractive house by using laminated rafters. Buy the rafters from manufacturers or lumber yards who are equipped to make them. You can put up this type of house very quickly because the members are precut. Figure 8 shows the inside of a laminated rafter house.

You can make the foundation for a laminated rafter house by imbedding treated posts 3 feet into the ground and fastening a 2 by 6 inch sill to the top of the posts. Space posts 4 feet apart. Put up the rafters in pairs and fasten them to the sill and ridge board. Use rafter ties and purlins to strengthen and align the rafters.

You can apply the polyethylene film in the same way as described for the rigid frame house.

Fig. 6 Ridge ventilation in the panel house is accomplished by having sliding panels.

Fig. 7 Covering the panels indoors is both fast and easy.



HEATING AND VENTILATING

Bottled gas heaters, using propane or butane gas are good. You can use the heaters with a blower to force the flue gas through ducts. Place the ducts around the outside wall of the house to heat it evenly. Use long enough ducts to lower the temperature of the flue gas to the house temperature before it blows outside. An 18 by 96 foot double-layer polyethylene house needs a heater that puts out about 160,000 Btu's per hour.

Conventional steam, hot water, or forced air heating systems are also all right to use.

In a plastic house ventilation is important because a plastic house is more air-tight than a glass house. It needs ridge vents and sidewall vents. The area of the vents should be at least one-tenth of the floor area.

You can use fans mounted in the gable ends for better air movement in the house. For winter use, we recommend a fan capable of providing one air change every 30 minutes. Fan capacity is figured by dividing the volume of the house by the time needed for one air change. For example, a house with 15,000 cubic feet volume would need a 500-cfm fan.

MANAGEMENT

Use the following points as guides to the successful building and operation of polyethylene greenhouses:

1. Locate the house on a well-drained soil.
2. Use treated lumber for members that are in or near the ground.
3. Remove slivers and rough spots on the framework to avoid tearing the plastic.
4. Wait until late summer to cover the house so the film is damaged less by sunlight.

Fig. 8 Interior view of a laminated rafter greenhouse.

5. Place the plastic covering on the house on a quiet warm day.
6. Large sheets (8 to 16 feet wide) of film will be easier to use.
7. Use two (inside and outside) layers of film for lower heating costs.
8. Provide enough heat to allow some ventilation even while heating.
9. Provide plenty of fresh air for heaters at all times.
10. Provide enough ventilation to cut down on condensation and dripping.

PLANS

You can get detailed plans for the rigid frame (plan No. 795-C1-6) and panel type house (plan No. 795-C1-7) at a small cost from your county agricultural agent or from the Agricultural Engineering Dept., Michigan State University, East Lansing.

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