Farmnote

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Building a plastic tunnelhouse

By the Horticulture Division

The tunnelhouse described here is based on selected ideas from similar units. It is designed to withstand local weather conditions and to make best use of the natural environment to grow horticultural crops without artificial heating or cooling. It is a low cost house, easily constructed with a minimum of labour.

The term "tunnelhouse" generally refers to all types of greenhouse with plastic or similar sheeting stretched over a U-shaped frame, and where the plastic sheeting can be changed to suit seasonal conditions. This differentiates a tunnelhouse from the familiar conventional-shaped glasshouse but both perform the same task.

Double-skin, inflated plastic sheeting and bubble plastic are fitted on tunnelhouses that require greater heat retention for winter crop production, particularly where supplementary heating is necessary for forced crop production. Rotating plastic covers and shade-cloth material from winter to summer will help to extend the life of the plastic sheeting.

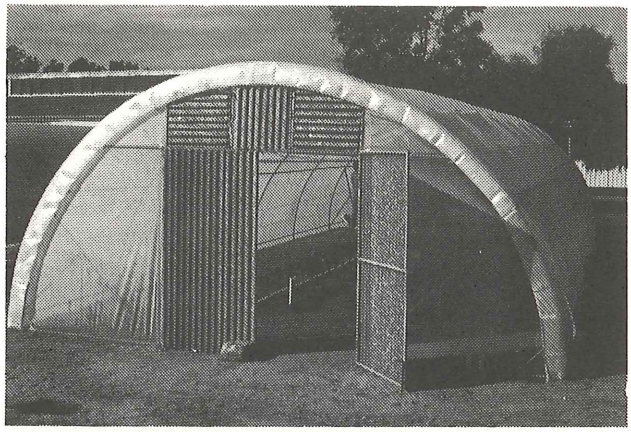

Fig. 1.—A finished tunnelhouse. Louvres above the doors and bubble plastic cladding are optional.

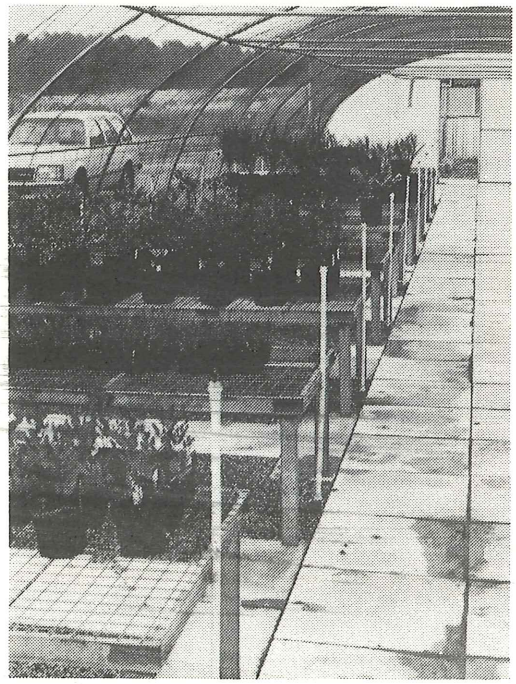

Fig. 2.—Shade-cloth cladding for perennial or summer crops.

Site preparation

The specifications for this tunnelhouse cover a level area about 18 metres by 8 metres.

The tunnelhouse frame consists of fourteen 75-centimetre lengths of 32-millimetre arch support tube pre-drilled with 8mm holes about 3cm from one end. The tubes are driven into the ground at 2.54m intervals along two parallel lines 6.7m apart. The tubes are driven in until they are level and about 5cm above ground.
Take care not to burr the inside of the tubes.

Arch fabrication

The pipe for the arches is welded into 10.2m lengths. These are then put through an arch-shaping device to form the required shape. The first 30cm at each end is straight and the following 100 to 120cm is curved, but not to the same degree as the remainder of the arch. This results in a horseshoe-shaped arch which adapts to the required shape when sprung into the leg support tubes. An alternative to using a shaping device is to bend the pipe around a set of pegs driven into the ground (see Figure 6). If this method is used, it may be necessary to fabricate the arches in two halves and join them.

Bracing

All bracing is cut to length, and bent and drilled where necessary once the arches are in position. Offcuts from arch fabrication can be welded together for corner bracing. All the outer holes in the bracing are drilled with a 10mm drill to accommodate the square shank of the cuphead bolts. See Detail B.

Ends and entrances

The ends, doorways and doors are built in after the arches are erected. Each door is built to accommodate the width of a sheet of standard corrugated fibreglass sheeting. Restraining pins made from 13mm rod are fitted to the inside bottom edge of each door. These pins drop into 15mm pipe driven into the ground to hold doors open or closed.

Erection

The leg of each arch is sprung and inserted into a pair of leg support tubes which are pushed 20cm into the ground. An 8mm hole is drilled through the leg via the pre-drilled hole in the support tube and a 6mm high tensile hexagon bolt fitted. See Detail C.

The screwed and socketed lengths of pipe for the longitudinal bracing are then marked and drilled together with the arches in the positions shown in Detail A, and bolted in place on the underside of the arches. Each succeeding length is screwed into the previous one.

Pipes for the transverse braces are cut to length and fixed into position on the longitudinal braces

immediately adjacent to the arches, which are bent and fitted to the arches with clamps. See Detail D.

Following this, the end framework is cut to length and fixed into position with clamps. See Details E, F and G.

The corner bracing is cut to length, bent and bolted or clamped into position. See Detail B.

Four runs of 2.5mm galvanised wire are lightly strained into position on the outer side of each half of the arches. Three of the wire runs should be equal distances apart between the ridge and side longitudinal bracing and the fourth about 70cm below the side longitudinal brace. The wires are taped into place on the intermediate arches with P.V.C. tape. These wires help to reduce the inward sagging of the plastic cladding. NOTE: All joints should be covered with strips of plastic (taped into position) or P.V.C. tape to prevent tears in the plastic cover.

Plastic cover

Eleven-metre wide 150 micron plastic sheeting is suitable for a tunnelhouse of this size because it eliminates any need to join the sheeting. The cover is cut 0.8m longer for overlap and welding of a 75mm hem to take a nylon cord for fixing at each end. Bubble plastic covers should be cut 1.2m longer so that 0.3m can be folded back over each end arch to form a hem with a cord inserted for fastening to a star picket (see Figure 3). The bubble plastic can be kept firmly in position by tying the overlap and pulling it down over the end arch.

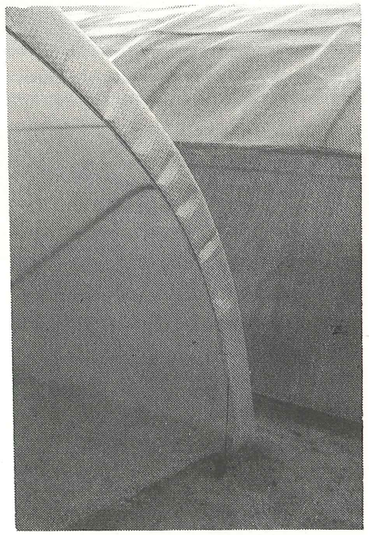

Fig. 3.—Fixing the bubble plastic at the end of the frame.

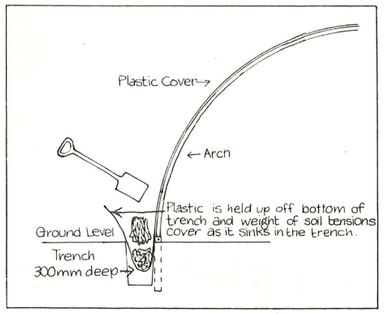

Fig. 4.—The plastic sheeting is stretched over the tunnelhouse frame by the weight of soil on the sheeting, which is placed into a 300mm deep trench at the perimeter of the tunnelhouse.

Both ends of the tunnel are sealed with the same 150 micron plastic used for the cover. The plastic is welded into position on site with a plastic welding iron. After welding around the arch and door frame is finished, the bottom edge of the plastic sheet is dug into a shallow trench.

Fitting the cover

A narrow trench about the width of a spade and 300mm deep is dug along either side of the tunnelhouse, outside and immediately adjacent to the arch support tubes. The cover is then rolled out over the framework and pulled square, with equal overhang on the sides and each end. The plastic is carefully buried along one side of the house and firmly tramped in. Along the other side, the plastic is held clear of the bottom of the trench, the soil heaped on and the plastic allowed to gradually sink to the bottom of the trench. This operation applied progressively along the trench ensures that the cover is slightly tensioned and there are no wrinkles. Once again, the soil should be firmly tramped down (see Figure 4). NOTE: The cover should be fitted during warm conditions so that it may be stretched into position as tightly as possible. This will ensure that sagging is kept to a minimum during hot weather.

The next step is to fasten the ends by driving in a 50cm star picket at each corner to secure the nylon cord. A short piece of 13mm trickle tube is placed over the cord and inserted in the slot cut in the hem to prevent tearing. The ends of the cover can be then tightened by driving the stakes in as may be required. After fitting the doors and sundry bolts and catches, the house is ready for use.

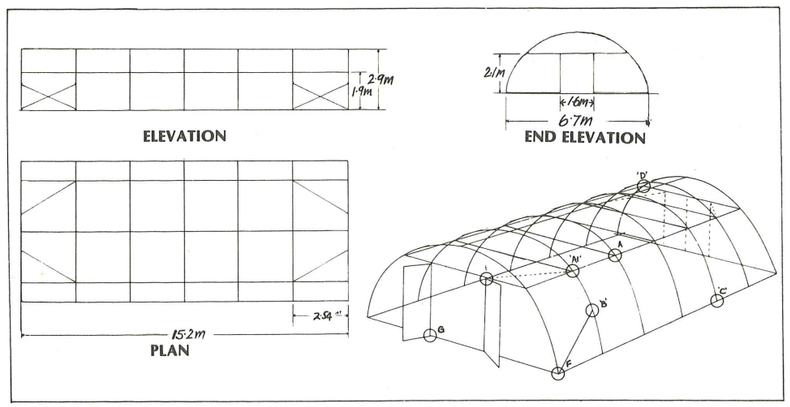

Fig. 5.—Elevation, plan and three dimensional view of single layer plastic tunnelhouse. Detail of pipe joints is shown in separate drawings.

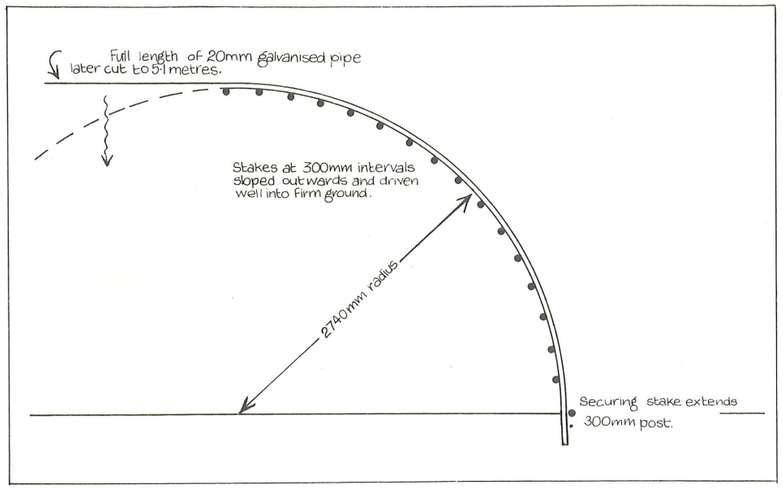

Fig. 6.—An alternative method for bending pipes. Pegs sloping outwards and at 300mm intervals are driven firmly into the ground.

Shade-cloth cover

Where the house is used to grow perennial or summer crops which require shading, effective protection may be achieved by making the following modifications.

As mesh is necessary to support a shade-cloth cover, extra longitudinal braces have to be fitted. Braces from 25mm by 1.6mm galvanised E.R.W. tube are bolted to the arches about 100mm above the ground each side of the house. Braces from 19mm by 1.6mm galvanised E.R.W. tube are bolted to the arches midway between the existing longitudinal braces.

Roof safety mesh is cut into lengths to fit over the house between the arches and fastened to the lower longitudinal braces. The shade-cloth cover, made to measure with reinforced hems and eyelets at 300mm intervals, is secured to the house with nylon blind cord at each end and either side at the ground level. (See Figure 7).

Other materials

Materials other than steel piping can be used to build tunnelhouses. Fibre glass rods have been used extensively to build greenhouses in countries with similar climatic conditions to W.A. (see Figure 8). Many more arch supports 1.7m apart are necessary if using fibreglass rods or lighter gauge steel piping. Bamboo rods and laminated timber battens have been used, but the abrasive action of these materials can limit the life of the plastic sheeting.

Materials required

14 arch support tubes 75cm long (10.5m of 32mm galvanised pipe)
7 arches 10.2m long (71.4m of 20mm galvanised pipe)
7 transverse braces 4.85m long (33.95m of 20mm galvanised pipe)
12 corner braces 3m long (36m of 22mm galvanised pipe)
2 end frames (9.8m of 20mm galvanised pipe)
4 doors 2.1m high by 80cm wide (34.4m of 20mm galvanised pipe)
3 longitudinal braces 15.2m long (45.6m of 20mm screwed and socketed galvanised pipe)
34 Downee 20mm tees cat. no. T2020
8 Downee 20mm crossover gate hinges cat no. H2020
37 64mm x 8mm galvanised cuphead bolts and nuts
14 51mm x 6mm high tensile hexagon head bolts and nuts
4 sheets of 2.1m long standard corrugated fibre glass sheeting
22 metres of No. 20 nylon blind cord

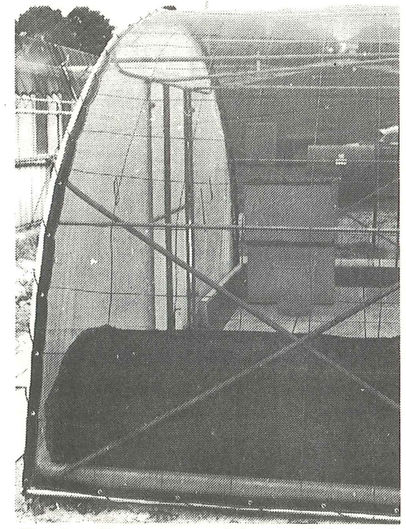

Fig. 7.—Fastening prefabricated shade-cloth covering to the tunnelhouse frame.

23 metres of 150 micron, 11m-wide U.V. stabilised polythene sheeting (including material for ends)

Extra materials for shade cover

2 longitudinal braces 15.2m long (30.4m of 25mm by 1.6mm galvanised E.R.W. tube)
2 longitudinal braces 15.2m long (30.4m of 19mm by 1.6mm galvanised E.R.W. tube)
1 60m roll of roof safety mesh
50% shade-cloth cover fabricated to fit 15.2m by 9.6m
28 65mm x 8mm galvanised cuphead bolts and nuts

Sundries

Gutter bolts; pop rivets; P.V.C. insulation tape; door catches and bolts; steel pegs; 13mm rod; 15mm pipe; approximately 20m of 25mm black polythene pipe and about 70m of 2.5mm galvanised fencing wire.

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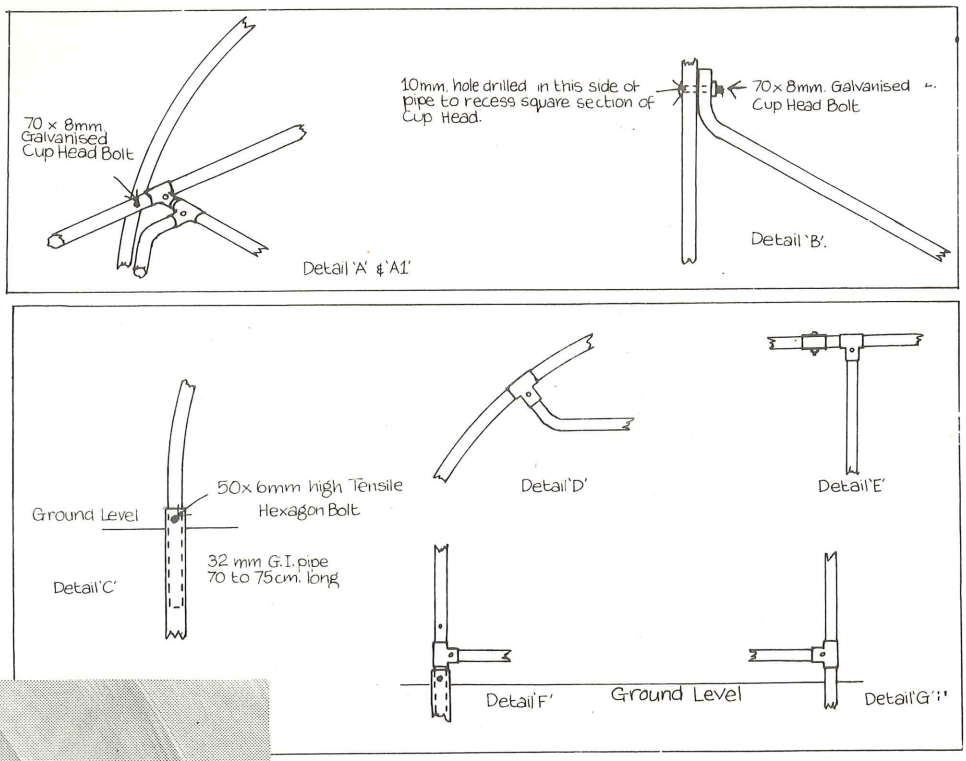

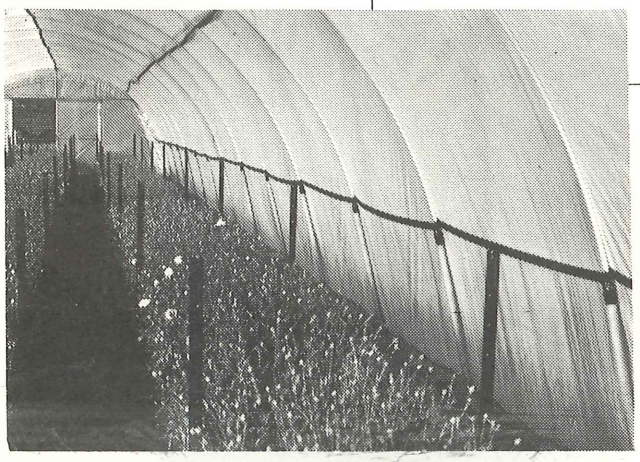

Fig. 8.—Fibreglass rods can be used instead of steel piping for the frame.

Cost of material—early 1983

	$
Piping	500
Clamps and hinges	49
Bolts and nuts	8
Fibreglass sheeting	60
Nylon cord	6
Plastic	181
Sundries	18
Total	$822

Estimated time for fabrication and erection (levelled site): two men for 3.5 to 4 days.

Extra cost to fit shade-cloth

	$
28 66 by 8mm galvanised cuphead bolts and nuts	5
31m of 19 by 1.6mm galvanised E.R.W. tube	40
31m of 25 by 1.6mm galvanised E.R.W. tube	48
1 x 60m roll of 3.15mm roof safety mesh	70
Fabricated shade cloth-covers	288
	$451

Additional cost for bubble plastic
Fabricated cover 11m wide by 16.4m long $732

NOTE: Bubble plastic should last at least five years if taken off during summer. U.V. stabilised polythene sheeting lasts only two years at best.

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