CONTAINERIZED GREENHOUSE AT TOWNER NURSERY

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The State Forest Service Nursery at Towner, North Dakota began construction on a 30 by 96 foot greenhouse with a 12 by 30 foot attached headhouse in September, 1976. The frame of the greenhouse is inch galvanized pipe purchased from Weeber Manufacturing Company. The hoop stakes, which support the arches, were permanently set in the foundation. A two by six framework for the walls was attached to the hoop stakes by use of pipe clamps. Treated (Chemonite) plywood insulated with technifoam forms the remainder of the 40 inch sidewall. The greenhouse end opposite the headhouse was covered with tedlar fiberglass. We found it necessary to reinforce the purlins with corner braces where they attached to the end wall. Without the extra braces, high winds would push the wall in, causing the clamps to slip. We also put poles under the 48 inch fans for extra support.

The covering consists of two layers of 1W stabilized polyethylene and is held in place by one by three's and double-headed nails. The double-headed nails allow for easy replacement of the covering. The polyethylene is fastened to the headhouse by a cable which forces the covering into the groove between the end arch and the headhouse wall. The shade cloth is tacked to the 1 by 3.

The headhouse contains two 225,000 BTU furnaces, the kool-cell system, the nutrient injector, and the control systems. Having the kool cell system on the inside and the louvres in the outside wall permits use of the kool pad in cold weather without danger of the system freezing. The headhouse is protected during watering by a plastic curtain.

The drain system in the floor consists of 12 inch diameter holes drilled through the fill material into the sandy soil beneath and filled with crushed rock. A four inch layer of crushed rocks forms the floor of the greenhouse.

The benches are wood frame with wire mesh tops. Walking space between benches provides access for weeding and thinning.

The fan jets tubes fit under the benches. We feel this provides more even bed temperatures during cool weather than the overhead tubes.

The nutrient injector consists of two 23i gallon fiberglass tanks, metering valves, an air compressor, and a pressure regulator.

The pressure regulator maintains a constant pressure on the nutrients, forcing them through the needle valves and into the water system at a constant rate. This system works very well if you have stable water pressure.

We purchased a team II control system built by ACME Engineering to regulate the greenhouse environment. This control has proved satisfactory, but lacks adjustment between heating and cooling stages. It does, however. provide good control of the other functions and is very simple to operate.

The cooling system consists of four stages in addition to a 51 per cent shade cloth. The first stage is a 24 inch fan with one louvre open, second stage adds one 48 inch fan and all four louvres open, third stage turns on the other 48 inch fan, and fourth stage activates the pump to circulate water through the kool cell pad.

Two fixed overhead lines with adjustable baffle nozzles provide irrigation in the greenhouse.

Six banks of twelve 300 watt bulbs furnish auxiliary lighting. The lights are mounted on a single channel attached to the center purlin.

This greenhouse was constructed by nursery personnel. Only the heating, plumbing, and electrical systems were contracted. The greenhouse was put into production March 1, 1977. We use Colorado stryo block containers and with the present bench system, this greenhouse holds about 45,000 trees.

Our method of filling containers may be of interest to some of you. We use peat and vermiculite as a potting medium. A manure spreader is used to mix the components together. Layers of peat alternated with layers of vermiculite are loaded into the spreader. Forest duff is added for mycorrhizae and the entire load is watered to the desired moisture level. The mixture is then run through the spreader. A backstop or enclosed area helps to prevent unnecessary scattering of the mix. Sometimes it is necessary to run the mix through the spreader more than once. A power loader and a manure spreader makes it possible for two people to prepare enough potting mix in 8 hours for a crop in our greenhouse.

The prepared potting mix is loaded into a V bottom hopper with adjustable loading doors at each end. Gravity flow provides our employees with a constant flow of potting medium to the containers. A wire mesh top on the filling table allows excess potting mix to collect in the tub below. Two by four cross pieces under the wire provide a solid area to drop the containers on for settling the mix into each cavity. A packer made from wooden blocks bolted to a piece of plywood presses the potting medium down to the proper level in all 30 cavities at one time. The protruding bolt heads make a small depression in the center to hold the seed. We seeded by hand and covered the seeds with perlite. This method of filling and seeding took 8 people 3 days to fill and seed 45,000 cavities.

Our present crop of Siberian larch, Ponderosa pine, and Scotch pine was started in March and will be moved to the lath house to harden off about September first.

The high cost of heating and no shortage of field stock makes it hard to justify a winter crop at this time. Our plans are to close the greenhouse for the winter and start another crop about March first.