CONTAINERIZED SEEDLINGS, U.S.F.S., STUART PROJECT

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INTRODUCTION AND HISTORY

The U.S. Forest Service, Southern Region, has been growing containerized seedlings since 1969, on the Kistachie National Forest. Thus far, at the Stuart Project near Pollock, Louisiana, we have produced 1.5 million seedlings for shipment to areas from east Texas to Florida to the coast of North Carolina. The major effort has been devoted to growing southern pine species although we have grown some oak, yellow-poplar, and black walnut seedlings. The objective has not been to produce seedlings on a massive scale but, rather to conduct what we called a pilot project. Initially we wanted to know if southern pine containerized seedlings could be grown in the south and to develop a mechanized system of producing and planting containerized stock.

Prior to May, 1969, the Alexandria Research Center had conducted tests and concluded a 1:1:1 mixture of sand, vermiculite and top soil was a satisfactory media. We started using this media in spiral wound kraft tubes. The 1" x 8" tubes were the primary containers used for the first two years. Some 11/2" x 10" tubes were also used. One of our early discoveries was that some of the tubes were made with a glue that was toxic to pine. This phytotoxicity accounted for some of our mortality early in the program. The tubes were placed in paperboard boxes where they remained until planted. The boxes were the type used to pack poultry and fish in so they were readily available. At the beginning, all phases of the operation were performed with hand labor. The fact that each tube was handled a minimum of two times--once prior to filling and then transferred to another box after filling--attributed much to a production rate of only 5,500 tubes per day for a 14 man crew. It should be pointed out that much of this labor was furnished through Operation Mainstream, a federally sponsored program to employ chronic unemployed persons.

For the first year the seedlings were grown out in the open unprotected from sun, rain, or hail. A little improvement was made the second year as wooden racks were added so that when covered with shade screen some protection was given. We really got fancy near the end of our experience of growing outside as metal racks complete with rolls of shade screen arrived on the scene. After about eight weeks the seedlings were shipped. One thousand seedlings in the 1" x 8" tubes with sand, vermiculite, top soil media weighted about 350 pounds.

PRODUCTION

As we became convinced southern pines could be grown in tubes and survive outplanting, more emphasis was placed on our objective to develop a mechanized system of production. The Japanese paperpots were selected as our primary container. The individual container is

approximately 1" x 6". The set of 266 paperpots is easier to work with than an equal number of 1" x 8" kraft tubes. While we use a mechanized system, it has by no means reached the stage of automation that requires very little hand labor. The set of paperpots must be opened by hand and inserted into the tray used for growing and shipping. The basic carton for growing and shipping is a tray and cover made of 275 pound test kraft paperboard. The tray was designed to hold one set of 266 paperpots.

A commercial growing media of peat, vermiculite and perlite is loaded in a hopper over a vibrator. The tray of paperpots is filled as it is left on the vibrator for 30 seconds. A vacuum cleaner is used to remove ¼ inch of media from the containers to provide room for the seed. Seeding is done by a vacuum seeder designed for our use. After the tray is under the seeder, it is seeded twice. The seeder is designed to drop a seed in each of the 266 pots. Of course, we do not get a uniform matrix when the paperpots are fitted in the tray so each container does not get a seed. By seeding twice, at least one seed is dropped in an average of 96 per cent of the pots. The seeder can be used for all our pine species except longleaf. We are still seeding longleaf by hand. A vibrator feeder is then used to cover the seed with vermiculite. The finished tray is placed on a pallet and is ready to be moved to the greenhouse.

A six man crew using this system can produce approximately 2,500 containers per manhour. Because longleaf must be seeded by hand, one manhour per thousand seedlings must be added to this production rate.

GREENHOUSE

After a couple of years of growing in the wide open spaces, two greenhouses were constructed. They are a modified Cornell 21 type wood frame structure covered with air-inflated double layer polyethylene. Each house is 20' x 96' and is capable of handling 200,000 to 250,000 containerized seedlings. Since the greenhouses were considered to be for temporary use during the pilot project, they were not air-conditioned. A combination of wet pads and shade screen is used to lower the temperature. This summer we are using a white greenhouse paint instead of shade screen. We are quite pleased with the effectiveness of this paint.

Inside there is nothing really fancy. Air exchange, heating, and cooling, is dependent upon dual exhaust fans, overhead air turbulation duct and fan, heater, and wet pads. Uniform watering is accomplished with a motorized overhead car, with spray booms attached, traveling on a track. The water and electric line to the car is also attached to an overhead line to keep it off the floor. Metal racks are used to support the trays of seedlings.

GROWING AND CARE

As the greenhouse is loaded, the care and growing begins. We start with the media dry. The first few days we water frequently--10 to 20 times a day depending upon the weather--until the media is thoroughly wet. Watering is reduced as germination increases. We hold to no hard and fast rule

for watering. Watering is really done on an "as needed" basis. During the last couple of weeks the seedlings are put under some stress by reducing the amount of water they receive.

Water soluble nutrients are added after the seedlings are in the house about four weeks. Weekly applications are made until the seedlings are shipped. Chelated iron is added as clorosis becomes evident. The seedlings are grown for about 10 weeks before shipment.

Shipments have normally been made during December, March, and June. The seedlings are not moved outdoors to be hardened-off. The receiving units are advised to place the seedling in partial shade until they are planted. The weight of one thousand seedlings in the paperpots is about 80 pounds.

Our most serious problem to date has been caused by damping-off fungi. Pathologists have identified Fusarium sp., Rhizoctonia soloni, and Pythium sp. from our seedlings. In some instances, we have had severe losses after the seedlings were shipped as well as while they were in the greenhouse. With the assistance of Alexandria Research Center and Forest Pest Management Group, State and Private Forestry, Pineville, studies are currently being conducted to find a fungicide or combination of fungicides to control the problem. We are limited in our efforts in that only about two chemicals are registered for use with pine containerized seedling. One of these fungicides, captan, was suspected to have been the cause of reduced germination. In the past we have gotten only very limited control with captan. Hopefully the current studies will soon provide an answer to this disease problem.

SHIPPING

We ship in the same box the seedlings are grown in. A paperboard cover is fitted over the tray. This cover protects the seedlings and allows stacking of the trays. Our shipping requirements would not normally be encountered in operational production of containerized seedlings. Because of the nature of our pilot project, we were required to ship throughout the southeastern United States.

Shipments were made by open bed trucks, refrigerated transports, air freight, and commercial motor freight. Most of the seedlings have been shipped by refrigerated transport with the temperature maintained at 55 F. This method was used to ship to recipients greater than a day's travel from the Stuart Project. Open stake body trucks were normally used whenever less than a day's travel was involved. The covers, placed over the seedlings afforded sufficient protection to the seedlings. We also shipped by air freight when we had a few thousand seedlings to send great distances. One shipment was even made by commercial motor freight. After eight days on the road, the loblolly arrived in good condition other than being a little dry.

The costs for shipping containerized stock is more than for bare-rooted nursery stock. This is due primarily to their relative bulkiness which means fewer seedlings can be shipped on the same size truck. A fully loaded refrigerated transport can hold approximately 550,000 bare-rooted stock but only about 230,000 of our containerized seedlings in the paperpots.

When the seedlings arrive at their destination, the trays are unloaded by hand and placed in partial shade. About the only care needed after the seedlings are received is watering. I do not have a complete summary of the results of all the plantings. The seedlings have been planted by hand and machine; on good sites and adverse sites, from December through August; and on sites with varying degrees of site preparation. Under these conditions there have been a number of failures but, overall results have been favorable enough to believe that with healthy, vigorous seedlings many sites in the South can be planted with containerized seedlings.

OUTLOOK

The Southern Region is going to continue the pilot project for another year. More attention is to be directed toward defining the morphological seedling best suited to our needs and how to achieve the growth of this seedling the easiest. Since longleaf is the most difficult to plant with bare-rooted stock, emphasis will be given to improving its survival and growth.

We feel progress has been made in our pilot project. We recognize mistakes that have been made in the past and some that we are still making. Containerized seedlings are certainly not going to solve all of our reforestation problems but, I am confident they will become a tool available for our use.