GROWING CONTAINERIZED EUCALYPTUS IN SOUTH FLORIDA 1/

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Abstract.--The Florida Division of Forestry has produced 396,000 containerized Eucalyptus seedlings since 1972. The design of a nursery to successfully grow containerized Eucalyptus seedlings varies greatly from the previous Slash Pine production of the Herren Nursery and the production of containerized conifer seedlings. A twelve week nursery growing season, a growing density of 25 seedlings per square foot, small seed interspersed with chaff, and summer planting all add to the challenge. It is through meeting challenges like this that a new hardwood pulp resource will be created in South Florida.

HISTORY OF NURSERY PRODUCTION

In 1971, research for growing containerized Eucalyptus in Florida was limited to the previous experience of the Florida Forest Foundation which had established species trials with a number of Eucalyptus species in South Florida. The Florida Division of Forestry had cooperated with the Foundation and through its interest in the species had grown Eucalyptus in open seedbeds as well as in quart pots. Seedlings grown in open seedbeds did not survive well upon outplanting. This was due to the fact that a good fibrous root system could not be produced in open seedbeds.

The largest reforestation effort before 1972 was a fifty-acre planting half each of Eucalyptus robusta and E. grandis. These seedlings were grown in quart pots at the Florida Division of Forestry's Ferren Nursery in South Florida. They were planted during the summer of 1969. As a result of this planting and other factors relating to the available hardwood supply in Florida, renewed interest in the species developed.

This interest resulted in the formation of a Research Cooperative in the fall of 1971 to develop Eucalyptus as a timber resource in the South Florida area. The Florida Division of Forestry as a member of the Cooperative was to grow the seedlings. They were to be ready for outplanting in late June of 1972 for a private landowner who was a member of the Eucalyptus Research Cooperative. Realizing that experience as well as research data were very limited for growing containerized Eucalyptus, we set out to grow the seedlings with the help of George Meskimen[3] in the fall of 1971.

I will omit the criteria for growing containerized Eucalyptus here as it can be found in the paper: BREAKING THE SIZE BARRIER IN CONTAINERIZATION--"WASHED" EUCALYPTUS SEEDLINGS[4] presented during this meeting by George Meskimen.

The time factor was against us in 1971 since we only had four months to develop a growing system. Containers would be our greatest hurdle. We needed a container to grow 25 seedlings per square foot. The con-

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4/p. 200-204, In North Am. Containerized For. Tree Seedling Symp. Proc. Great Plains Agric. Counc. Publ. 68.

tainer should not be cylindrical for fear of root spiral. The container had to facilitate machine planting and encompass air root pruning to force lateral root development. This started the process of evolution, which we have gone through, to develop a containerized nursery system for growing eucalyptus seedlings.

The die is not yet cast although we have made considerable progress.

We have used three types of containers: speedling trays, wedge walls and Ray Leach tubes. We have used portable shade, as well as fixed shade. We have fertilized by hand and, with mechanical equipment. Handling of containers has gone from a flat bed trailer to handling in a unit system of twelve trays with metal skids and the development of a skid hauler. Thinning and rearranging the crop has been reduced to acceptable limits in time and cost of equipment. The use of trays with individual removable cavities and the development of the poultry wire covered frame made this contribution.

In retrospect, I consider our progress to be acceptable in view of the sodium chloride water problems we encountered the first and third year in the growing season. In what other system could you move the nursery crop when insurmountable problems with water were encountered as we experienced in 1974 when the crop was moved 250 miles north to our Andrews Nursery?

Through this type of evolution, we have arrived at our present stage of developing a containerized nursery system to grow Eucalyptus. We have produced 396,000 seedlings which has reforested 900 acres in Eucalyptus.

NURSERY SYSTEM AND EQUIPMENT

The Herren Nursery was built in 1959 and designed to grow Slash Pine seedlings. Much of the facilities and supporting equipment was not easily adaptable to a containerized growing system.

Modifications of the various systems have been made with partial success although some leave much to be desired for containerized seedling production.

The irrigation system was designed with main and lateral lines underground. The risers are spaced on a 40' x 40' pattern with one valve controlling six 600 foot lateral lines. This system is not desirable when plants of varying irrigation requirements are being grown. Separate valve controls were needed and were installed for the 1974 growing season in the area where the containerized Eucalyptus seedlings are grown. The larger irrigation heads were replaced with #20 rainbird heads to reduce droplet size and avoid seed displacement in the containers. A mist system for germinating the seed would improve the system if it could be integrated with the existing system for final growth.

The shade support system consists of 4" x 4" x 12' wolmanized posts set three feet in the ground and extending nine feet above ground. The posts are set on a 20' x 40' spacing with the 20' distance down the lateral irrigation lines. Number six galvanized wire is stretched overhead, criss-crossed as well as crossed on the diagonal, to support the shade fabric and anchored by deadmen.

Polypropylene 25% shade fabric is used during germination of the seed and for early growth before thinning in the tubes is needed.

The shade structure is adequate with the exception of the poorly drained soils which hold water in the area between the rows where the tractor tires run. An asphalt or concrete surface would solve this problem. Metal skids were constructed for the 1974 growing season to insure that the containers would provide air root pruning. In addition, the metal skids would serve as a handling unit which would hold twelve trays or 3,360 seedlings. The skid is constructed of angle iron with dimensions of 4' x 8'. It has six-inch legs, which extend below the floor which is expanded metal. The trays are held in place by a metal strap which is four inches above the floor running around the top of the skid.

The containers are filled with dry Jiffy Mix direct from the bag. The mix is poured over the metal skid filled with twelve trays. The expanded metal bottom of the skid allows the excess mix in the filling process to fall to the concrete floor where it is picked up and re-used. The metal skid is placed under the irrigation to wet the mix completely in the tubes before the actual sowing. Efforts to fill the tubes with pre-wet mix left air pockets in the tubes and was abandoned. In the sowing operation, the trays are removed from the skids and set on a conveyor belt where they are checked for mix settling before they reach the sowing table located at the opposite end of the conveyor belt.

Due to the present technology in cleaning and sizing, Eucalyptus seed precision sowing is not possible.

Germination data and expected survival are used to compute the sowing rate of one tray in each species to be sown. A measuring device is then made and used to measure the amount of seed for each tray. The measured seed is then placed in a salt shaker and spread as evenly as possible over the tray (fig. 1). This process is repeated for each tray. Due to the possibility of gravity separation within the seed, considerable variation is often found in the density of germinated seed in each tray. In the future the trays will be sown directly in the metal skid. The skid will be elevated to working height and a templet will be used to catch excess seed.

Figure 1.--Sowing Eucalyptus seed.

Following sowing, the trays are placed on a dead roller conveyor where they are mulched with vermiculite. This is done by hand. They are then placed back on the metal skid and watered with a mist nozzle before being transported to the field and placed under shade.

Each metal skid holding 12 trays is transported with a skid hauler commonly called the Crab (fig. 2).

The Crab is a raised three-point-hitch boom, developed and built in our shop. It attaches to the three-point-hitch of the highboy tractor. It is raised and lowered by the tractor three-point-hitch. The four pickup arms are activated by a hydraulic cylinder to open and close them from the tractor seat.

The metal skids are lined out in rows as conventional nursery beds. The highboy tractor and Crab can travel over the previously placed skids.

This system makes maximum utilization of the shade structure in addition to allowing mechanical handling of the trays (fig. 3). The Crab and skids are also used in the growing system for the 300,000 potted tropicals grown for urban planting by Herren Nursery. New 2" x 2" x 5" containers encompassing air root pruning are now used in this system to produce better root systems than were previously possible in quart pots.

The seed generally will complete germination in two weeks. Irrigation is applied 15 minutes twice daily during germination and early growth. Density per cavity ranges from 10% blanks to five seedlings per cavity depending on the quality of the seed and the accuracy of the germination test.

The thinning process can be started when the seedlings are 1/2 inch in height in the tubes now in use. The individual tube permits easy handling at this stage. It also allows for lifting individual tubes to eye level to permit snipping with the surgical scissors. All seedlings except the one dominant to be left are snipped off in the thinning operation.

The tubes containing one seedling are then placed in a 4' x 8" wooden frame constructed of 1" x 4" boards. The frame is covered on the top and bottom with one inch poultry netting. The lip of the tube prevents it from falling through the wire. The tubes are now spaced at 32 per square foot. Each frame will hold 1,024 plants. The frames are then taken from the nursery building, where the thinning and rearranging is done, back to the irrigation area with the Crab. They are lined out as before in rows on 6" x 6" concrete blocks with the ends of each rack sharing a common block: Space is left between rows to allow ample room for the tractor tires to permit the tractor to travel over each row of racks for fertilizing.

Fertilizer is applied with a three-point-hitch boom type sprayer and the tractor. Flood jet nozzles are used on the boom. The rate of fertilization varies depending on growth and the length of time left to complete final growth.

Fungicides and insecticides are applied in the same way when the need arises.

The seedlings are moved back to the building for shipping. The tubes are removed from the racks. The seedlings are extracted from the tubes and are placed on a conventional grading belt in the packing shed. As they move along the belt, they pass graders who remove the cull seedlings. The culls are those which are usually less than six inches in stem height, or those which have sustained injury in being extracted from the tubes.

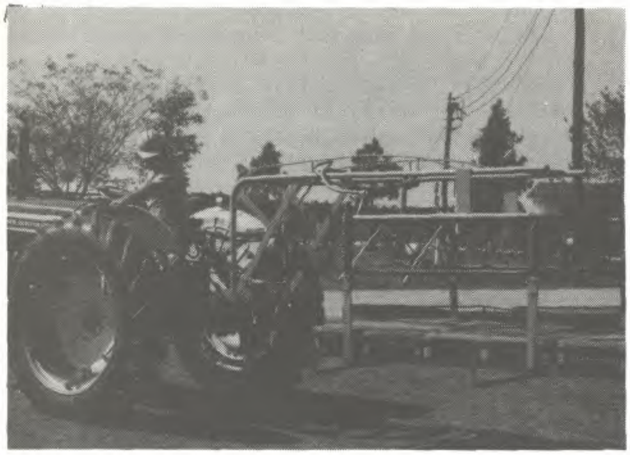

Figure 2.--"Crab" or skid hauler.

Figure 3.--Positioning skids in shade.

A packing stand is located at the end of the grading belt. The seedlings are packed into cardboard boxes. The box is designed with a short telescoping lid and ventilation. Wet Kim-pac is used in the boxes for moisture retension.

The seedlings are picked up at the nursery by the planter. A two-day interval appears to be about maximum for storage in the field due to the very hot temperatures which exist in summer planting.

CONCLUSIONS

After three seasons of growing containerized Eucalyptus seedlings by the Florida Division of Forestry, it is apparent that the final die is not yet cast for the best co n-tainer to meet the biological needs of the seedlings, as well as one to meet the economic and mechanization needs within the nursery system. Each crop of seedlings has been a new challenge to try to solve the problems which were encountered with the previous crop. he have demonstrated that containerized Euca lyptus seedlings can be grown successfully in a number of various sizes and shapes of containers.

Field seedling survival would not appear to be a problem from most any container which would be large enough to sustain growth of the seedlings in the nursery to a stem height of 10 inches and provide sufficient foliage production to produce a good woody stem in 12 weeks. Air root pruning appear to eliminate root spiral and should be considered essential in any container used to grow Eucalyptus seedlings. Shading the seedlings for the full 12 week growing cycle would probably increase early growth and reduce the risks which are involved with extremely high fertilization rates.

The greatest need for research in growing containerized Eucalyptus seedlings at the present time is in the area of seed technology. Some form of mechanical seeding into the containers to insure that 90% of the cavities will contain one seedling each is desperately needed. Seedling packaging and storage research to extend the storage life of the plants after packaging would increase the efficiency of the planting, as well as, the nursery operations.

Growing containerized Eucalyptus seedlings on a commercial scale before research has had a chance to develop the cultural practices of growing and packaging is at best a high risk. It is also a challenge worthy of the undertaking.