CONTAINERIZED TREE PRODUCTION IN THE TROPICS 1/

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Abstract.--Container production of pine seedlings in the tropics presents challenges unlike those in the temperate zone. Larger trees and larger containers are required to enhance survival. More studies are needed to determine the minimum container size possible to raise seedlings 25 to 35cm tall and to reduce the excessive dependency on hand labor.

Forest tree seedling production in the tropics (and subtropics) presents challenges unlike those in the temperate zone. Although seedlings of many hardwood species survive well in the field, either stump planted or bareroot planted, the subtropical pines, Pinus caribaea, P. oocarpa, P. kesiya, and P. merkusii, and several important species of eucalyptus normally suffer serious mortality when bare-root planted. In the "quasi-greenhouse" climate of the lowland tropics, seedlings ready for outplanting (25 to 35cm tall) are produced between 5 and 8 months after germination. Containers are used to improve survival rather than to extend the growing season as is done in the temperate zone.

Several tropical countries produce between 2 and 8 million container-grown lowland sub-tropical pine seedlings each year (Lamb, 1973). The demand for such seedlings can be expected to continue, so the development of an efficient container production system for this scale of operations would be invaluable.

Containerized production of forest tree seedlings is a relatively old practice in the lowland tropics. Container types commonly used are clay balls (handmade), split bamboo pots (handmade), polyethylene bags (hand-filled), clay pots (handmade), tar paper pots (handmade), tin cans (hand-filled), etc. Seedlings may also be planted directly into soil-filled trays from which they are lifted with a spatula. Non-rigid containers are hand-filled and individually lined out in nursery beds. However, rigid containers (such as the tar paper pot) are lined out by hand and filled using a shovel.

Shortly after germination, seedlings are transplanted from germination beds into soil-filled containers. In the typical tropical nursery, these transplants, in individual containers, are lined out into nursery beds and left for 5 to 8 months. Height growth is not uniform and so trees are graded 1 to 3 times in the nursery and regrouped according to height. This process is hand-labor oriented but it reduces loss through seed bed competition. Mowing at a uniform height is not widely practiced in containerized seedling production in the tropics.

Container size or volume is as important as container material. Traditionally in the tropics 250 to 350 cubic centimeters of soil has been considered necessary to grow trees 25 to 35cm tall. Thus, most containers weight between 0.8 to 1.3 kg when filled with soil. For example, in Puerto Rico 10 x 20 cm polyethylene bags are commonly used. These bags hold approximately 300 cubic centimeters of soil, and the maximum number of trees per tray which can be safely handled by one man thus is between 30 and 40. However, if peatmoss (or a light weight synthetic medium) is used instead of soil, a 30 to 40 percent reduction in weight is achieved and it is practical to transport 55 to 60 seedlings at a time. Trays designed

1/Paper presented at North American Containerized Forest Tree Seedling Symposium, Denver, Colorado, August 26-29, 1974.

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to hold 30 to 35 seedlings grown in 10 x 20 cm bags are approximately the same size as the Japanese paper pot which has 266 tubes (3 x 9.6 cm) or the Styroblock "8" which has 80 cavities. Thus, the relative nursery area required to grow tropical trees is considerably greater than that required for temperate trees.

Heavy and periodic applications of fertilizer may enhance tree growth in smaller volume containers (100 to 150 cm^3), particularly if a well-drained and well-aerated lightweight synthetic medium is used. Although a synthetic medium would lower the weight of individual seedlings, its use on a large scale is not yet feasible because of the cost. We are currently studying various mixtures of sphagnum moss, peat moss, perlite, sand, compost, sugar cane waste, sawdust and the most economical, light weight medium to produce trees 25 cm tall.

There are two divergent options for increasing the number of trees which can be transported by laborers. These are: (1) accept a smaller tree seedling for outplanting or (2) reduce the seedlings biomass through selection and breeding.

The major problem associated with outplanting smaller trees (8 to 10 cm tall) is the added expense of protection from weeds and vines. Most plantations using seedlings 25 cm tall are hand weeded 5 to 8 times before they become established. Smaller seedlings are expected to require weeding over an even longer period.

If trees 8 to 10 cm tall are outplanted, it is possible to pack between 80 to 100 per tray. In experimental trials with spiral kraft paper tubes (3.75 x 15 cm) we found that 80 to 100 trees was the maximum number possible for one man to safely handle when clay soil was used as the potting medium. Growth rates, however, were unacceptable in the kraft paper tubes. Poor growth was attributed to poor aeration.

Larger trees require large containers for root development, and must be grown at wider spacings to reduce competition for light. Crown dimensions of the subtropical pines must be considered in order to determine the minimal container size. Natural variability in seedlings of Pinus caribaea suggests the possibility of selecting for late emergence of secondary needles, thus retaining a small crown diameter (and close nursery spacing) until lifting. In this species primary needles range from 15 to 71 mm in length and secondary needles may emerge as late as 6 months after germination. No compensatory losses in vigor are foreseen in selection for either short primary needles or late emergence of secondary needles. Seedling needle characteristics are transitory in the tree development thus, artificial selection for these needle traits may not seriously alter the total genetic variation of this species.

Finally, there is a need to study the effect of nursery treatment and container type and media on growth in the 6 to 8 month period immediately following outplanting. Field measurements show that most seedlings fail to grow during the first 3 to 4 months following outplanting, and after 6 to 9 months they have only grown about 10 to 25 cm. This growth rate is inadequate in the face of the serious problem of weed and vine competition. More physiological studies are needed to determine how growth can be stimulated at this stage. It is possible that nursery treatment and container type could be modified to overcome this problem.

LITERATURE CITED

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