

PROGRESS REPORT: IMPROVED SEEDLING PRODUCTION IN THE SOUTH

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Abstract.--Production of genetically improved seedlings in the 13 southeastern states in 1977-8 totaled 370 million or 41% of the 895 million seedlings grown. Improved seedlings amounted to 38% of the state nursery production, (45% of the industrial nursery production,) and (39% of the federal nursery production.)

INTRODUCTION

In almost 30 years of active tree improvement work in the South, we can be proud of many accomplishments. We have three active tree improvement cooperatives which include eight southern state forestry organizations, 36 forest industries and one forest seed company. The other five southern state forestry organizations all have independent tree improvement programs, most of which have cooperative arrangements with universities or U. S. Forest Service research projects. In addition, the southern region of the U. S. Forest Service and TVA both have active tree improvement programs.

There are more than 9,000 acres of seed orchards established in the South. These orchards produced over 60 tons of pine seed in 1977. Six of these orchards have produced more than 100 pounds of seed per acre including one loblolly orchard (Weyerhaeuser - North Carolina) which averaged 197 pounds per acre over the entire 33 acre orchard.

NURSERY PRODUCTION

Overall nursery production in the South has increased from 857 million seedlings in 1975-6 to 877 million in 1977-8 (figure 1). In 1975-6, state nurseries produced 54% of the total southern production while in 1977-8, state nurseries produced 55% of this total.

Reforestation personnel in the 13 southeastern area states (AL, AR, FL, GA, KY, LA, MS, NC, OK, SC, TN, TX, and VA) predict that the 1979-80 seedling crop will total 599 million (figure 1). If the 29 southern industrial nurseries continue to produce 391 million seedlings, the total will be 990 million for this season. However, heavy rains this spring washed out seedbeds in some nurseries and cool weather delayed germination in others. For these reasons this season's production may not reach the prediction of 990 million seedlings.

New industrial nurseries in Alabama, Arkansas, Mississippi, South Carolina, and Texas will make a significant impact on the overall reforestation effort in the South. A total of 8 nurseries are in various stages of construction, including one (Champion - South Carolina) which started in production this spring. Since about 44% of the state nursery production is contract-grown seedlings for industry, the completion of these new industrial nurseries should free a substantial production area within the state nurseries. Hopefully, this will enable some state nurseries to establish better crop rotation schedules and improved soil management procedures.

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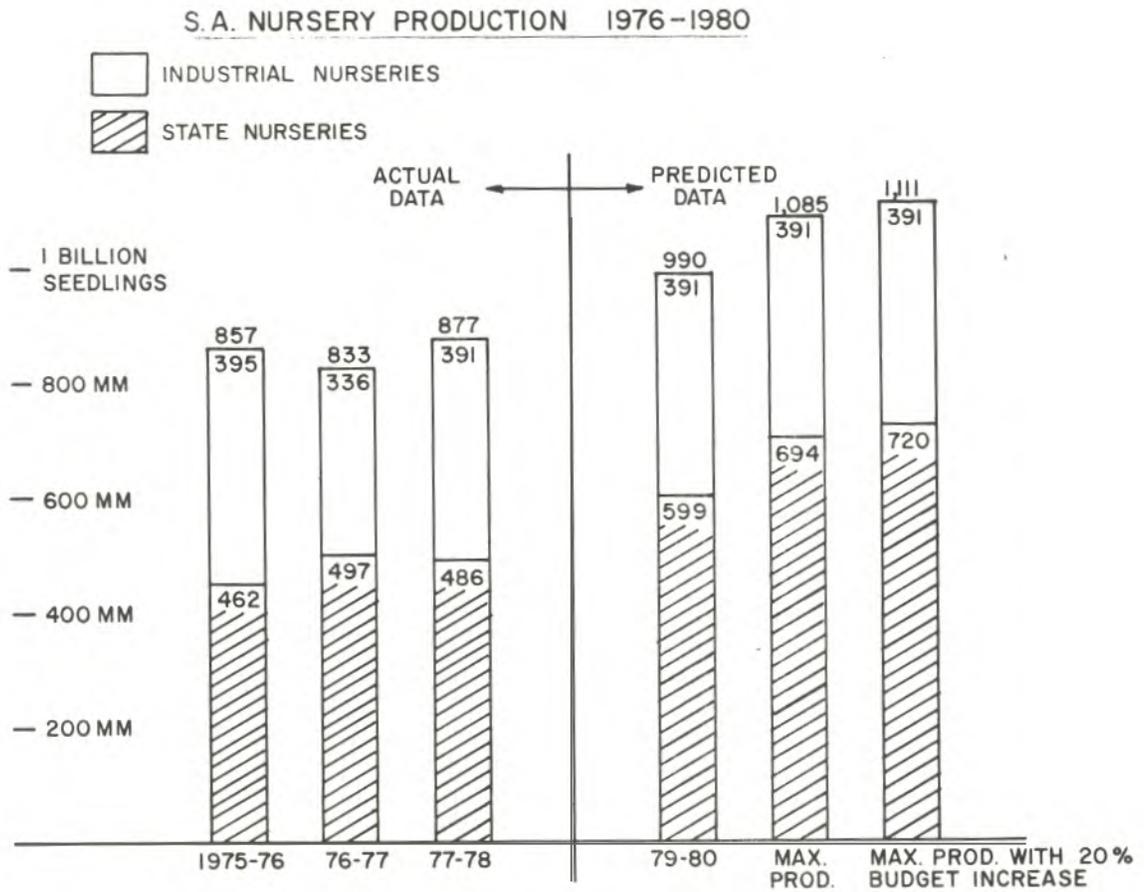


Figure 1.--Nursery production in the South: 1975-1980.

IMPROVED SEEDLING PRODUCTION

The number of genetically improved seedlings produced in the state, company, and federal nurseries in the South has steadily increased in the past three years from 27% in 1975 to 41% in 1977-8 (table 1, figure 2).

State nurseries have made the most dramatic improvement by increasing the percentage of improved seedlings from 14 in 1975-6 to 38 in 1977-8. It is predicted that the 1979-80 state nursery crop will be 43% improved seedlings. Industrial nurseries increased the number of improved seedlings from 41 to 45% in the 1975-8 period, while the Ashe nursery percentage increased from 35 to 39%.

With one exception, all the southeastern state nurseries produced some improved seedlings in the 1977-8 season (figure 3). State nurseries in Alabama, Georgia, Louisiana, North Carolina, South Carolina, Texas and Virginia produced substantial numbers of improved seedlings in that season. The three states with the highest percentage of improved seedlings were Georgia (80%), South Carolina (73%), and Texas (59%).

Table 1.--Improved seedling production in the South (millions of seedlings)

| | <u>1975-6</u> | <u>1976-7</u> | <u>1977-8</u> |
|--|---------------|---------------|---------------|
| State nursery production (total): | 462 | 497 | 486 |
| Nursery-run: | 398 | 379 | 300 |
| Improved: | 63 | 118 | 186 |
| % Improved: | 14 | 24 | 38 |
| Industrial nursery production (total): | 395 | 336 | 391 |
| Nursery-run: | 232 | 176 | 214 |
| Improved: | 163 | 160 | 177 |
| % Improved: | 41 | 48 | 45 |
| Federal nursery production (total): | 20 | 21 | 18 |
| Nursery-run: | 13 | 10 | 11 |
| Improved: | 7 | 11 | 7 |
| % Improved: | 35 | 52 | 39 |
| Total production: | 877 | 854 | 895 |
| Nursery-run: | 643 | 565 | 525 |
| Improved: | 233 | 289 | 370 |
| % Improved: | 27 | 34 | 41 |

Company nurseries in Alabama, Florida, Georgia, North Carolina and Virginia produced substantial numbers of improved seedlings during 1977-8. The highest percentages of improved seedlings were produced by company nurseries in Florida (85%), North Carolina (81%) and Alabama (76%).

HOW CAN WE MAXIMIZE THE GAINS FROM IMPROVED SEEDLINGS?

In order to develop the full potential of these improved seedlings, nursery management techniques need to be improved. Emphasis must be placed on quality rather than quantity.

Soil management procedures must be updated (Leaf 1976). New sources of organic matter must be found to replace depleted stocks of sawdust and bark. Composting of sewage sludge with wood residues is a promising technique which is currently under evaluation at several nurseries. Fish sludge and MILORGANITE are being used successfully at the USFS Wind River nursery (Dutton 1979).

Precision seed sowing is essential in order to better utilize improved seed and to enable mechanized pruning of lateral roots. Low seedbed densities (20-25 seedlings per square foot) are necessary to enable adequate diameter growth and root development.

New species of mycorrhizae indicate a great potential for improving both nursery and field performance of pines and hardwoods (Cordell, et al 1979; Kormanik, et al 1977).

New herbicides are more effective and cheaper than the chemicals used in the past (South 1979).

IMPROVED SEEDLING PRODUCTION

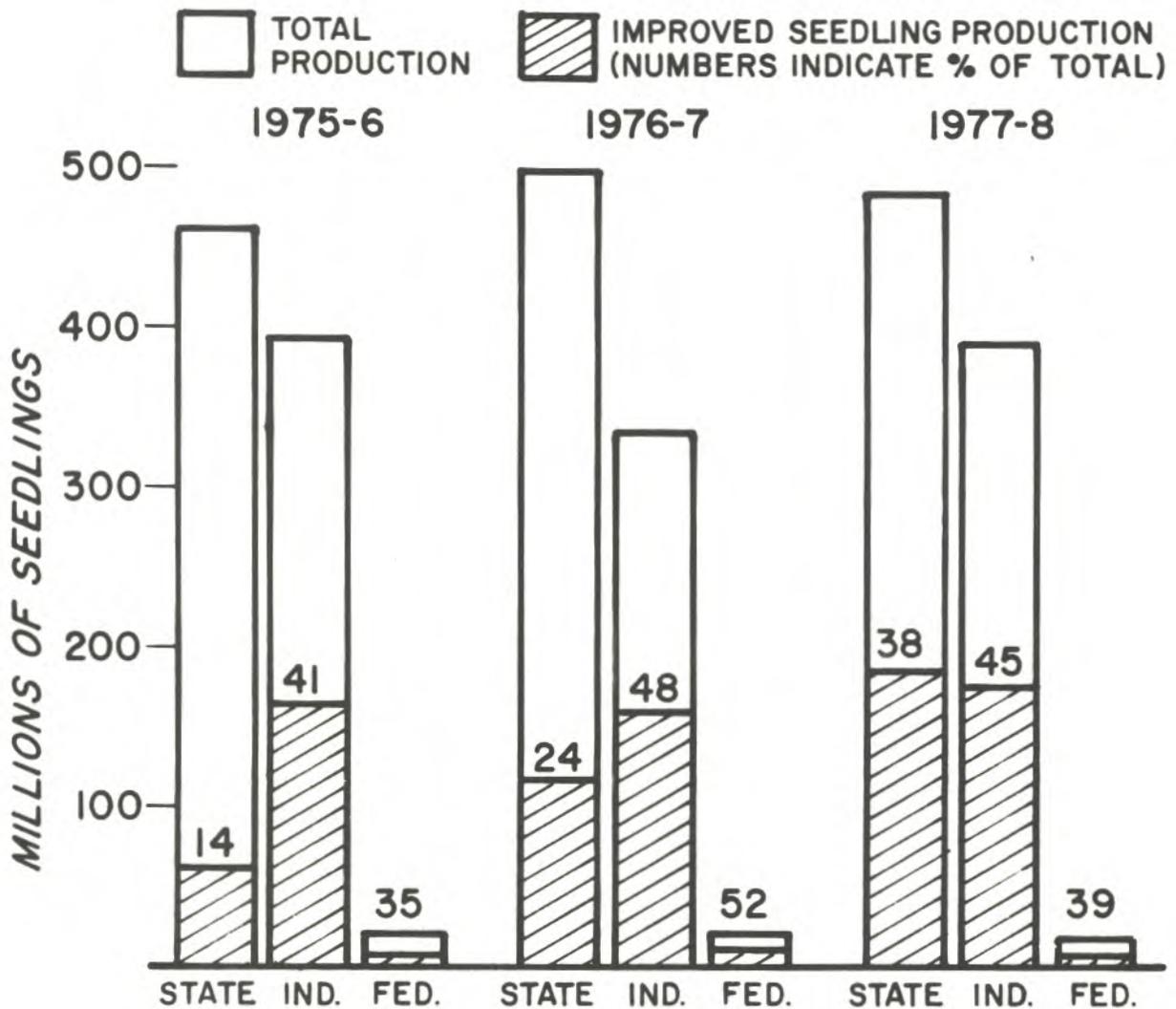


Figure 2.--Improved seedlings from southeastern state, industry and federal nurseries.

1. Root wrenching has been an effective means of encouraging compact, dense root systems of *Pinus caribaea* and *P. radiata* in New Zealand (Bacon and Hawkins 1979). Use of this technique in this country, in the Pacific Northwest and the South resulted in variable degrees of success. New evaluation studies are underway by both federal and industrial research groups.

2. Top pruning has been used by several nurseries to restrict top growth, add diameter growth and encourage root growth through the fall (Dierauf 1977).

3. A well-planned schedule of withholding nutrients and water in the fall will also slow down active top growth and promote earlier dormancy.

4. Careful adjustment and operation of mechanical lifting equipment will minimize damage to the seedlings. The optimum survival and growth of seedlings is dependent on undamaged root systems and intact mycorrhizae.

9. There seems to be a popular belief that seedlings packed in Kraft/Polyethylene bags can be treated like pulpwood! Nothing is farther from the truth. The K/P bags were developed specifically for cold storage use. Seedlings confined in the bags will produce considerable heat just in the process of respiration. When temperatures rise inside the bags, fermentation can take place very quickly.

Recent studies in the Pacific Northwest have indicated the importance of good air circulation in cold storage units. The internal temperatures of K/P bags without good air circulation were as much as 22°F higher than those with good air circulation. Merely piling bags more than two deep on pallets resulted in a 10°F increase in temperature. These increased in temperature where bagged seedlings were maintained in cold storage, point out the potential for rapid temperature increases when seedlings are packed in K/P bags and taken out of cold storage. Bagged seedlings left in the sun for just a few minutes can build up lethal temperatures. The entire process of tree breeding, improved seed production and high quality seedling production in the nursery is a complete waste of time and money if the seedlings do not survive! Careful inspection and constant supervision of the storage, shipping and planting operations are essential for the realization of maximum genetic gains from the overall tree improvement process.

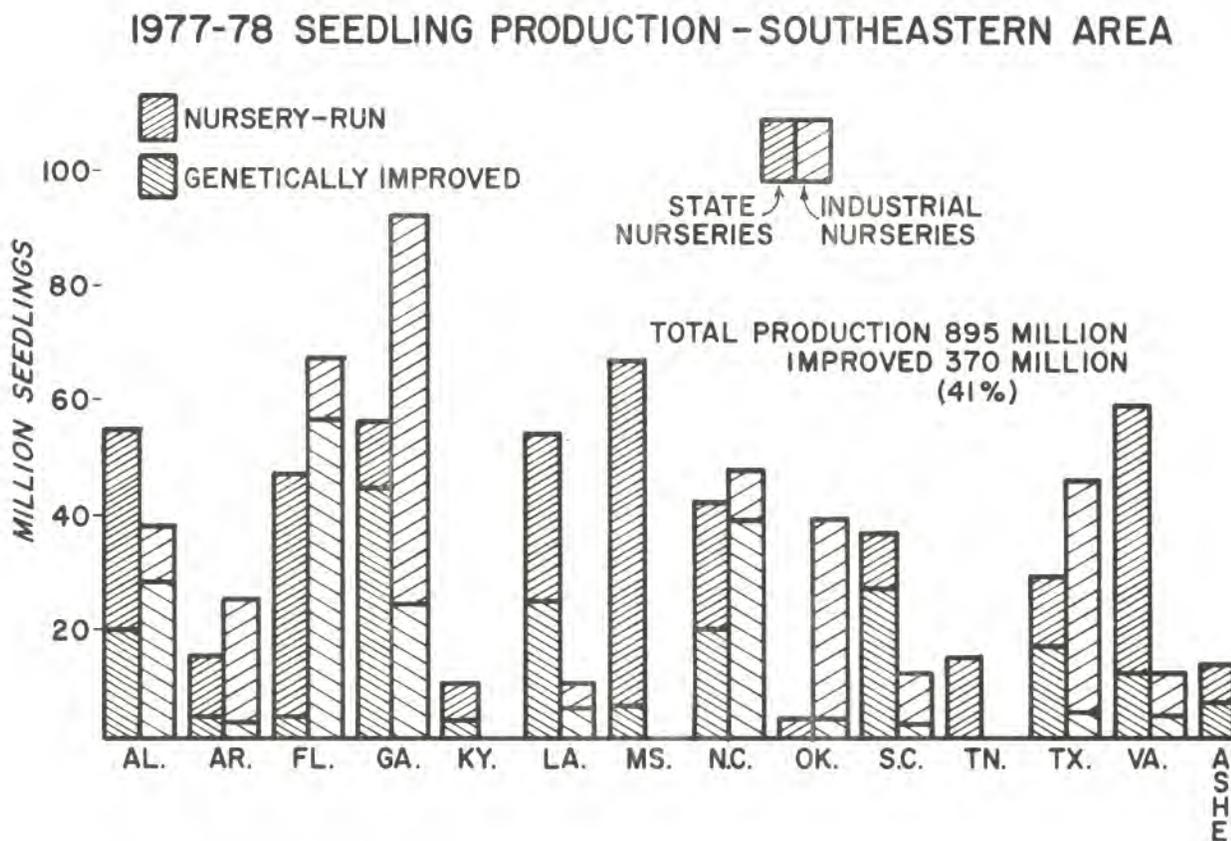


Figure 3.--Improved seedling production: 1977-8.

1/ Personal communication from P. J. Heide, Scott Paper Company, Hamilton, WA.

SUMMARY

Genetically improved seedlings currently amount to 41% of the 895 million seedlings grown in the South. Many southern seed orchards are producing commercial quantities of seed with a total production of over 60 tons of pine seed produced in 1977. Maximum genetic gains from this improved seed will be accomplished only if major improvements in nursery technology and seedling handling can be implemented.

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