A SEVEN-YEAR-OLD OCALA SAND PINE SEEDLING SEED ORCHARD

Ralph A. Lewis, Timothy LaFarge and James L. McConnell 1/

Abstract.--A 20 acre Ocala sand pine seedling seed orchard was established in 1978 near Ocala, Florida. First year survival was 67%. An apparent adaptive mechanism that allows some trees to survive unfavorable environmental conditions was noted. After 7 years and 2 thinnings, the tallest trees were over 26 ft. and the tallest family averaged over 19 ft. Although a few cones were observed after 3 years, the orchard is just starting to produce a significant amount of seed.

Additional keywords: Orchard management, seed orchard design, single-tree plot, Pinus clausa.

The theory for design and management of seedling seed orchards is well known but few production orchards of this type have been established in the South. In January of 1978, a production seedling orchard of the Ocala race of sand pine (Pinus clausa var. clausa Ward) was planted on the Ocala National Forest in central Florida.

METHODS AND MATERIALS

Orchard Design and Layout

Design.--The orchard is designed for 30,000 seedlings, consisting of 120 families with each family represented by a single tree plot in each of 250 blocks (replications). A block consists of 10 rows of 12 trees planted on a 5 ft. by 5 ft. spacing. Actual orchard area is slightly less than 17 acres with another 3 acres devoted to roadways and border strips. Border rows were planted around the exterior and along both sides of all interior roadways.

Layout.--The size and complexity of the planting required that the layout be simple but precise. All blocks and rows within blocks were tagged. Every planting point was marked with a wire stake flag. In order to help guide the planters, each block was staked with a single color with all adjacent blocks staked with different colors. This was accomplished by alternating red and white blocks next to alternating blue and yellow blocks. Another color (orange) was used exclusively for border rows.

1/ Forester, Eastern Zone Geneticist, and Regional Geneticist respectively, USDA Forest Service, Region 8, Atlanta, Georgia.

Materials

Site.--The planting site is located in central Florida on the Lake George Ranger District, Ocala National Forest. Soils are excessively drained, stongly acidic deep sands of the Astatula series. The area is part of a "longleaf island" and it has a slightly higher clay content than the more typical sand pine sites. The topography ranges from flat to slightly rolling. The site was prepared by removing all woody vegetation followed by raking and double disking.

Seed.--Wind-pollinated seeds from 131 select trees (all growing in wild stands on the Ocala N. F.) were collected in 1976. Sufficient seed from each collection to produce at least 250 healthy seedlings were planted in April of 1977 in the Chipola Experimental Forest nursery near Marianna, Florida.

Seedlings.--The early care and culture of the seedlings were routine but in late summer, both moisture and fertilization were gradually reduced in order to induce hardening-off. Although this procedure tended to produce slightly smaller seedlings, it prepared the seedlings to better cope with planting shock. Lifting began during the first week in January,1978. Trees were individually tagged with family identification, sorted into "block" bundles (one tree each of 120 families), and packed in kraft bags. After transportation to the vicinity of the planting site, the bags were stored under refrigeration until planted.

Planting and Mapping

Planting.--Each block was planted by a single two man crew using a standard dibble. Randomization of families in a block was obtained by planting the seedlings in the sequence they were removed from the bag (trees were throughly mixed during packing) and by starting the planting of each block on a row picked at random.

Mapping.--Mapping of each block was done as quickly as possible after planting. The family identity of each seedling was recorded from an attached paper label along with the planting location (row and point within row). These data were double checked in the field and edited by computer for duplicate family numbers within block.

RESULTS

Survival

First year.--Two survival counts were made during the first year. The first count was done in May on about 26% of the orchard. Overall survival was estimated to be 66.5%. Both block and family survival

appeared to vary greatly. In October, a complete inventory counted 20,047 live trees for a survival rate of 66.8%. Individual families ranged from 27% to 86%. Of the 120 families, 24 had survival rates of 75% or more while 8 had rates less than 50%. Block survival ranged from 3% to 89%. The pattern of survival (by block) indicated that some mortality was not random. Of the 20 blocks in the orchard with survival below 40%, 16 were located in the southwest corner of the orchard. An exact cause for the poor survival in this area could not be determined.

Third year.--Additional mortality between the first and third year was very small. Survival was 64.2% for a net loss of 794 trees.

Growth

Third year.--Height growth for individual trees varied from less than 1 foot up to 14 feet. Mean height for the entire plantation was 7 feet with family means varying from 4.6 to 9.4 feet.

Seventh year.--Height growth continued at a rapid rate for most remaining trees. Mean height was 19.5 feet with some trees exceeding 26 feet tall. Individual family means ranged from 17.9 to 20.9 feet. Mean diameter (d.b.h.) was 2.9 inches.

Apparent Survival Mechanism

Description.--During the analysis of the first-year survival checks, inconsistencies were found in the data that indicated live trees were growing in spots previously tallied as dead. At first these were thought to be simple recording errors but a field check indicated the data was correct. Close examination of the seedlings revealed that they probably appeared to be dead during the early survival check because all foliage had turned brown and dropped off, leaving only the naked stem. At some time later, a new sprout appeared near the top of the old stem and took over as the terminal shoot. By the time of the second survival check, many of these "dead" trees appeared almost normal.

Frequency of Trait.--Since the first survival check only examined 26% of the plantation, it is not possible to determine the full extent of this trait. Comparison of data between the two first-year checks and the third-year check indicated that about 1.5% of the trees were involved. All families except one contained at least one tree that had the trait. The maximum frequency of occurence within family was 4%.

Growth.--Generally, height growth of the trees exhibiting this trait was inferior to other trees of the same family. Also, these trees were usually shorter than their neighbors in the block. There were a few exceptions where trees displayed outstanding growth and these exceptions seem to be concentrated in a few families.

Cultural Practices

In the first three years after planting, cultural practices were limited to spot control of competing vegetation and other activities to maintain the health and safety of the orchard. After the third-year measurements were analyzed, the first thinning was done. All stunted, deformed or badly overtopped trees were removed. Trees were also removed in order to improve spacing but care was taken to retain a good representation of all families. A subsequent thinning in 1984 removed more trees for spacing and rogued the four worst (in terms of height growth) families. This reduced the tree count to 7,400. Another thinning is currently underway to rogue several more of the poorest families based on combined orchard and supplemental test data.

Seed Production

Sand pine is well known as an early and prolific seed producer. By the third year after planting, several cones were observed on scattered trees. A majority of the trees were producing a few cones at the fifth year. The 1984 cone crop was estimated at 10 bushels per acre. Any serious effort to collect these cones has been precluded by the relatively dense and irregular spacing of the trees.

DISCUSSION

Successful establishment and maintenance of a large seedling seed orchard involve complex and demanding tasks that must be done at the proper time. Orchard development will be very rapid for a species such as sand pine. Frequent inventories and measurements are necessary in order to plan for thinnings and roguing. These data can also provide additional insight into the species and the population being grown.

For example, Ocala sand pine is difficult to transplant. Nevertheless, our data indicate considerable variation in survival by family. This information should be of value for both future testing and regeneration.

The apparent survival mechanism displayed by a small number of trees is interesting but it will probably have little influence in this orchard. Poor height growth by most of these trees has resulted in their removal during the first or second thinning. On the other hand, knowledge of the existence of such traits may be useful when selecting for tolerance to unfavorable site conditions.

A seedling seed orchard will never be as neat and tidy as its clonal counterpart. The close spacing during early development makes any vegetation management practices very difficult. The manager should be prepared to do much of the early thinning by hand. Mortality and removals due to thinnings are almost always randomly spaced so mowing and cone collection may be hampered for several years.