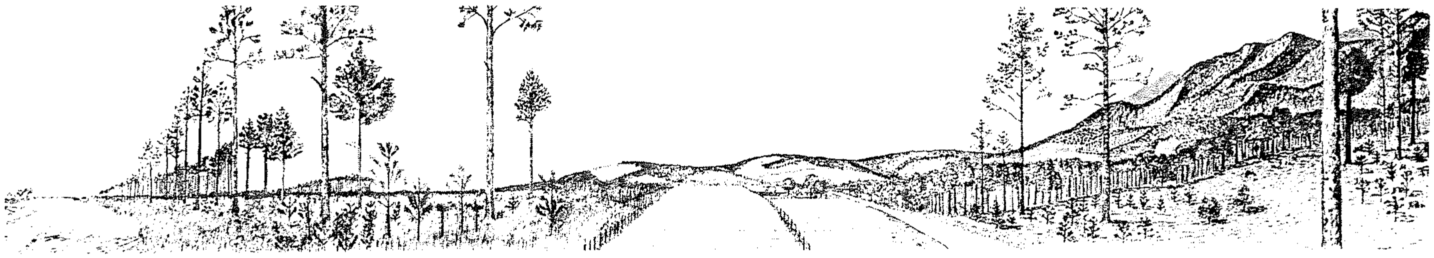

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ASSESSING THE POTENTIAL OLEORESIN YIELDS OF SLASH PINE PROGENIES AT JUVENILE AGES

Abstract.--The potential oleoresin yields of slash pine progenies can be assessed at juvenile ages, 7 to 8 years earlier than with previous methods. Seeds are sown in peat pots, outplanted shortly after germination at a spacing of $1\frac{1}{2}$ by 3 feet, and given intensive cultural treatment. At $2\frac{1}{2}$ years from seed, when the trees average about 9 feet tall, their potential yields are evaluated by a miniature chipping technique.

The rate of genetic gain in most tree improvement programs depends largely on how early the families in progeny tests can be reliably evaluated. Forest geneticists, therefore, are constantly on the alert for methods of assessing trees at juvenile ages. In a recent exploratory study, it was found that such an assessment can be made of the potential oleoresin yields of slash pine (*Pinus elliottii* Engelm.) progeny. With the technique described herein, progenies can be evaluated when the trees are about 3 years old instead of waiting until they are 10 years old or older.

PROCEDURE

Seeds of nine families and two control lots of commercial seed were utilized in the study. Estimates of the oleoresin-yielding potential of the nine families were available, having been determined by standard chipping techniques employed on the parent trees or on their mature progenies planted in earlier tests. The expected yielding ability of the two control lots was assumed to be average. The 11 seed lots represented a wide range in yielding potential, as indicated by the parental yield ratios (table 1).

The seeds were sown in 3- by 3- by 3-inch peat pots in a greenhouse in March 1963. About a month later, the seedlings were transplanted to a nursery bed, at a spacing of $1\frac{1}{2}$ by $1\frac{1}{2}$ feet. Eleven row plots of 3 seedlings each, one row from each of the 11 seed lots, were randomly distributed in a complete block. Ten replications of the block were planted. The trees were irrigated, fertilized, and cultivated to stimulate rapid growth.

In July of the following year, assessment of the potential yields of the trees was begun. The trees at this time averaged about 5 feet tall and about 1 inch in d.o.b. at 6 inches above the ground. Cambium-depth wounds, each $\frac{1}{2}$ inch square, were made on the lower stem of each tree at weekly intervals for a total of 7 weeks. The oleoresin was collected in 19- by 65-mm. shell vials which were fastened to the stems just beneath the lowermost wound. The procedure is similar to one used in tapping rubber trees (*Hevea brasiliensis*) (Thompson 1941).

RESULTS

The oleoresin yields of the various progeny corresponded closely with the yields of their parents (table 1). Because of a significant (0.01 level) correlation between oleoresin yield and stem d.o.b., the data were analyzed by covariance methods. Family differences in yield were significant (0.01 level) both before and after adjustment.

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U.S. Department of Agriculture-Forest Service

Table 1.--Oleoresin yields of progenies compared with estimated parental yields

Seed lot number	Progeny	Parental yield ratios[1]	Unadjusted progeny yields	Progeny yields adjusted for d. o. b.	Progeny yield ratios[2]
			Grams	Grams	
1	G-2 x G-1	2.06	3.28	3.36	1.66
2	G-4 x G-1	2.06	3.05	3.18	1.57
3	G-1 x polymix[3]	1.82	3.45	3.29	1.62
4	G-2 x polymix[3]	1.76	2.31	2.35	1.16
5	G-4 x polymix[3]	1.76	2.77	2.67	1.32
6	G-6W-413 x wind	1.08	2.00	1.94	.96
7	G-6W-3105 x wind	1.30	2.00	1.98	.98
8	G-126 x polymix[3]	1.12	1.83	1.69	.83
9	G-159 x polymix[3]	1.28	2.32	2.26	1.12
10	SR-1, 59S[4]	1.00	1.85	1.98	.98
11	GA-13C, 57S[5]	1.00	1.95	2.07	1.02

[1] These ratios were determined by dividing the average yield of the parents of each family by the average yield of typical trees of the same d.b.h. The commercial lots (10 and 11) were arbitrarily assigned a value of 1.00.

[2] Adjusted yields divided by the average of the two commercial controls.

[3] A mixture of pollen from 21 trees whose gum-yielding ability was moderately superior (52 percent) on the average.

[4] A commercial seed mix from Florida.

[5] A commercial seed mix from Georgia.

As a further statistical check, the adjusted family means were converted to yield ratios for which the average of the two control lots served as a base (table 1). Then the correlation coefficient between these progeny yield ratios and the corresponding parental yield ratios was computed and found to be 0.90, significant at the 0.01 level. Wettstein (1958) also found a high correlation in resin flow between 6-year-old progeny and their mother trees.

SUBSEQUENT TESTS AND CONCLUSIONS

The results strongly suggested that the oleoresin yield of young trees as tested by the technique described is reflective of the yield that would be obtained at more mature ages. The technique is therefore considered to be useful for the screening of parent trees on the basis of the performance of their progenies at juvenile ages.

Since the exploratory experiment was conducted, several similar progeny tests have been established in connection with our regular breeding program. These tests have led to some revisions of techniques, as follows:

1. Spacing has been increased to $1\frac{1}{2}$ by 3 feet, and chipping is done in the summer of the third year instead of in the summer of the second year. At this age ($2\frac{1}{2}$ growing seasons), the trees average about 9 feet tall (fig. 1A).

2. Circular instead of square wounds are now applied (fig. 1, B and C). These are 19 mm. in diameter and are made with a specially designed tool.[1] Immediately after the wound is made, a bead of 60-percent sulfuric acid paste (Clements 1966), about the size of a grain of rice, is placed in the center of the wound (fig. 1D). Then the vial is inserted and fastened with a rubber band (fig. 1, E and F). With this improved technique, only two wounds per tree, applied at weekly intervals, are necessary.

[1] Designed and made by Mozon T. Proveaux, Instrument Maker, at the Naval Stores and Timber Production Laboratory, Olustee, Fla.

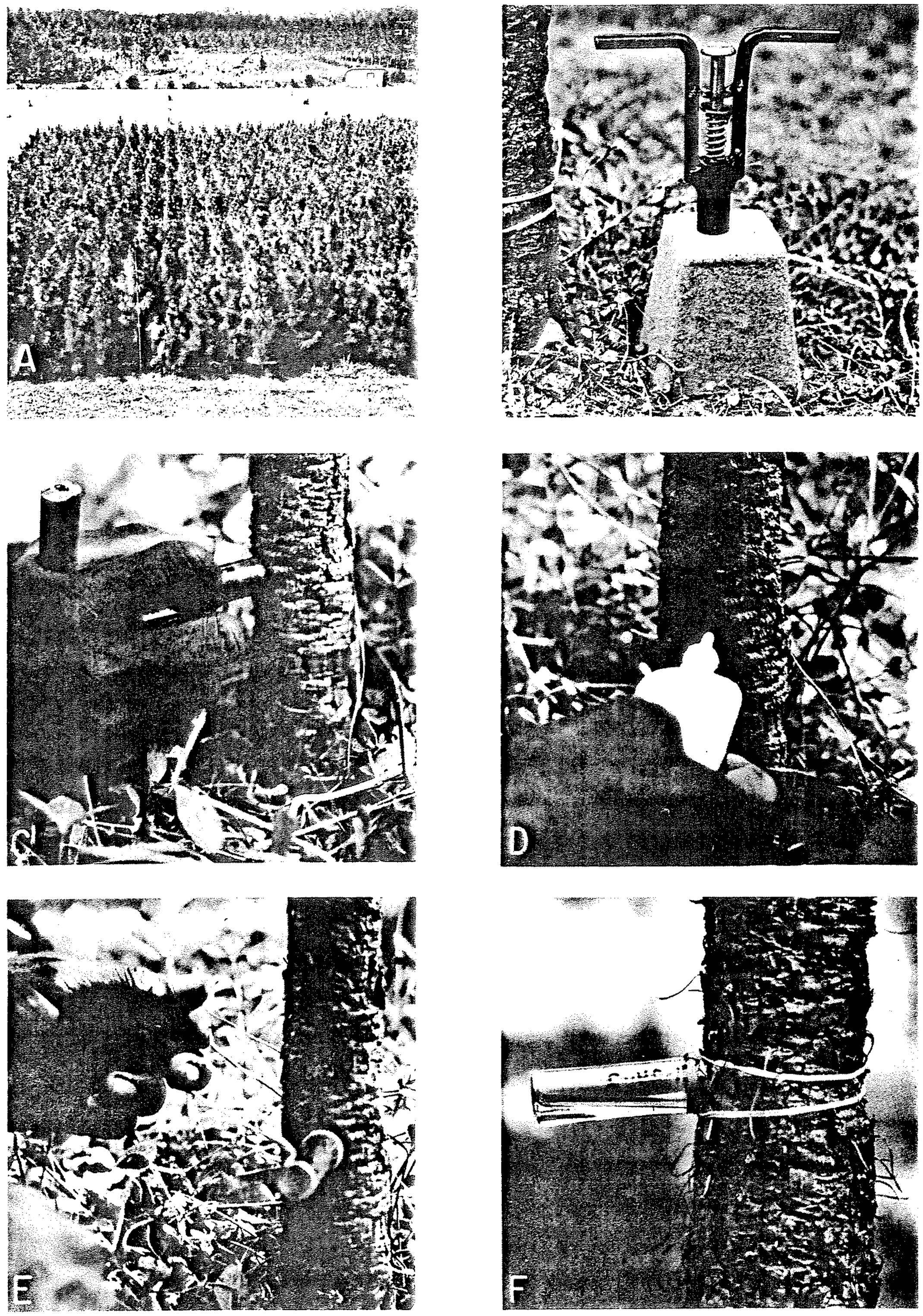

Figure 1. --Assessing the potential oleoresin yields of slash pines at $2\frac{1}{2}$ years from seed. A--The plantation at time of chipping; spacing is $1\frac{1}{2}$ by 3 feet; B--The tool used in wounding the tree; C--Making the wound; D--Applying sulfuric acid paste to the wound; E--Fastening the vial to the tree; F--Completed setup.

The possibility of assessing other traits, such as growth rate and branching habit, in conjunction with this technique is also being investigated. Large family differences in height growth are being noted at $2\frac{1}{2}$ years (fig. 2). These juvenile growth differences are partly genetic in nature and undoubtedly would be important in commercial plantings. But we have yet to determine whether or not they are reflective of differences that may be found at maturity.

Figure 2.--At $2\frac{1}{2}$ years, some families, such as the three tallest trees shown above center, are 25 percent taller than surrounding families.

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