MASS PRODUCTION OF SHORTLEAF X SLASH PINE HYBRIDS BY POLLINATING UNBAGGED FEMALE FLOWERS

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A simple method of mass-producing shortleaf x slash pine hybrids was attempted. Large quantities of slash pine pollen were spread on unbagged shortleaf flowers in the hope of recovering a high percentage of hybrid progeny and thus materially reducing the cost of producing such hybrids by conventional controlled pollination. The hybrid is very promising, but, as Snyder and Squillace (1965) have shown, seed yields from controlled pollinations have averaged only 8.5 sound seeds per cone.

Methods

The shortleaf pines were 10 natives in the Hodges Gardens and Experimental Area, Sabine Parish, Louisiana. They were open-grown, between 24 and 38 feet tall, and were flowering prolifically. One or more other shortleaf trees were within easy pollen flight of each.

The slash pine pollen was a mix of 1960 collections from several planted and native trees in central Louisiana and south Mississippi. Germination tests proved it highly viable. In April 1960, when the flower buds were large, examinations were made at intervals of 1 to 3 days to determine the optimum pollination time. When about one-third or more of the female flowers on a tree were receptive, the first application was made. The trees showed distinctive patterns of flowering; some matured the majority of their flowers almost simultaneously, others had flowers in several different stages at each re-examination and never had a large percentage receptive at one time. Thus, each tree was mass-pollinated from 1 to 4 times, depending upon the number of female flowers that were receptive at any one time.

The pollen was applied with an insecticide duster equipped with a 20-inch removable extension and an adjustable fishtail nozzle. The operator began at the top of the tree and worked downward. The duster held 75 cc of pollen and was easily reloaded in the tree. It was possible to cover practically the entire accessible portion of any of the 10 trees with 150 cc of pollen in an average time of 10 to 11 minutes. Tips of a few of the longest branches were missed, particularly when there was much wind. Missed branches were tagged so that they could be identified when cones were collected. To avoid wind, most of the work was done between 6:00 and 9:00 a.m.

Controlled pollinations with the same slash pine pollen were made on each tree to provide check material of known hybridity.

In the fall of 1961 all cones from controlled pollinations, and 40 cones from throughout the mass-pollinated portion of the crown of each tree, were collected. Seed was extracted and a sample from each lot was sown in the Harrison Experimental Forest Nursery near Gulfport, Miss., in the spring of 1962. The controlled- and mass-pollinated seeds from each tree were sown in adjacent rows to permit comparison with minimum effects of variation in nursery soil. At time of lifting, the seedlings resulting from mass pollination were separated into three groups per parent tree: putative hybrid, putative shortleaf, and undetermined. Those from each tree were classified by comparing them with their controlled-pollinated checks. Length, thickness, and straightness of needles, overall dimensions, and presence or absence of basal stem crook were the more important characteristics for classification.

The three groups of seedlings were then planted in the field, the mass-pollinated seedlings and the controlled-pollinated hybrid checks from the same female parent being placed in adjacent rows to facilitate final determination of hybridity.

Results

After 2.5 years in the field, an average of 10.7 percent of the seedlings resulting from mass pollination showed definite evidence of hybridity (fig. 1 and table 1). Differences in numbers of hybrids among the individual-tree progenies were analyzed by chi square and were significant at the 1-percent level.

Practically all the hybrids that were evident in the field, were in the group classified as hybrid in the nursery. During the first year in the field, however, it became clear that many non-hybrids had been included in the hybrid group. To improve classifying techniques, surplus seed from the study was sown in 1963 and the seedlings classified after one growing season in the nursery. Fifteen percent were judged to be hybrids, an estimate in fairly good agreement with the field result of 10.7 percent. It appears, therefore, that with some experience nursery separation of shortleaf x slash pine hybrids is practical.

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Table 1,-- Estimation of number of shortleaf (female) X slash (male) pine hybrids in individual-tree progenies produced by artificial pollination without bagging female flowers

Parent tree	Seedlings in progeny	Designated hybrid after 2.5 years in field,	
	Number	Number	Percent
A	59	1	1.7
B	78	16	20.5
C	56	6	10.7
D	79	17	21.5
E	58	7	12.1
F	50	4	8.0
G	44	3	6.8
H	83	1	1.2
I	54	4	7.4
J	75	9	12.0
Mean	63.6	6.8	10.7

The mass-pollinated cones yielded an average 13.2 full seeds, the controlled-pollinated cones 6.6. As 10.7 percent of the mass-pollinated seeds were hybrids, an average of about 1.4 hybrids (10.7 percent x 13.2) were produced from each mass-pollinated cone, versus 6.6 hybrids from each controlled-pollinated cone.

While comparative costs were not determined, the mass-pollinated cones required from one to four trips to each tree for pollination plus a total of about 20 minutes' climbing time per tree. This probably would compare favorably with the cost of producing equal numbers of hybrids by controlled pollination. In addition, the present results indicate that the mass-production method can be improved, either by selecting shortleaf parents for compatibility with slash pine, by culling non-hybrids in the nursery, or by a combination of both.

If mass pollinations were carried out only on trees like B and D (table 1), which yielded 20 percent hybrid progeny, the technique would certainly be more economical than controlled pollination.

The cost of nursery-culling non-hybrids could be eliminated if hybrids and non-hybrids were planted together. As Righter (1946) has pointed out, planting a mixture of hybrids and of a species considered well adapted to the planting site would test the performance of the hybrids and at the same time assure the landowner of an adequate stand even if the hybrids failed. If the hybrids outperformed the non-hybrids, they would eventually comprise most of the crop trees in the mature stand even if they had originally been in the minority.

FIGURE 1. — Shortleaf x slash pine hybrid (left) and shortleaf pine (right), both from same female parent, after 2.5 growing seasons. Note the long, straight needles and heavier branches of the hybrid.

Literature Cited

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