INFLUENCE OF ROOTSTOCK ON FLOWERING IN SHORTLEAF PINE

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Most of the improvement programs for southern pines involve the establishment of grafted seed orchards from scions of phenotypically superior trees. Horticulturists have long known that rootstocks have profound effects on fruit tree scions, and have applied this knowledge to induce early and prolific flowering and to control tree size (Sax 1958). If rootstock effects exist in pines, they may offer means to increase the productivity of grafted seed orchards.

To examine the possibility that rootstocks affect flowering, I counted the number of flowers on shortleaf grafts in two 7-year-old plantations that included shortleaf, slash, and loblolly pines grafted in all combinations of scion and rootstock. Only the shortleaf-top grafts were included, as it was too late in the year to score for flowering in the other two species.

The scions and rootstocks had been grafted as seedlings and outplanted in 1961 at 11- by 11-foot spacing in randomized designs. The plantations were cultivated and fertilized for the first 5 years, and mowed regularly thereafter. Insecticides were applied to prevent damage by tip moth. In general, the trees were growing under conditions that would be found in most seed orchards.

The original purpose of the plantations was to test the effect of rootstock on height growth, but after 5 years there were no significant height differences in the shortleaf-top trees (Allen 1967). When these tops were scored for flowering in the spring of 1968, they averaged 20 feet in height. Flowering had been observed as early as the fourth year, but no counts had been made.

The shortleaf scions flowered best on loblolly rootstocks: 93 percent of the tops had flowers, and the average number of flowers per top was 60.1. Performance was poorest on slash rootstocks, with 47 percent flowering and an average of 32.8 flowers per tree. Tops on shortleaf rootstocks were intermediate, with 67 percent flowering and an average of 45.2 flowers per tree.

The range in number of flowers per tree was so great--from 0 to 380--that it was not possible to determine if averages for the three rootstocks differed significantly. The differences in numbers of trees flowering, however, were significant (table 1).

The log-likelihood ratio test (Woolf 1957) for a 2 $\times$ 3 contingency table gave a chi-square value of 7.548 with two degrees of freedom. The probability of getting this chi-square value by chance alone is less than 0.025.

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Table 1.--Flowering response of shortleaf pine scions, after 7 years in the field

Rootstock	Trees with flowers	Trees without flowers
	Number	Number
Shortleaf	6	3
Slash	7	8
Loblolly	13	1
$\chi^2 = 7.548$*	$0.025 > p > 0.02$	

If we consider the number of trees showing any evidence of flowering, including not only flowers but conelets and old cones as well, the results are consistent with the flowering data and still significant (table 2). All of the shortleaf on loblolly rootstocks showed some evidence of reproduction, whereas only 60 percent of those on slash rootstocks and 78 percent of those on shortleaf rootstocks did.

Table 2.--Cumulative reproductive response of shortleaf grafts, after 7 years in the field

Rootstock	Trees with flowers, conelets, or cones	Trees with no evidence of reproduction
	Number	Number
Shortleaf	7	2
Slash	9	6
Loblolly	14	0
$\chi^2 = 6.779$*	$0.05 > p > 0.025$	

Since the plantations were small and not designed to test flowering, it would be premature to recommend loblolly rootstocks for shortleaf pine seed orchards on the basis of these results. The differences are large enough, however, to warrant further work, and a systematic search for a standard rootstock to be used with each pine species might be profitable.

LITERATURE CITED

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