GROWTH OF LOBLOLLY SCION MATERIAL ON ROOTSTOCKS OF KNOWN GENETIC ORIGIN

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Abstract.--Scion material was collected from compatible and incompatible loblolly ramets and grafted onto known families of loblolly and slash pine. Early evaluation of scion growth indicated significant differences between the two clones used as a source of scions. No difference was observed between rootstock species, although families within rootstock species did show to influence the growth of the scion material. Graft survival was 93.1 percent and was not statistically analyzed.

Additional keywords: Grafting, graft development, vegetative propagation, Pinus elliottii, P. taeda.

Studies involving forest species have indicated that scion growth and performance may be influenced by the type of rootstock used. Allen (1967) reported that loblolly pine (Pinus taeda L.) rootstock increased growth of shortleaf pine (Pinus echinata Mill.) scion material in comparison to shortleaf rootstock. The number of graft failures was also lower in the shortleaf-loblolly combination. In a study involving different species as rootstocks and scions, Ahlgren (1972) observed that white pine (Pinus strobus L.) rootstocks were frequently associated with rapid scion growth while red pine (Pinus resinosa Ait.) rootstocks demonstrated the opposite effect. Different species of rootstocks have also shown to affect the flowering behavior of the scion (Schmidtling 1973).

In order to further evaluate the influence of rootstock upon scion development, this study was established using genetically identified sources of loblolly and slash pine (Pinus elliottii Engelm.) as rootstocks.

METHODS AND MATERIALS

To provide genetically identified rootstock, seeds from four families of loblolly pine and two families of slash pine were collected from orchard ramets. Both open-pollinated and control-pollinated families were selected. Planting was done at the Indian Mound Nursery near Alto, Texas in May, 1972, and the seedlings were allowed to grow for one year under normal nursery conditions.

In March, 1973 scions were collected from two different clones in a 10-year old loblolly scion bank. These two clones were selected solely on the basis of their having incompatible ramets from which to collect scion material. Cuttings were obtained from both a compatible ramet and an incompatible ramet for each of the selected clones, with incompatible ramets identified by a stunted, chlorotic appearance. Neither incompatible ramet exhibited signs of

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severe union deformation, although one did show a slight swelling immediately above the union.

Following collection, cuttings were put into plastic bags and placed on ice for transporting to the nursery. A side graft was used, similar to the procedure described by Webb (1961). Completed grafts were covered by a polyethylene bag, with a small amount of commercial insecticide dusted inside each bag to control insects. Bags were subsequently removed following development of "pin-feather" needles on the scion, or upon death of the scion. The rootstock was later pruned to allow the scion to attain dominance.

A total of 290 grafts were made with 130 being made on loblolly rootstock and 160 on slash rootstock. Length of the scion was measured at the time of grafting to allow for a later determination of growth. An evaluation of graft survival and measurements of scion growth were made on July 15, 1973.

RESULTS

Only 20 of the 290 grafts died prior to July 15, 1973. Nine of the dead grafts were on loblolly rootstock, and 11 were on slash rootstock. Because of the small number of dead grafts, no statistical analysis was performed.

Average scion growth for the various graft combinations was obtained. A summary of this data for each of the main effects is given in Table 1. Analysis was performed using the least-squares regression method of the Statistical Analysis System (Barr and Goodnight 1972), and is presented in Table 2. Statistical significance was observed for differences between scion clones, between compatible and incompatible ramets, and among families within species. Differences between rootstock species and for various interactions were not observed.

Table 1--Average scion growth (cm.) for main effects of clonal scion material grafted onto known rootstock

Main Effect	Classification	Average Scion Growth (cm.)
Scion clone	D3PT10	16.2
	D3PT16	12.7
Ramet compatibility of scion clone	Compatible	16.4
	Incompatible	11.8
Rootstock species	Loblolly	14.7
	Slash	13.9
Source within species (loblolly)	6-44 x Open	17.6
	4-14 x 10-2	13.6
	10-2 x W	13.4
	5-6 x 15-10	12.7
(slash)	D12PC29 x Open	14.3
	D12PC93 x Open	13.5

Table 2--Analysis of variance for scion growth of clonal scion material grafted onto known rootstock

Source	d.f.	S.S.	M.S.	F Value
Scion clone (Scl)	1	807.48	807.48	20.05**
Ramet compatibility (Comp)	1	1310.32	1310.32	32.54**
Rootstock species (Rs)	1	103.27	103.27	2.56
Source within rootstock species (S)	4	397.09	99.27	2.47*
Scl x Comp	1	.24	.24	.01
Scl x Rs	1	4.53	4.53	.11
Scl x S	3[1/]	198.36	66.12	1.64
Comp x Rs	1	67.94	67.94	1.69
Comp x S	4	236.76	59.19	1.47
Error	247	9943.57	40.26	
Total	264[2/]	13069.56		

* Denotes significance at .05 level of probability
** Denotes significance at .01 level of probability.

1/ Scion clone D3PT10 was not grafted onto loblolly source 5-6 x 15-10.
2/ Five grafts could not be measured due to a broken terminal bud.

DISCUSSION

Excellent graft survival was observed approximately four months after grafting. This response is attributed to the use of previously grafted material as scions, grafting by experienced personnel, and proper aftercare. Because grafts continue to die throughout the first growing season, no conclusions could be made.

The observation that scion clone D3PT10 produced significantly more growth than did clone D3PT16 suggests that clonal differences for scion growth may be expressed early in the life of the graft. Field observation of the two clones in the scion bank indicated that any initial differences in growth had disappeared after 10 years, which is most likely due to a moderating effect of intense orchard management.

Scions collected from compatible ramets performed better than did material collected from incompatible ramets. Since the cuttings are genetically identical for each clone, this response is assumed to be the result of decreased vigor in incompatible ramets. Other mechanisms such as infectious viruses or toxic compounds associated with the rootstock of the original ramet cannot be eliminated on the basis of this study, and thus should be considered as possible contributing factors.

Although no difference was observed between the two species used as rootstock, families within species demonstrated a significant effect with loblolly source 6-44 x open resulting in the most scion growth. Determination of whether or not this difference persists over a period of time would require future evaluation, however the important point is that rootstock genotype did influence the growth of the scion material during the first growing season after grafting. Such a response indicates a definite need to select a satisfactory rootstock source prior to the initiation of a grafting program.

The effect of different rootstock families implies that by establishing breeding programs for specific genotypes to be used as rootstock, it may be possible to more precisely control graft development. In addition, such problems as graft incompatibility may also be overcome.

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