RAPID GROWTH AND HIGH SURVIVAL SHOWN IN (POPULUS ALBA X P. GRANDIDENTATA) X P. TREMULOIDES SEEDLINGS

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Additional keywords: Hybridization, rooting, aspen.

Abstract.--Seed produced by controlled pollination of (Populus alba x P. grandidentata) x P. tremuloides showed 85% germination, growth rates up to 6 cm./day in greenhouse, and 79% field survival. Preliminary results also indicate that some clones may root more easily than most aspen clones.

BACKGROUND

The cross between Populus alba and Populus grandidentata has been made (Einspahr 1964) and has been discovered growing wild in Iowa (Little 1957, McComb 1954). The cross between Populus grandidentata and Populus tremuloides has also been made (Einspahr 1964). However, one cross that, to my knowledge, has not previously been reported is the hybrid (Populus alba x P. grandidentata) x P. tremuloides.

Any genetic improvement program is dependent upon the amount of genetic variation present in the population. By increasing the variation within a population, the amount of improvement possible is also increased. There is also evidence that heterozygosity, in and for itself, is a desirable trait in selecting a perennial that will occupy a site for long periods (Wright 1976).

For these reasons, in attempting to produce offspring from one of the hybrid Populus alba x P. grandidentata clones available at the Iowa State Nursery, I chose to try to add yet a third species to the parentage: Populus tremuloides

METHODS

Flowering branch cuttings from the Populus alba x P. grandidentata cross were collected on March 14, 1976 and placed in a growth chamber. After the foliage emerged, the female clone was tentatively identified as CRANDON, NC 5339.

Branch cuttings had a fresh portion of stem cut every two days at which time the humidifier was refilled and the interior of the growth chamber sprayed with distilled water. When female flowers were receptive, they were pollinated using a small paint brush with Populus tremuloides pollen forced and collected earlier. Fruit set was good with most of the flowers developing into pods. Approximately 500-1,000 seeds were collected from approximately 100 catkins. Catkins were collected in a sack, allowed to finish opening and refrigerated. Seed was extracted from the catkins by rubbing it through a fine mesh soil screen. A

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germination test showed 86% germination within 48 hours.

The seedlings were allowed to grow in the flats approximately three weeks until they had attained an average height of six cm. They were then transplanted into four-inch peat pots filled with a 2:1 mix of coarse vermiculite and fine ground peat with slow release fertilizer. Within another three-week period they attained an average height of 20-25 cm.

To test field survival and growth 140 seedlings were planted on a dry sandy southwest aspect site located at Big Creek State Park approximately 20 miles south of Ames. The soil organic matter content was 1.5%, phosphorous 14 kg/ha, and potassium 80 kg/ha. No supplemental fertilizer was added. The site was plowed to a depth of approximately 6" and then tilled to a depth of 4". Plants were set out June 6, 1976. Spacing was 1 meter x ½ meter. Weed control was achieved by hoeing 2 weeks after planting and then again 5 weeks after planting. Weather conditions at planting time were very dry and the seedlings had not been properly hardened off for field planting. Most died back at least 10 cm. and re-sprouted from axillary buds.

Twenty-five seedlings that were not field planted were transplanted to 12" pots and put on a near optimum fertilizing and watering schedule in the greenhouse to check for optimum growth rates.

RESULTS

Field growth and survival

Table 1 shows the average growth rates of the 109 seedlings that survived the summer. Many seedlings got off to a poor start because of the adverse planting conditions. Later growth was slowed by the extremely dry soil prevailing during most of the growing season. Even under these adversities, survival was 79% and growth rates, shown in Table 1, although not spectacular, were respectable.

Table 1.--Average field growth of (P. alba x P. grandidentata) x P. tremuloides (cm. /day)

June 25	July 15	July 24	Aug. 6	Aug. 16
.55	.95	.96	1.03	.74
cv[a] = 74%	cv = 63%	cv = 70%	cv = 57%	cv = 138%

[a] coefficient of variation

These averages are deflated considerably by the number of seedlings that were nipped back by rabbits and thus had negative growth rates during some periods. Also some seedlings stopped growing and set bud during Period 5, and thus had zero growth. The average growth rates for the 10 best seedlings, shown in Table 2, may prove more indicative of the true potential growth.

Table 2.--Average field growth of top 10 seedlings (cm./day)

June 25	July 15	July 24	August 6	August 16
1.27	1.81	1.74	1.92	1.84

Greenhouse growth trial results

The greenhouse growth trials, being closer to optimum conditions, produced several times the growth rates of field tests.

Because no standard North Central region clones were included in these tests, I compared my results with an earlier study conducted by Dr. Paul Wray in 1974. He evaluated 25 clones that have been used in the North Central region. Most of these clones were of the cottonwood family, but they are otherwise highly comparable as the trials were conducted in the same greenhouse under nearly identical fertilization and watering schedules. It should also be pointed out that Wray's materials represent clones that have already been tested extensively and chosen as superior while my seedlings are ½ sib offspring of one improved parent and quaking aspen male parents of unknown quality. Table 3 shows the growth rates measured in cm./day for the period of time where Dr. Wray's trials overlapped my own. The dates given are the approximate mid points of each measurement period.

Table 3.--Comparative greenhouse growth rates (cm./day)

	June 17	June 24	July 3
North Central clones	3.21	4.07	4.28
(*P. alba* x *P. grandidentata*) x *P. tremuloides* seedlings	2.48	3.67	4.30

During the final measurement period the seedlings had caught up and passed the North Central clones.

During the first two measurement periods, the hybrid seedlings did lag behind the selected clones. So I felt it might be informative to examine the top 5 seedlings of each group. This data is presented in Table 4.

Table 4.--Average growth of best 5 North Central clones and (P. alba x P. grandidentata) x P. tremuloides seedlings (cm./day)

	June 17	June 24	July 3
North Central clones	3.99	4.89	5.02
Seedlings	3.65	4.82	5.72

Rooting information

One complaint often voiced about the aspen group is that many, if not most clones, are difficult to root from greenwood cuttings or hardwood cuttings. A rooting study now underway indicates that this problem exists for this new group of clones. Several, however, show some promise of improved rooting. Figure 1 shows the between clone variation in rooting from tip cuttings. Although not as good as the cottonwood group, this does indicate that specific clones within the aspen group may be propagated asexually, by greenwood cuttings thus allowing the breeder to capture all of the superiority of a given genotype.

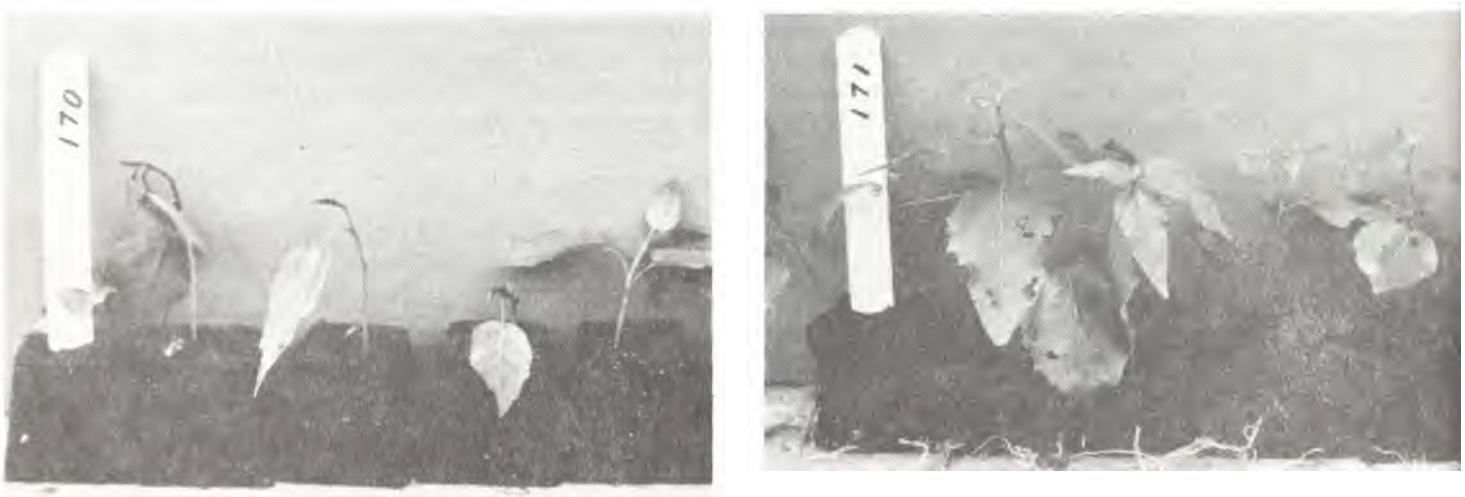

Figure 1.--Clonal variation in rooting.

Interpretation of results

These results are based on preliminary studies and must be regarded as such. Perhaps some of the clones produced will prove to be superior in field trials to those already under study. All three parent species are well adapted to dry conditions. The results of the field trials indicate that this drought resistance may well have been passed along or even increased in the hybrids. In a broader interpretation, these studies reemphasize that a vast ocean of genotypes are still out there awaiting discovery or creation.

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