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Performance of Willow Clones on Sharkey Clay

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SUMMARY

Random clones of black willow (*Salix nigra*) and sandbar willow (*S. exigua*) from near Stoneville, MS and of *S. argentinensis* and *S. babylonica* X *S. alba* were grown on Sharkey clay near Stoneville, MS for 11 years. *S. babylonica* X *S. alba* grew best throughout the period. *S. nigra,* severely damaged by the cottonwood leaf beetle at age 1, was performing well by age 11, while the single clone of *S.* X *argentinensis* and 2 of the 3 clones of *S. exigua* had died.

Additional keywords: interspecific hybrids, selection, asexual propagation, *Salix* sp.

INTRODUCTION

Black willow (*Salix nigra* Marsh.) abounds along streams and in wetlands throughout the eastern United States and adjacent parts of Canada and Mexico (McKnight 1965). Because of the tolerance to flooding, it thrives where little else grows. Along the lower reaches of the Mississippi River, the better specimens are sawed and the lumber brings prices as high as $1000/mbf. Occuring in stands too dense for good growth, the majority of the trees are never harvested because of hidden defects, primarily ring shake.

Black willow is dioecious, easy to cross, easy to propagate by seedlings or asexually from dormant cuttings, and sexually mature as early as age 1 or 2. Its early sexual maturity interests tree breeders. Abundant genetic variability and the general low quality of the species suggest that it would benefit from improvement efforts. Insufficient demand for the present low quality material fails to justify tree improvement for a species so naturally abundant. Nevertheless, breeders will likely want to work with willow, if only as an experimental tool. Growers of other hardwood species may be interested in it as a potential species to plant in areas too poorly drained or otherwise unsuitable (sewage disposal plants) for other species.

To supply information on growth potential, a small willow clonal test was established by the Southern Forest Experiment Station near Stoneville, Mississippi in anticipation of this need. Performance through age 11 is reported here.

MATERIALS AND METHODS

Experimental materials consisted of unrooted cuttings of 49 *Salix* sp. clones as follows:

43 black willow (*Salix nigra*) clones
- 14 female
- 16 male
- 13 of unknown sex

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3 sandbar willow (*Salix exigua* Nutt.) clones[1]
3 interspecific hybrid clones
1 *Salix* X *argentinensis* (*Salix babylonica* L. X *Salix humboltiana* Willd.)
2 *Salix babylonica* X *S. alba* L.

The black willow and sandbar willow clones all come from random trees from natural stands in the general vicinity of Stoneville. The hybrids were received from Dr. Arturo Ragonese of the National Center of Agricultural Investigations at Cestellar, Argentina and maintained in a clonal nursery at Stoneville.

Cuttings of the female and 16 male black willow clones came directly from 30–40 year old trees. The 13 black willow clones of unknown sex and the 3 sandbar willow clones were obtained directly from 2–3 year old trees. Cuttings of the hybrid willows were made from one year old regrowth taken from 2 year old nursery rootstock.

The experiment was installed in 1970 as a randomized complete block design with six replications of single tree plots using unrooted cuttings planted at 10 by 10 feet spacing. The site was a recently cleared Sharkey clay (a very fine, montmorillonitic, nonacid, thermic Vertic Haplaquept) on the Delta Experimental Forest at Stoneville, MS. Internal drainage is poor, and the very low site is subject to summer flooding.

Nineteen of the clones were planted from dormant cuttings on March 12. The 30 black willow clones of known sex were planted as freshly collected, nondormant branch cuttings from 30–40 year old trees on May 1. Because of the differences in cutting materials and planting dates, the two groups are not directly comparable and should probably be considered as two separate interspersed experiments.

Data were collected on cottonwood leaf beetle (*Chrysomela scripta* F.) defoliation, height at age 1, and diameter at breast height (dbh) at ages 4 and 11. At each age, data were subjected to missing plot computations (using Yates' approximation, Steel and Torrie, 1960) after exclusion of the clones with poorest survival but prior to computation of means and analysis of variance. At age 11, severe mortality excluded two entire replications.

Age 4 dbh data were subjected to more detailed analysis in comparing black willow, sandbar willow, *S.* X *argentinensis* and *S. babylonica* X *S. alba.* The 30 late-planted black willow clones were considered separately and only means were computed. Analyses of variance for each of the other groups was conducted separately. Comparisons among groups of clone means were made using an unequal variance, unequal replication "t" test (Steele and Torrie 1960) at the .05 level.

RESULTS

Age 1 height and defoliation results (Randall 1971) are included here for comparison and discussion. Only 45 of the original 49 clones survived to the end of the first growing season. The total remaining clones dropped to 40 by age 4 and further decreased to 31 clones by age 11.

Results of t-test comparisons of age 4 dbh revealed that each group mean was significantly different from each other group mean at the .05 level (table 1).

The *S. babylonica* X *S. alba* hybrid clones outperformed all other species/hybrid groups and individual clones tested. When examined closer, these clones also proved to be quite branchy and of general poor quality. The age 11 mean dbh adjusted for missing plots was 7.6 inches (table 1). The best tree of this hybrid averaged 10.9 inches, 4.4 inches better than any other clone. The elimination of two replications resulted in a low mean for the other hybrid clone.

The single *S.* X *argentinensis* clone showed early promise of performing as well or better than the native group of black willow clones planted from cuttings of 2 or 3 year old trees, but it died out by age 11.

The sandbar willow group of clones ranked best for age 1 height and high for cottonwood leaf beetle resistance, but, like the *S.* X *argentinensis* clone, this trend did not carry through to age 11. Only 1 of the original three sandbar willow clones was still alive at age 11 and that one ranked lower than the means of the other groups planted from comparable material. The best tree of the sandbar willow was only 5.6 inches for age 11 dbh.

The native black willow clones were poorest for age 1 leaf beetle resistance, but performed adequately for growth throughout the experiment. A few individual clones ranked above the experiment mean for both age 4 and age 11 dbh. The best tree at age 11 was 8.7 inches dbh. When only those clones

[1]These clones were classified as *Salix interior* Rowlee by Randall (1971).

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Table 1.—*Summary of character means by species or hybrid group for Delta Experimental Forest willow planting*

Species or hybrid	Character			
	Age 1 defoliation (%)	Age 1 height (ft)	Age 4 dbh (in)	Age 11 dbh (inches)
Black willow (*Salix nigra*)	69	5.6	2.0	4.9
Male	78	5.0	1.6	4.6
Female	55	4.6	1.9	4.4
Juvenile (sex unknown)	71	7.0	2.5	5.4
S. X *argentinensis*	52	6.1	3.1	.....
Sandbar willow (*S. exigua*)	9	9.4	2.2	5.2
S. babylonica X *S. alba*	5	8.6	4.7	7.6

planted from 2 to 3 year old trees are considered, the potential of black willow appears more favorable. The mean of these clones was 0.5 inche dbh better than the mean of all black willow clones at age 11. A few individual clones planted from younger material exceeded 6 inches for age 11 dbh. The black willow clones planted later from cuttings of older trees never equalled any groups planted early from younger material. A few individual clones of this older group did rank above the experient mean.

The performance of the willow species and hybrids in this study compare favorably with other species planted on the same soil type and within a mile of this experiment. One such study involving 40 families of sweetgum (*Liquidambar Styraciflua* L.) reported a mean dbh of only 3.3 inches at age 11 (Ferguson and Cooper 1977). A study of 80 clones of eastern cottonwood (*Populus deltoides* Bartr.) reported a mean dbh of only 5.7 inches at age 14 (Cooper and Ferguson 1979).

DISCUSSION

Willows, known to grow much better on soils other than Sharkey clay, can be grown on sites such as used in this case. Few alternative uses for this type of site exist.

The small number of clones representing each species or hybrid group or a single testing site severely limits the conclusions that can be drawn from the data. Nevertheless, the failure of sandbar willow and *S.* X *argentinensis* suggests they are unsuitable in the area where tested.

S. babylonica X *S. alba* appears to have some potential. It is excessively branchy, but its extremely rapid growth rate suggests that other hybrids involving one or both of the same parent species should be examined.

The best black willow clones performed well enough to suggest that a selection program would be effective in identifying suitable black willow clones. Experience with sycamore, *Platanus occidentalis* L., indicates that material from south of the planting site outperforms northern and local material (Cooper et al. 1977 and Ferguson et al. 1977). Other work with eastern cottonwood, *P. deltoides,* a more closely related species to *Salix,* indicated the same geographic trend.[2] Therefore, selected clones from possibly as far as 150 miles south of the planting site might perform considerably better than the unselected, local clones in the present study.

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[2]Personal communication with D. T. Cooper, Southern Forest Experiment Station, Starkville, MS.