SELECTION OF POPULUS CLONES FOR SOUTHERN BOTTON LANDS

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In the past few years there has been an astounding increase in the demand for information about suitable methods of regenerating the various hardwood species. This interest is manifested by both foresters and landowners, but all too often there are no specific recommendations that can be made. The Stoneville Research Center of the Southern Forest Experiment Station began in 1954 to anticipate these needs. Though funds, equipment and personnel have been limited, some interesting and important results have already been obtained. After the completion of the new Southern Hardwood Laboratory, now under construction at Stoneville, progress will be more rapid.

I have been asked to tell you a little about one phase of the work, namely, the selection of Populus clones for planting southern bottom lands. It seems advisable to begin with a few words about hardwood regeneraton and the general goals we hope to attain.

To repay the costs and risks of plantation establishment, which are and probably will remain higher for hardwood than for pine, superior stock, regardless of species, should possess these attributes: (1) be well adapted to survive and grow under the climatic conditions to which it will be exposed, (2) make faster-than-average growth both in height and diameter, (3) have good stem form, (4) prune itself easily, and (5) resist insects and diseases. For certain species other important characteristics might be added--for example, superior ability of a clone to root if the species is usually propagated by cuttings.

To develop such stock as rapidly as possible became our purpose. We would have liked to include in our tree-improvement all 50 of the major commercial hardwoods in the Mid-south. That being impossible, we chose the genus Populus as a starting point. The chief considerations were that cottonwood, P. deltoides Bartr., is the fastest-growing tree in North America, and growth results are therefore quickly available; that its wood has always been in

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good demand; that considerable work in hybridization of the genus has been reported both from the U. S. and Europe; and that we had a plentiful supply of samples of both native material and Euramerican hybrids. Euramerican hybrids, which are crosses between European species or hybrids and P deltoides, probably are better adapted to our climatic conditions than other exotic species would be. They were recommended for our study by the late Dutch authority Dr. Houtzagers.

Selecting the method of obtaining superior stock most suitable to our conditions was the next problem. Authorities such as Schreiner (10), Snow and Duffield (11), Wiesehuegel (13), and Rudolf (9) have pointed out that selection of "superior" trees in existing stands is a good way to begin. The next step is controlled breeding using these selected trees as parents to work toward the gathering of the good characteristics of each into a single clone where possible. Better-than-average individuals--that is, superior trees--exist in all stands, and their identification is usually not too difficult. Using them as a source of improved planting stock is a more rapid means of improving planting material than producing hybrids of proven capabilities by a program of controlled breeding, although this latter method is important as a supplemental measure.

Initially, five clones from local superior mature cottonwoods, three clones from the best 1-year-old trees in our cutting nursery, and 12 Euramerican hybrid multi-source cultivars were established and increased. Later we added several cottonwood clones and a few hybrid cultivars from Italy. A cultivar is "an assemblage of cultivated individuals which are distinguished by any morphological or physiological character(s) sufficient for mans use and maintainable as distinct under sexual or asexual reproduction"(12). A cultivar, therefore, may be derived from more than one parent tree. A clone is a cultivar derived from a single individual by asexual reproduction.

The Populus collection at Stoneville is listed in table 1, along with important attributes. Vegetative propagation by cuttings has been used exclusively to increase the planting stock available. The cultural practices were those now in general use and described in our current publication on cottonwood plantations(5). By 1959 there was sufficient stock of many of the clones and cultivars to permit the establishment of a replicated progeny test on one of the best cottonwood sites, a tract of silt loam on the bank of Lake Ferguson, near Greenville, Mississippi. These trees will be grown to maturity, at about 30 years of age, to provide opportunity to follow their development throughout this entire period and to aid in detecting any elite individuals.

Some results are already evident after 2 years. The hybrid clones differ significantly in average height. P. deltoides is very significantly taller than the average of all the hybrids

combined. The greatest growth for an individual cottonwood tree in 2 years has been 30 feet in height and 4.8 inches in d.b.h. One hybrid, I 214, a spontaneous cross between P. deltoides and P. nigra(European black poplar), is very signigicantly better than the average of all the others combined but not better than cottonwood. In diameter growth over the 2 years P. deltoides has similarly outstripped all hybrids.

Hybrids also show significant differences in second-year survivals, which range from 25 to 100 percent. Cottonwood was not signficantly different from the hybrid average nor from the average for I 214 alone, which was 100 percent.

Comparing the superior cottonwood clones with the best 20 percent of run-of-the river-bank trees revealed no significant differences in second-year heights or diameters. Survival differences among clones were very significant, but must be attributed in part, if not entirely, to age of clonal parents rather than to genetic influences. Clones from 1-year-old trees survived 100 percent; those from mature trees, only 25 to 75 percent. This corroborates earlier observations that cuttings from mature trees root less easily than those from 1 - to 3-year old sprouts, but masks possible genetic differences in ability to survive.

It is still too early to be certain about some of the other attributes. Differences appear to be asserting themselves, but no statistical verification has yet been possible. However, brief mention of a few observations may be of interest.

Resistance to the leaf rusts, Melampsora spp., is quite noticeable in some instances. The hybrids P regenerata and P. serotina, as well as the cottonwood clone Rosedale 6, have been almost eliminated from consideration because of their susceptibility. Others such as I 214 and Rosedale 8 are attacked only slightly. It should be possible to select or develop a local rust-resistant clone. We have this year obtained a variety named Siouxland which is said to have such resistance. It was orginated by the Experiment Station of the South Dakota State College at Brookings, South Dakota.

In efforts to locate poplar trees that are resistant to insect attack, we have made little progress. Defoliators reduce the vigor of and sometimes kill young seedlings. Trunk borers cause defects in trees of all sizes. The twig borer, by attacking the terminal shoot, markedly slows height growth of young trees. One-year-old cottonwoods that were protected from insects have averaged 3.5 feet taller than infested trees. But while we have observed no naturally resistant trees, tests have shown that dipping cuttings to half their length in an activated carbon dust containing 44 percent of the systemic insecticide phorate (of which one of the trade names is Thimet) will protect against all troublesome insects for the first year (7). The cuttings are dipped just before they are planted. Tests are under way to determine if soil treatments with the same chemical in granular form will give protection in subsequent years.

On the basis of early results we have tentatively selected the following poplars for additional work: they hybrids P. eugeneii, P. robusta, and I 214, and the cottonwoods Catfish 2 and 5, Texas Select, Alton and Rosedale 8. The five cottonwoods and the hybrid I 214 are the best planting stock we have collected thus far for use on southern bottom lands. Except for I 214, the hybrids are slower than cottonwood and therefore are not recommended. However, they have other attributes that it seems desirable to attempt to transfer by controlled breeding into a super elite clone.

Our future efforts with Populus will continue to be heavily concentrated on developing elite material. The ultimate goal is to develop clones that are well adapted to a wide range of sites, that will grow 15 feet in height and 2 to 3 inches in d.b.h. each year, that will root easily, and that will produce well-formed trees while resisting insects and diseases. A large order, you say? We have already made a good start, and I believe such a goal can be achieved.

Table 1. --Populus tree improvement stock collection at the Stoneville Research Center, Southern Forest Experiment Station, as of May 1, 1961

Name	Origin	Date acquired	Under formal test	Important attributes
1. P. x euramericana (Dode) Guinier cv. 'Bachelierii'	Holland	1954	X	Poor trunk form. Susceptible to leaf rust
2. P. x euramericana (Dode) Guinier cv. 'serotina erecta'	"	"	X	Same as above
3. P. x euramericana (Dode) Guinier cv. 'eugeneii'	England	"	X	Good trunk form, but susceptible to leaf rust
4. P. x euramericana (Dode) Guinier cv. 'gelrica'	Holland	"	X	Defoliates late in fall, poor trunk form, resists leaf rust
5. P. x euramericana (Dode) Guinier cv. 'marilandica'	"	"	X	Same as above
6. P. x euramericana (Dode) Guinier cv. 'mussolinii'	"	"	X	Defoliates late in fall, poor trunk form, moderately susceptible to leaf rust
7. P. x euramericana (Dode) Guinier cv. 'regenerata'	"	"	X	Defoliates early in fall, poor trunk form, very susceptible to leaf rust
8. P. x euramericana (Dode) Guinier cv. 'serotina'	"	"	X	Same as above
9. P. x euramericana (Dode) Guinier cv. 'I 214'	"	"	X	Defoliates late in fall, good trunk form, little leaf rust, good height growth
10. P. x euramericana (Dode) Guinier cv. 'eugeneii'	"	1952	X	Defoliates late in fall, good trunk form, somewhat susceptible to leaf rust
11. P. x euramericana (Dode) Guinier cv. 'robusta'	"	"	X	Defoliates late in fall, very good trunk form, slightly susceptible to leaf rust
12. P. nigra	"	1954	X	Defoliates early in fall, poor trunk form, considerable leaf rust
13. P. trichocarpa	Washington	1959		Very poor trunk form, and very susceptible to insects and disease
14. P. x euramericana (Dode) Guinier cv. 'I 154'	Italy	1960		No observations
15. P. x euramericana (Dode) Guinier cv. 'I 262'	"	"		" "
16. P. x euramericana (Dode) Guinier cv. 'I 214'	"	"		" "
17. P. x euramericana (Dode) Guinier cv. 'I 455'	"	"		" "
18. P. deltoides (Catfish 1 from mature tree)	Miss.	1954	X	Good height growth and trunk form
19. P. deltoides (Catfish 2 from mature tree)	"	"	X	Very good stem form, slightly susceptible to leaf rust
20. P. deltoides (Catfish 3 from mature tree)	"	"	X	Poor rooting ability, some susceptibility to leaf rust
21. P. deltoides (Catfish 4 from mature tree)	"	"	X	Develops multiple sprouts, and is slightly susceptible to leaf rust
22. P. deltoides (Catfish 5 from mature tree)	"	"	X	Very good stem form, fair rooting ability, good height growth, little leaf rust
23. P. deltoides (Rosedale 6 from 1-year-old tree)	"	"	X	Very susceptible to leaf rust
24. P. deltoides (Rosedale 7 from 1-year-old tree)	"	"	X	Moderately good trunk form and height growth
25. P. deltoides (Rosedale 8 from 1-year-old tree)	"	"	X	Good height growth, slight susceptibility to leaf rust
26. P. deltoides (Texas Select-cultivar)	Ft. Worth	1958	X	Good trunk form, rapid height growth. May endure dry sites
27. P. deltoides (Arkansas Select-cultivar)	Pine Bluff	"		Rapid height growth
28. P. deltoides (Alton-cultivar)	Alton, Ill.	"	X	Good trunk form, rapid height growth, stands late freezes, little leaf rust
29. P. deltoides x P. trichocarpa (McKee poplar)	Washington	1961		Rapid early growth but considerable susceptibility to leaf rust
30. P. deltoides (cv. Carbondale 1)	Illinois	"		Rapid growth
31. P. deltoides ("Siouxland" developed by S.D. State Col.)	S.D.	"		Resistant to leaf rust
32. P. deltoides (Texas Select 1 clone)	Ft. Worth	"		Combination of rapid growth, good trunk form, and leaf-rust resistance
33. P. deltoides (Arkansas Select 1 clone)	Pine Bluff	"		Same as above
34. P. deltoides (Alton 1 clone)	Alton, Ill.	"		Same as above
35. P. deltoides (Rosedale 9 from 1-year-old tree)	Miss.	"		Rapid height and diameter growth
36. P. deltoides (Archer 1 clone)	"	"		Rapid growth; ortet grew 30 feet tall and 4.8 inches d.b.h. in 2 years

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