Cottonwood Improvement in the Lower Mississippi Valley

ROBERT E.FARMER,JR.[1/]

In river bottoms of the lower Mississippi Valley, cottonwood (P. deltoides Bartr.) is a pioneer species of major economic importance. Because of its extremely rapid growth on suitable sites, it has considerable potential for intensive management in plantations. Poplar culture in the South may eventually approach agronomy in levels of investment and return. Cottonwood also has the potential for spectacular failure under a wide range of conditions. With few forest species is it so important that the silviculturist apply all the techniques and knowledge available. To merit costly attention, the material must be genetically worthy. Thus development of genetically superior cottonwood is simply an essential aspect of intensifying its culture.

Cottonwood is used by the lumber, veneer, and paper industries; tree improvement goals must derive from the requirements of all three uses. Briefly, the products of cottonwood breeding should be inherently straight, cylindrical, rapid-growing trees with clear wood having high specific gravity and long fibers. Good form and rapid growth will be partly dependent upon inherent pest resistance.

The object of this paper is to review the status of cottonwood improvement research in the lower Mississippi Valley. Specifically, I will discuss silvical characteristics strongly related to development and use of improved stock, patterns of natural variation,

[1/]Southern Hardwoods Laboratory, Stoneville, Mississippi, maintained by the Southern Forest Experiment Station in cooperation with the Mississippi Agricultural Experiment Station and the Southern Hardwood Forest Research Group.

and the nature of breeding systems currently in use. My comments will deal largely with research centered at the Southern Hardwoods Laboratory of the Southern Forest Experiment Station. Active cottonwood improvement programs are presently limited to those of this laboratory and the Texas Forest Service.

SILVICAL CHARACTERISTICS RELATED TO IMPROVEMENT

Cottonwood is a dioecious species with prolific annual seed crops. Flowerbuds are formed in early summer; flowering and wind pollination take place the following spring, and seed dispersal occurs between May and August in the lower Mississippi Valley. Seeds germinate and become established on moist soil immediately after dispersal. Unlike some other Populus species, cottonwood can be easily grown from seed in the nursery.

Controlled crosses essential to breeding can be made on bottle-grafted scions bearing female flowers. These grafts to juvenile stock may be made under greenhouse conditions in early fall or immediately prior to forced flowering in late winter. Fresh pollen is easily obtained in late winter by forcing male flowers. One or two catkins containing several hundred seeds apiece are subsequently matured on each graft in two to three months. In short, cottonwood's reproductive characteristics lend themselves to genetic improvement research.

Populus deltoides is easily propagated by stem cuttings. Twenty-inch-long unrooted cuttings of juvenile material are predominantly used as planting stock. Products of genetic improvement research will undoubtedly be clones vegetatively propagated on a commercial scale.

Intensive cultural practices including thorough site preparation and weed control are now recommended in establishing cottonwood plantations. Irrigation and pruning may become common. Breeding programs must incorporate tests of the relationship between cultural practice and expression of genetic potential.

Site relationships are currently of major interest to cottonwood growers and improvers. River-channel deepening and straightening are reducing occurrence of natural cottonwood on new riverfront sites, and hence necessitating planting or seeding on older land. In some cases planting is being attempted, for pressing economic reasons, on soils whose nutritional or textural characteristics are marginal for cottonwood. Success on such sites may require especially adapted stock.

NATURAL VARIATION

While silvical considerations affect the nature of cottonwood breeding, improvement is fundamentally dependent upon natural variation and inheritance of characters to be modified. The literature on natural variation in European and North American. Populus species is extensive, and there are a few data on inheritance; but the cottonwood population in the lower Mississippi Valley has received little investigative attention. Consequently, the first job of the Southern Hardwoods Laboratory has been to obtain data directly applicable to breeding in this area. This is being done through (1) direct sampling in natural stands, (2) clonal tests of randomly selected trees, and (3) progeny tests. I shall summarize some initial results.

In natural stands at several locations in the Mississippi Delta, specific gravity of wood samples from individual trees ranged from .32 to .46, and 98 percent of this variation was due to differences between trees within stands. Wide variation in dates of flowering and seed dispersal followed the same pattern as wood density; within-stand variation was much greater than that between stands or between locations. Further, dates of phenological events for individual trees in different years were significantly correlated; this indicates, for example, that within a given group of trees flowering occurs in the same sequence year after year.

Through clonal 'tests of random selections on several sites, we can determine the degree to which clones (genotypes) vary, and can evaluate the relative effects of genetics and environment. Variation in juvenile growth rate of clones is, as one would expect, strongly influenced by environment, but our data indicate that it is sufficient to provide around a 9-percent increase in early height growth if one selects the best 10 percent of an average population on the basis of test results. Form of juvenile cottonwood varies widely and is under moderate genetic control. Some clones have numerous small branches and a Christmas-tree-like shape; others are rangy, loose-limbed trees. The typical form is candelabra-like.