COTTONWOOD CULTURE AND RESEARCH IN THE SOUTH

D. T. Cooper[1/]

Abstract.--Plantation culture of cottonwood became operational by the mid-sixties, and by 1970, more than 5,000 acres per year were being planted to cottonwood in the South. Indications were that this amount might increase. But, in spite of improved clones and additional research findings, acreage planted per year has decreased to about 3,000 acres. This decline in planted acreage was caused by a combination of factors including soaring land values, interest rates and costs of fuel, labor and equipment; problems with survival rate and anticipated long-term growth rate; misjudgment of site; land use for soybeans; failure of pulpwood markets to develop as expected; and recent losses to floods, insects, and diseases. New clones, techniques that reduce establishment costs, improved markets for small wood, and interest outside the Delta should result in an increased rate of planting.

Cottonwood Research Through 1970

Planting Technology

Planting culture of cottonwood (*Populus deltoides* Bartr.) was operational in the South by the mid-sixties. Following the guidelines of the Southern Hardwoods Laboratory (McKnight 1979), growers cleared highly productive sandy loam bottomland sites containing degenerate natural stands and planted them to cottonwood. Site preparation consisted of shearing stumps and residual trees just below the soil surface, piling part of the debris around the edge of the clearing to exclude deer and burning the rest, and then discing. During the dormant season, 20-inch long hardwood cuttings were placed in subsoil trenches or holes made by planting bars at 9 x 9 to 12 x 12 ft. spacing. Cuttings were either genetically unselected or had been through some mursery selection for rootability and early growth rate. Clean cultivation was practiced the first year. Cultivation was continued the second year if needed. Generally, fertilizer and herbicides were not used. Repeated thinnings were planned so that a mixture of products could be provided. Individual companies had as their primary goal such products as pulp, particleboard, lumber, matches, and veneer. Acreage planted per year exceeded 5,000 by 1970. Dutrow et al. (1970) reported that the economics of growing cottonwood were attractive and predicted that a million acres could realistically be planted to cottonwood.

[1/] Principal Plant Geneticist at the Southern Hardwoods Laboratory, which is maintained at Stoneville, Mississippi by the Southern Forest Experiment Station, Forest Service--USDA, in cooperation with the Mississippi Agricultural and Forestry Experiment Station and Southern Hardwood Forest Research Group.

Improved Planting Stock

Mohn and Randall (1969) demonstrated that selection among cloned open-pollinated progeny in replicated trials could produce improved clones. Fourteen moderately select clones were chosen for potential commercial use (Mohn et al. 1970). The Southern Hardwoods Laboratory set as a goal the selection of 25 unrelated clones representing the best one percent of the natural population,[2/] and several clonal tests were established or planned to provide these clones. The importance of genotype-environment interaction was recognized (Randall and Mohn 1969). Several hybrid clones were tested and found unsuitable in the Delta (Maisenhelder 1970). An east-west provenance test by Oklahoma State University (Posey et al. 1969) revealed that trees from eastern Oklahoma have faster growth, lower specific gravity, longer fibers, straighter stems, and greater drought susceptibility than those from western Oklahoma. A separate north-south provenance test by the Southern Hardwoods Laboratory and the University of Illinois involving materials from Minnesota to Louisiana showed that southern trees were branchier than northern trees at the end of the first growing season (Rockwood 1968). Farmer and Nance (1968) developed crossing techniques suitable for the South, and the first sets of crosses were soon completed. Farmer and Mohn (1970) summarized the status of genetic improvement of cottonwood.

Diseases and Insect Problems

Toole (1970) reported on leaf rust caused by *Melampsora medusae* Thum. in the lower Mississippi Valley. Wilcox and Farmer (1967), Farmer and Wilcox (1968), and Farmer (1970) reported on genetic variability, relating rust incidence to growth rate. It was evident that highly resistant clones could be selected. However, a moderate level of resistance appeared adequate in the South.

Mortality from *Cytospora chrysosperma* Fr. and *Phomopsis macrospora* Kobayashi and Chiba was found in 2- to 3-year-old plantations on old fields where weed competition and unusually dry conditions stressed trees (Filer 1964).

By 1970, several insect problems had occurred in cottonwood plantations. Damage by the cottonwood leaf beetle (*Chrysomela scripta* Fab.) was described by Morris (1956). The trunk borers, *Saperda calcarata* Say and *Plectrodera scalator* Fab. were discussed by Morris (1963), and the biology of the twig

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[2/] Mohn, C. A., J. S. McKnight, and D. M. Schmitt. 1969. Problem analysis: Southern Hardwood Genetics and Tree Improvement. Southern Forest Experiment Station.

borer (Gypsonoma haimbachiana Kearfott) was studied by Morris (1967). Phorate (Thimet[R])[3] was an effective systemic insecticide for some cottonwood insects when used as a dip for unrooted cuttings (Morris 1960). By 1970 carbofuran (Furadan[R] [3] 10% granules) was found to be a superior systemic.[4]

Cottonwood Research Since 1970

Planting Technology

Research has continued at a rapid pace since 1970. Baker and Broadfoot (1976, 1977) developed refinements in site selection. Kaszhurewicz (1975) found that cutting length and planting depth should be varied according to site. Randall and Krinard (1977) found that long, rooted cuttings survived much better than long, unrooted cuttings and that 1 foot of root was sufficient. Kennedy (1979) found that the planting season for conventional unrooted cuttings could start earlier in the fall and extend later into the spring than previously thought.

Krinard and Johnson (1975) confirmed the need for the recommended 12 x 12 ft. or wider spacings. The work of Woessner (1972), and Krinard (1976) indicated that pruning should be delayed until June or July to minimize epicormic branching. General volume tables for young plantation cottonwood were developed by Mohn and Krinard (1971), and separate volume formulas for individual clones were developed by Woessner (1973).

The distribution of biomass in the tree and nutrient accumulation was studied by Switzer et al. (1976) and Baker and Blackmon (1977). This work led to the finding by Baker et al. (in press) that cottonwood from a Louisiana seed source had only one-half as much potassium in the bole at age 10 as did cottonwood from a Southern Illinois seed source, although both sources grew nearly equally well at the testing site, near Greenville, Mississippi. An earlier study by Baker and Randall (1975) showed that foliar potassium was consistently higher in slow-growing clones than in fast-growing clones.

Improved Planting Stock

The "blue tag" certification in 1974 of 5 of the 14 superior clones described by Mohn et al. (1970) represented the first blue tag (highest level) certification of any forest reproductive material in the United States. Impressive expected gains for growth rate were reported (Randall and Cooper 1973, Mohn and Randall 1971, and Randall 1977). Additional evidence of the importance of clone-site interactions was found (Mohn and Randall 1973; Randall and Cooper 1973), but interactions between clones and planting year were small (Mohn and Randall 1973).

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[3] Mention of trade names is solely for identification and does not constitute endorsement by the USDA. The symbol R signifies trade mark registration of the materials' name only and does not imply registration by EPA.

[4] Abrahamson, L. P. 1971. Establishment and Final Report FS-SO-2251-2.5.

Disease and Insect Problems

The geographic distribution of clones highly resistant to leaf rust along the lower Mississippi River was reported by Cooper and Filer (1977). Studies were conducted to determine geographic movement of urediospores, conditions necessary for germination, chemical means of control, and the nature of resistance to rust (Shain 1976).

Septoria musiva Peck was found capable of causing cankers on unwounded first-year stems (Filer et al. 1971). Before this, *P. deltoides* was thought to resist stem infection by this fungus, although a leaf spot caused by this same organism was common. Older nurseries and nurseries not having the leaves tilled into the ground before initiation of spring growth had the most cankers. Cull rates in nurseries were high. Filer (1976) suggested that, in addition to sanitation practices, cuttings should be dipped in chemicals. Cankers near the groundline on long unrooted cuttings have caused mortality. Canker organisms may also contribute to poor survival of unrooted cuttings. Morris et al. (1975) pointed out that *S. musiva* is a pioneering organism that frequently leads to other cankers and that avoidance of stress by proper choice of planting sites and timely thinning minimizes canker problems. Clones resistant to Septoria leaf spot have been found (Cooper and Filer 1976).

Several generations of the leaf beetle and twig borer occur each year in the South. Periodic outbreaks result in stunting and forking (Morris et al. 1975). Moderate levels of resistance to the leaf beetle have been found (Oliveria and Cooper 1977). Woessner and Payne (1971) reported resistance to the twig borer in the hybrid poplar NE 316 in Texas. Reasonable control of both the leaf beetle and twig borer can be achieved with carbofuran applied with a subsoil applicator (Abrahamson et al. 1977).

The poplar tentmaker, *Ichthyura inclusa* Hbn., was considered of limited importance by Morris and Oliveria (1976) but has since caused serious repeated defoliation on thousands of acres of plantations near Stoneville, Mississippi. Crowns have been thinned and trees weakened.

The clearwing borer, *Paranthrene dollii* Heim., currently causes about 12 percent cull in nurseries (Solomon et al. 1976). Infested stumps in nurseries serve as principal reservoirs. Trunks of trees 3 years old and older are attacked by the poplar borer and may become so riddled that they break (Abrahamson and Newsome 1972). The cottonwood borer, formerly seen mostly in drouthy sandbar stands, has moved into nursery and plantation areas and has caused breakage at the ground line. According to Cook and Solomon (1976), the insect borers are capable of serious damage to cottonwood but do not threaten its production.

Current Trends and Future Direction for Cottonwood Planting

Based on planting intentions 10 years ago and the research conducted since then, acreage planted to cottonwood in the South should have increased, but it has not. Land values, interest rates, and costs for fuel and equipment soared in the seventies. Some improved clones were poorer in survival rate and in long term growth rate than anticipated. Some cottonwood was planted on unsuitable sites. The pulpwood market did not develop at the expected rate and, as a result, thinnings were delayed. Unusually high flood water during 1973, 1975, and 1979 destroyed thousands of acres of newly planted cottonwood. High soybean prices presented an attractive alternative use for much plantable land. Extensive defoliation by the poplar tentmaker in 1977 and 1978 had a sobering effect on growers and researchers alike. Now, competition from other plantation hardwoods is becoming a reality.

A recent survey conducted by Wayne Wells of Westvaco for the Southern Hardwood Research Group revealed that only 3,000 acres are now planted annually to cottonwood in the South. There have also been some geographic shifts in planting, with less planting in Louisiana and more in Western Kentucky. Plantings are anticipated on the Shawnee National Forest in Southern Illinois, but very little cottonwood is planted any distance away from the Mississippi River.

Several factors contributing to reduced cottonwood planting will probably continue. Land values, interest rates, fuel costs, and equipment costs will likely remain high. Additional floods will occur, soybean prices will probably remain strong, and interest in other plantation hardwoods can be expected to increase. The poplar tentmaker may not be serious again, but other problems of similar magnitude can be anticipated.

On the brighter side, other reasons listed for reduced planting should become less important. Recent refinements in site selection procedures, the development of more broadly adapted clones, and willingness to plant wet and dry areas to other species will result in less cottonwood planting on unsuitable sites. The demand for fuel promises to provide a market for surplus pulpwood and allow prompt, profitable thinnings. Part of the 5 "blue tag" Stoneville clones will soon be replaced with new, faster-growing clones and existing tests should provide additional fast-growing clones. A southwide provenance test, just initiated, should result in better clones for regions outside the Delta.

A promising planting technique, now in limited use in the South, is the planting of long-rooted planting stock at wide spacings. Deer fences are not needed, savings in site preparation can be achieved, more weeds can be tolerated, and herbicides can be used more easily than with current planting methods. Less soil compaction occurs because mechanical weed control can be delayed until the ground is dry. Considerable protection from flood damage is achieved. The wider spacing, required because of higher planting costs associated with each tree, makes time of thinning less critical. Wide spacing is acceptable since essentially full stocking of suitable trees is possible.

There is much still to be done if plantation culture of cottonwood is to continue to expand in the South. Research on reduction of establishment costs, improvement of rooting of cuttings, coppicing, and development of clones with broader site adaptability and higher specific gravity should be given high priority.

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