Largest of these 10-year-old cottonwoods are 12 inches d.p.h. and 100 feet tall.

PLANTING HARDWOODS

By ROBERT L. JOHNSON, *U.S. Forest Service*

Southern hardwood forests contain many species and grow on a wide range of sites. This diversity among species represents a challenge to managers whose primary tool in the natural forest is stand manipulation. Even-aged management has been applied to many natural stands during the past 25 years which led, in the 1960s, to clearcutting as the primary silvicultural system. Recently, however, more consideration has been given to uneven-aged management, partly because so many landowners have goals for their woodlands in addition to, or other than, timber.

By creating, through cutting or deadening, conditions conducive to establishment and growth of hardwoods, forest managers favor selected species in many different hardwood timber types. For example, forest openings of one acre or more usually favor development of intolerant species if a seed source is present; smaller openings, particularly those under half an acre, favor tolerant species.

In southern bottomlands, natural succession and diameter-limit cuts have resulted in many stands of relatively low value on sites of potentially high productivity. Such stands offer few opportunities for manipulation. It is in some of these areas that hardwood management has been undergoing a slow but significant change to intensively managed plantations during the past 15 years.

A prime example of this change is in the broad bottomlands of the lower Mississippi River. Unlike many areas where hardwoods grow, these sites are well adapted to intensive culture. Terrain is nearly flat and easily negotiated by heavy equipment. Many commercial species grow well, including the extremely fast-growing eastern cottonwood, but natural stands are producing much less than their potential.

History of Southern Hardwood Plantations

Commercial planting of hardwoods began in the South in 1960 when Crown Zellerbach Corporation purchased a 15,000-acre cattle-cotton plantation in the Mississippi Delta. The whole area was planted in cottonwood at the rate of 2,000 to 3,000 acres per year. Because this was the first large-scale hardwood planting in the South, many problems were encountered. Among the problems were source and care of planting stock, quantity and disposition of equipment, spacing, estimates of site quality, and yield predictions. Nevertheless, within five years of Crown Zellerbach's original plantings, at least six other companies began commercial planting of cottonwood.

Research and experience have solved many of the problems of planting cottonwood and other hardwoods (methods are similar to those used by farmers in growing corn, soybeans and cotton). Today, at least two more companies and several private landowners are growing cottonwood and other hardwood species. Other species being planted are black walnut, American sycamore and sweetgum which, with cottonwood, account for about three-fourths of the total hardwood plantation acreage in the South.

Plantation Establishment

Site Evaluation and Preparation. Areas considered for planting are first evaluated for potential productivity. Frequently, identification of soil type is adequate. Species planted on unsuitable sites have poor survival, slow growth and are highly susceptible to attack by insects and diseases.

Site preparation is the most costly step in establishing hardwood plantations in southern bottomlands. Contract clearing, raking, windrowing, burning and, when needed, disking may cost upwards from $200 per acre. Such intensive site preparation is required because trees must be cultivated until they are about 3 feet tall. This cultivation is essential to achieve nearly complete control of competing vines, weeds, natural sprouts and seedlings.

In the past a number of hardwood plantings have failed because of inadequate weed control, but some species are affected much more than others by competition. Cottonwood, for example, cannot tolerate weeds, but yellow-poplar, sycamore and green ash can often survive and grow above weeds and natural regeneration. None of the hardwoods, however, does well where vines and natural regeneration combine to compete with the planted trees. There are strong indications that with most intolerant hardwoods, trees that grow well early continue to grow better than those that start slowly — another good reason for weed control. Nearly complete weed control is essential for only one year in cottonwood but for up to three years among slower-growing species such as the oaks. After trees reach 6 to 8 feet tall, one or two diskings during the growing season would be desirable to keep competition under control until crown closure.

Planting Stock. Quality planting stock

should be used. Select cottonwood clones developed by U.S. Forest Service researchers at Stoneville, Mississippi are available for purchase from the nurseries of several southern states. On most sites, 20-inch long cuttings are used when planting cottonwood. For most other species planted commercially, seedlings are used. Best results are from seedlings 3/8 inch or larger in diameter at the rootcollar. Such seedlings are frequently difficult to obtain from 1-0 stock unless they have been custom grown. Large seedlings are worth additional effort because of better growth and survival in the field and because they may not require intense cultivation.

Spacing and Yields. Most planters use spacings in the range of 10 by 10 feet to 12 by 12 feet. These spacings are preferred because they allow farm equipment to be used for mechanical weed control, and enable most trees to develop into minimum commercial size, 5.1 inch diameter at breast height (d.b.h.) or larger, without thinning. Such spacings, however, may require artificial pruning to produce high-quality sawlogs. Crown to total height ratios, which for most species should be 40 to 50 percent, can be regulated through thinnings. When thinning is delayed too long, some species such as cottonwood will not respond to the additional growing space, and growth is below potential. First and even second thinnings can be mechanized by removing alternate rows, but later thinnings are selective.

Merchantable yields from cottonwood plantations have ranged between 3 and 3½ cords per acre per year over 10 years. Results with other species indicate that plantation trees grow significantly better early than the same species in natural stands. Comparisons for long-term yields are generally unavailable.

Recent Work

Sycamore, black walnut, sweetgum and cottonwood have received the most attention for planting in the South, but current Forest Service research at Stoneville involves nine other hardwood species, including five oak species. Considerable progress has been made with cottonwood on site selection, plantation establishment and management, and insect and disease identification and control. The most recent work with cottonwood involves 8- to 10-foot tall planting stock to eliminate the need for intense cultivation, to reduce cost of site preparation, and to establish trees above competing weeds and deer. Basic work is also being done in nutrient cycling to guide foresters on selection of rotation lengths and the need for species mixtures.

The concept of growing hardwoods at spacings as close as 4 by 6 feet in short rotations (four to six years) followed by whole tree chipping and coppice regeneration is receiving attention. Predicted yields from sycamore grown under this system are high but so are costs. Initially, the short-rotation, close-spacing work done in the Southeast at Athens, Georgia, was for fiber production. But during the last two years, such systems have been envisioned for fuel. At the Forest Service Laboratory in Rhinelander, Wisconsin, hybrid poplars are planted at very close spacings (9 by 9 inches), irrigated, and fertilized to achieve maximum yields of fiber in a short time.

Although planting activities for eastern cottonwood and black walnut appear to have stabilized, other hardwoods are being more widely planted than in the past. The basic technology for planting most hardwoods is either available or soon will be; the future is in refinements and cost-cutting techniques. Although methods of establishment and management may vary by species and localities, plantations of eastern hardwood species most surely will increase as the demand for hardwood products increases. □