North Central Forest Experiment Station 3.07

CENTRAL HARDWOOD NOTES

Planting Bottomland Hardwoods

Diverse problems confront the forest manager when planting bottomland hardwoods. Bottomland vegetation types and sites are complex and differ markedly from uplands. There are different and more numerous hardwood species that grow faster in denser stands. Sites are subject to varying intensities and duration of flooding and the action of overflow river currents that deposit and erode soil. Added to these natural differences are the man-made influences of drainage ditches, borrow pits, levees, dams, dredging, and cultivation. Entirely different soils occur over very short distances. One or two feet in elevation often mean a change in suitable species. Therefore, the planter must consider each site a separate challenge and apply knowledge gained through careful examination and experience. The following information, offered to improve planting success with bottomland hardwoods, is based on experience in southeast Missouri and information available from recent research.

Site Evaluation

It can take you as long as a year to adequately evaluate and modify a site for planting with the right species. Standard soil maps are helpful but you should not rely on them entirely. Thorough soil probing of the planting site is necessary to detect changes that occurred after the maps were prepared. Collect and test soil samples to determine nutrient deficiencies. Soil testing is inexpensive and is especially important on sites that have been farmed and that are not subject to periodic flooding. investigate the flooding history including frequency, duration, season of occurrence, and the velocity and direction of overflows. Any areas that have active scouring or siltation should be noted.

The influence of soil organic matter content on planting success is not well understood. However, large amounts of decaying organic matter will make some nutrients unavailable for seedling growth and additional fertilizer may be needed to overcome deficiencies. In cultivated fields, find out if chemicals have been used to control weeds in the past to avoid chemical carryover which can harm planted seedlings.

Species Selection

You should make sure that the species selected for planting are suited to the site. Baker and Broadfoot (see References) developed a practical method of site evaluation to select cottonwood, green ash, hackberry, sugarberry, pecan, sweetgum, sycamore, yellow-poplar, and the oaks --cherrybark; Nuttall, swamp chestnut, water, and willow oak. Their method estimates the suitability of sites for these bottomland hardwood species by incorporating the physical conditions of the soil (factor 1), moisture availability during the growing season (factor 2), nutrient availability (factor 3), and aeration properties of the soil (factor 4), into a site

quality rating ("site index"). Each major factor consists of many soil and site properties that affect tree growth (table 1). Each soil factor is assumed to be responsible for a certain percentage of tree growth, with the proportion of growth accounted for by each factor being composed of contributions from each of its soil-site properties.

Table *1 .-Major soil factors and contributing soil-site properties*

(1) Physical condition	(2) Moisture availability	(3) Nutrient availability	(4) Aeration
Soil depth and pans	Water table	Geologic source	Structure
Texture	Pans	Past use	Swampiness
Compaction	Position	Percent organic matter	Mottling
Structure	Microsite	Top soil	Color
Past use	Structure	Soil age	
	Texture	pH	
	Flooding		
	Past use		

Harrington and Casson (see References) developed an interactive computer program (SITEQUAL) from the Baker and Broadfoot field guides. SITEQUAL calculates site index (SI) for all 14 species simultaneously and provides a breakdown of site index into component contributions by each factor. The major advantages of SITEQUAL are completeness and speed. Fourteen species are evaluated for a site rather than 3 or 4, and in less time. The user can also identify which of the four factors is at the least optimum level. For instance, although the total SI for cottonwood was still acceptable on a site cultivated for 30 years (table 2), nutrient availability (factor 3) received only 42 percent (11 out of 26) of its possible contribution points, indicating that fertilization might be used to improve growth. If the total SI is below a given level for a species, that site should be considered unsuitable unless soil conditions are improved. You should be thoroughly familiar with the Baker and Broadfoot publication before you use the SITEQUAL program.

Site Preparation

Before planting, most sites require clearing to permit the use of machinery such as harrows and disks. The exception is recently cultivated land. Fields with well-developed pans need to be subsoiled. Good hardwood sites are normally covered with dense vegetation of grasses, vines, and weeds which can be controlled by thorough disking. If machine planting is used, allow enough time between disking and planting for the ground to settle and firm.

Table 2.-*Major soil factors as components of site index for two species on ideal and cultivated sites*

Conditions	Species	Contribution of factors (1)	(2)	(3)	(4)	Total SI[1]
Ideal	Cottonwood	46	46	26	12	130
	Pecan	27	30	30	28	115
Cultivated	Cottonwood	31	35	11	12	89
	Pecan	17	22	21	28	88

[1] Maximum height growth in 30 years for cottonwood and 50 years for all other species.

While the minimum nutrient requirements are not known for most species and may vary with site conditions, major deficiencies should be corrected before planting. Apply a minimum of 120 pounds of nitrogen, 150 pounds of phosphorus, and 350 pounds of potassium per acre until better information is available. This treatment should suffice for several years. A pH level of 5.5 to 6.5 seems desirable for most hardwood species. It is better to delay correcting minor deficiencies for a few years to avoid stimulating unwanted competition.

Planting

Plant only large, healthy seedlings with root collar diameters of at least 1/4 inch and heights of over 18 inches. This usually means you will have to cull out the small seedlings. Also you may need to modify planting machines to accommodate large seedlings. Handle large planting stock carefully to avoid breaking the tops.

On firm soil, the seedlings should be planted with the root collar 1 inch below ground level. Seedlings should be planted deeper in loose soil to prevent root exposure when the soil settles. Prevent freezing, heating, or drying of the planting stock. Planting should be suspended if the temperature gets lower than 25 degrees F.

Keep rows straight with uniform spacing between rows to facilitate post-planting cultivation or spraying. Spacing is determined according to the species, cultural treatments and the end product. Most land managers use from 350 to 600 seedlings per acre.

Frequently you must deal with untrained, inexperienced planting crews. Under these circumstances, it is essential that you give personal supervision to storing, transporting, and handling planting stock as well as planting methods.

Plantation Care

Control of weeds, vines, and grasses is essential to establish hardwoods on bottomland sites. Hoeing, disking, and chemicals have all been tried. Disking is probably the most popular method, but a major disadvantage is that the ground must be dry enough to work. Often the land manager sees the vegetation overwhelm the seedlings during the early spring growth period while the ground is too wet to disk. When the ground is finally dry enough, the seedlings are hidden in the vegetation and some are destroyed during disking.

The land manager can select from a whole arsenal of chemicals to control unwanted vegetation. Overspraying while the seedlings are dormant shows some promise for effective control. Pre-emergent herbicides applied at the time of planting have had a beneficial effect on survival and growth of hybrid poplars.

Much research is now needed, but likely a mixture of chemicals targeted at the problem species will prove to be the most effective method. There are a number of important factors to consider when dealing with chemicals for weed control, including the tolerance of various tree species to specific chemicals. You need to consult local or regional experts to be sure treatments are effective, safe, and comply with appropriate regulations.

References

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