QUALITY SEEDLINGS - A CRITICAL NEED FOR SUCCESSFUL HARDWOOD PLANTATIONS

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Increasing worldwide demand for forest products, coupled with serious inroads into the amount of land available for forest management, has given new impetus to the proposition that we must manage those lands available to us for maximum productivity.

Much of our pine land has received the benefit of intensive plantation management for many years. With few exceptions, however, our southern hardwood lands have received little more than minimal management, if any at all. But as industry has learned to make better use of the hardwood resource, its value has increased, and in certain sections hardwood supply has become a critical factor. This increased dependence upon the hardwood resource has spawned renewed interest and commitment to hardwood plantation management. For it is with artificial management that we are able to make the most efficient use of the land resource.

Currently, hardwood plantations are significantly more expensive to establish than pine. This is because the hardwoods that we are interested in regenerating are much more intolerant to competing vegetation than the pines, and therefore must receive very intensive site treatment in order to survive and grow (Hunt, 1974; Geyer, 1974; McKnight, 1970). Because of this, good seedling quality and the resulting improved survival and growth are of considerable concern to the hardwood plantation manager.

A number of factors are involved in defining a "quality" hardwood seedling. In general, a quality seedling should:

1. Possess good genetic potential.
2. Be large and thrifty.
3. Be fully dormant and packaged adequately to withstand storage for extended periods.

In most instances, the nurseryman has little control over the genetic quality of hardwood seedlings grown for industry. However, with the acceleration of hardwood tree improvement programs, the nurseryman must remain conscious of the great potential value of improved seed (Zobel, 1974) and must therefore maximize the utilization of that seed while in his care. Seed losses due to improper storage or stratification, excessive sowing rates and improper cultural practices must be eliminated.

Seedling size has been demonstrated to be very important for early growth and survival of various species of hardwoods. In a number of studies comparing seedling grades based on root collar diameter, larger seedlings of sycamore, sweetgum, green ash, and cottonwood have consistently grown faster and survived better than smaller size classes (Ike, 1962; Johnson and McElwee, 1967; George and Frank, 1973; Phares and White, 1972).

In one test of yellow poplar seedling grades, the larger seedlings consistently attained a given height three years ahead of the smaller ones after 16 years in the field (Funk, Limstrom and Laidly, 1974). Larger diameters also increase the seedlings' resistance to rabbit clipping (Nugent, 1970a). Current recommendations are for a minimum of 3/8 inch diameter at the root collar for all hardwood species being operationally planted, although larger diameter seedlings of up to an inch or more are desirable.

The biological advantage of large seedlings is only half the story. As was mentioned earlier, hardwoods are very sensitive to competition effects and consequently must have some form of intensive competition control. This requirement dictates that considerable additional attention be given the site preparation and aftercare for the establishment of a hardwood plantation over that necessary for pine. In brief, the current operational procedure for hardwood plantation establishment is:

1. After harvest, shear all standing trees and stumps at or just below ground line with a serrated "V" blade mounted on a large crawler tractor.
2. Root-rake the site and pile all debris for burning. Repile and burn if necessary.
3. Disk the area with a heavy-duty site prep disk to reduce the site to bare soil. This should be done in the fall to limit regrowth of vegetation.
4. Row-mark the site to allow for planting at exact square spacing which facilitates cross disk cultivation after planting.
5. Machine plant perpendicular to the guide marks. Planting machines are specially modified to accommodate the large hardwood seedlings.
6. Cross disk cultivate as needed for one to two years after planting to control competition and stimulate seedling growth.

Hardwood lands revegetate rapidly after clearing, making cultivation a tedious task unless the seedlings are tall enough for the operator to see easily, and robust enough to resist being bent over by soil thrown around the base. Short seedlings must be cultivated more often and in some cases must be straddle-cultivated. Either case results in higher costs and increases the chance of disk damage. A minimum height of about 2 1/2 feet is acceptable. Seedling heights of from 3 to 5 feet can be grown, and are preferred.

These large seedlings are difficult and expensive to produce. Low seedbed densities of from six to ten seedlings per square foot, high rates of fertilizer, proper irrigation, and weed and pest control all contribute heavily to this expense (Formy-Duval, 1973). However, industry is convinced that large hardwood seedlings are necessary for successful plantations and therefore these seedlings must be provided.

Finally, the quality seedling must be fully dormant and packaged adequately for transport and storage. Many of our hardwood bottomlands are flooded or otherwise inoperable during the winter planting season.

This makes it necessary for the forester to plant cold stored, dormant seedlings during the spring and summer (Nugent, 1970b). In some cases seedlings are held four to nine months before planting. Repeated handling for watering and other activities during this storage period makes good quality packaging that will not easily loosen or tear of prime importance.

In summary, industry needs hardwood seedlings that are genetically and physiologically capable of making maximum use of the site, as well as seedlings that will facilitate and complement various operational activities such as storage, transport, and cultivation.

Research into improved nursery techniques such as mycorrhizal manipulation can provide new technology that will increase the nurseryman's ability to produce better quality seedlings which will have direct impact upon plantation productivity.

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