ANOTHER LOOK AT PLANTATION SPACING [1]

Robert R. Morrow, Associate Professor of Forestry
Department of Conservation, Cornell University
Ithaca, N.Y.

Many studies have been made of spacing, particularly for several of the southern pines, red pine, and Douglas-fir. There is general agreement on the following points:

(1) Spacing does not influence height growth over a wide range of density. However, on very poor sites wide spacing sometimes produces taller trees.

(2) Wide spacing results in increased diameter growth and shorter rotations; branch size is also increased.

(3) Wide spacing reduces total volume production only prior to stand closure, after which the site is fully utilized.

Initial spacing and spacing throughout the rotation is often a financial question. Relatively close spacing is encouraged by good markets for small wood from thinnings and premium prices for poles and lumber with high density and without large knots. However, higher prices must compensate for increased costs of planting and noncommercial thinnings carried at suitable compound interest rates.

1 See Tree Planters' *Notes No. 65.* April 1964, pp. 12-13.

The author has studied plantation spacing in New York and has experimental spacing plots of larch, red pine, and Norway spruce planted in 1950 and 1951. Results of examination of several red pine plantations (now more than 35 years old) planted 12 by 12 feet and the experimental larch plots (dominant trees now more than 30 feet tall) support most results reported in the literature. In addition, they suggest upper limits of spacing in regions without markets for small wood from early thinnings. Apparently these limits are determined largely by the number of good stems that can be selected and brought through the rotation. For many conditions of normal planting with mass-produced planting stock of only average quality, initial spacings of 10 by 10 to 11 by 11 feet produce enough good stems of larch and red pine if survival is 80 percent or higher. For high-quality nursery stock of genetically improved material planted on the better sites, it may be possible to use even wider spacings.

Initial spacings of 10 by 10 feet or larger will produce a larger central core of low-quality juvenile wood. However, this core is produced on fewer trees, and it is doubtful if the amount of juvenile wood per acre varies greatly with spacing. Moreover, wide juvenile rings represent little volume per tree since they are laid on a small circumference, and they provide a larger base for future rings of desired growth rate and bigger circumferences. Since intolerant trees such as larch and the hard pines culminate growth in both height and basal area at an early age, it is important to produce before growth declines both a sizable base core of juvenile wood and a larger volume (larger circumferences) of desirable wood on individual stems.

Although there are exceptions, there is now little reason for spacing being unduly influenced by consideration of disease, insect, and weed pests. Site preparation and chemical weed control methods are usually cheaper and much more satisfactory than attempts at controlling weeds with close spacing. White pine weevil is also controlled best with recently developed chemical treatments. There are arguments both ways regarding the relationship of spacing to insect and disease pests, but widely spaced trees on good sites are vigorous trees and often more resistant trees. For example, resistance of many pines to bark beetles is directly related to vigor.

Table 1, provided by Morrow et al. (1), is presented as a guide for New York growers. They recommend rectangular, rather than square, spacing to permit easy access and optimum management of the plantation. They also suggest that rural landowners who plant in distant and inaccessible places and who are not prepared to thin as needed should plant at even wider spacings.

TABLE 1.--Guide to plantation spacing for major species

Site	Species[1]	Markets available for					
		Lumber, poles, pulp, and posts		Lumber and poles		Lumber only	
		Spacing	Trees per acre	Spacing	Trees per acre	Spacing	Trees per acre
Deep, well-drained, fertile soil	red pine	6 x 10	700	8 x 10	550	8 x 12	450
	Japanese larch	6 x 10	700	8 x 12	450	10 x 12	350
	Norway spruce	6 x 8	900	--	--	8 x 10	550
	white pine[2]	6 x 8	900	6 x 10	700	8 x 10	550
Medium soils	red pine	6 x 10	700	8 x 10	550	8 x 12	450
	Japanese larch	6 x 10	700	8 x 12	450	10 x 12	350
	Scotch pine	6 x 10	700	--	--	10 x 12	350
	white pine	6 x 9	800	7 x 10	600	8 x 12	450
	Norway spruce	6 x 9	800	--	--	8 x 12	450
Shallow, poorly drained, impoverished soils	Scotch pine (other species not recommended).	8 x 10	550	--	--	12 x 12	300

[1] White spruce similar to Norway spruce and Austrian pine similar to red pine.
[2] White pine should not be planted unless you are prepared to control white pine weevil.

Even with present knowledge, more forest managers should establish spacing plots on important soils and management units. Research can establish biological facts and broad patterns of procedure, but individual foresters should relate test results to their own planting conditions and financial situation.

Literature Cited

(1) Morrow, R. R., Hamilton, L. S., and Winch, F. E. 1956. (rev. 1964). Planting forest trees in rural New York. Cornell Ext. Bul. 956.