The Development Of Unthinned
Loblolly Pine Plantations At
Various Spacings

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Synopsis

The effects of three initial spacings (5x5, 7x8, and 9x10) on tree
and stand development are considered in unthinned loblolly pine
plantations on a good site through 20 years. Spacing begins to exert
its influence on tree size at the onset of canopy closure which ranges
from five to ten years for these spacings. At 20 years mean tree size
in the 9x10 is larger than in the 5x5 by 40% for DBH, 110% for stem
volume, 100% for crown dimensions, and 3% for total height. Thus, all
dimensions other than total height are strongly dependent on initial
spacing. Differences at the stand level also occur early during
development, but these differences diminish through time. For example,
at ten years the 5x5 spacing contains about one-third more volume and
total dry matter than the 9x10 spacing, but the differences are reduced
to less than 10% at 20 years. This indicates a difference in the
pattern of growth among the spacings, with the current annual increments
maximizing earlier in the closest spacings.

The carrying capacity for basal area on this site is 200 sq.
ft./acre, and at the carrying capacity the gains from growth are offset
by mortality losses. The basal area carrying capacity is reached at 15
years for the 5x5, 20 years for the 7x8, and sometime beyond 20 years
for the 9x10.

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Plantation growth and mortality are both related to the level of basal area, and the basic relationship holds for all spacings. The rates of current annual volume increment are maintained at 90% of the maximum value (about 4 cunits/acre) from basal areas of 80 to 180 sq. ft./acre. The losses from mortality become apparent beyond 150 sq. ft./acre, and the annual losses approach 1.5 cunits/acre at basal areas beyond 200 sq. ft./acre. Thus, the mortality losses are greatest in the 5x5 spacing, and approach 800 trees/acre and 8 cunits/acre through 20 years. In contrast, the mortality losses in the 9x10 spacing for the same interval are only 100 trees/acre and 1.5 cunits/acre.

When merchantability limits are imposed, the highest yields are shifted to the wider spacings. For pulpwood, the top producer is the 7x8 spacing, with a yield of 50 cunits/acre at 20 years. About one-half of the total volume in the 7x8 spacing and one-third in the 9x10 spacing could be harvested as small sawlogs at 20 years. The overall stem quality is somewhat lower in the 9x10 spacing, and this is expressed in terms of basal sweep, fusiform cankers, and larger branches. The relative amount of juvenile wood at 20 years is 77% of the volume in the 5x5 spacing and 72% in the 9x10 spacing.

Based on these results, it seems like planting densities of 700-800 trees/acre give reasonably complete utilization of the site's potential, while capitalizing on the effort expended in establishment. This allotment of growing space provides high merchantable yields coupled with low mortality losses, reasonable insurance against risk, and the flexibility for a variety of management alternatives.