Growth Trends Of Loblolly Pine On Two Drained Wetlands

By CORTLAND E. YOUNG, JR.

During the past 15 years, loblolly pine has been planted on thousands of acres of wet forest land altered by drainage. Those responsible for the drainage are concerned with how the trees are doing. Gradually we are developing the knowledge to determine this. Results from a recent study have helped by providing an example of growth under varied moisture and soil conditions. Growth was found to be better during a wet year, when water table levels were higher, than during a dry year, when lower water levels prevailed. Moreover, growth was also considerably better on a heavy soil than on a light soil.

The data were obtained from two representative drained wetland areas in Berkeley County, South Carolina, just west of Charleston. One case study area was a ridge bay formed between old beach lines as the ocean receded from the eastern seaboard in past geologic eras. Within the bay are found deep sandy soils. Further inland, the second wetland area used in this case study was another type of bay commonly referred to as a “Carolina Bay” which often has a characteristically heavy soil. Neither bay was accessible for logging prior to drainage in 1952-1955. After the over-story of pond pine on the ridge bay and cypress-hardwood on the Carolina Bay was removed, the areas were planted with loblolly pine seedlings.

Within each of the two bays, one 1/10-acre plot was established to index growth. The plots chosen were typical and contained 10- to 12-year-old loblolly pine trees in a healthy, vigorous condition, and growth responses could be easily detected. Height and diameter growth of five trees on each plot were measured every two weeks during the 1963 and 1964 growing seasons. In addition, bi-weekly measurements of water table levels and rainfall totals were made. Analysis of soil texture provided the information necessary for plot soil type identification. Plot data were analyzed in two ways to see if water table levels were correlated with growth. First, total growth and average water table levels for the 1963 growing season were compared to those for 1964 and, secondly, increment growth within each growing season was compared with bi-weekly water levels.

Tabulation of rainfall records and water table data for the two growing seasons demonstrated quite different moisture conditions prevailed between the two years, with 1963 dry and 1964 wet. At the same time, diameter growth on both plots was 100 per cent greater in the wet.

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year than the dry one, and height
growth was 20 per cent greater.
For both years, diameter and height
growth on the clay loam plot was
more than double that for the loamy
sand plot (table 1).
Statistical comparisons between
growth and water conditions with­
in a growing season followed the
same pattern as seasonal compari­
sions, i.e., growth was better during
wet periods than dry periods. How­
ever, this relationship was true only
for diameter growth and then only
in the dry (1963) growing season.
But water table levels are not the
only influence on diameter growth;
statistical analysis of the data
showed that less than 40 per cent
of the growth was accounted for by
fluctuations in the water table.
Favorable location of the plots
within each wetland area could ex­
plain, in part, the growth patterns
demonstrated by the trees, partic­
ularly in the wet year. The ridge
position of the Plummer plot and
slope position of the Bayboro plot
made surface flooding a rarity, and
promoted better aeration for the
tree roots than may have existed
in other parts of the bays. This
micro-site phenomenon has un­
doubtedly been observed many
times on both drained and natural
sites. Whether it be on an old
stump, ditch bank, man-made beds,
or a slight rise, elevated trees often
grow at a better rate than those
only a few inches lower. This would
suggest that land-owners should
take advantage of any elevated spot
when planting pine on wet forest
land. An alternative would be to
drain any low spots artificially to
bring them to a drainage state com­
parable to the slightly elevated
locations.
The growth differences due to
soil are one of the striking results
of this study. Previous research has
shown that at approximately the
same moisture level a higher rate
of growth can be expected for lob­
lolly pine on a heavy vs. a light soil.
This is certainly supported by these
measurements. Often in the past,
woodland owners have put primary
reliance on water table manipula­
tion for increasing forest production
without considering the soil to be
drained. Innate fertility of soils
should be evaluated before an area
is drained because some peat and
sandy soils are much less produc­
tive at any level of moisture with­
out supplemental fertilization. At a
minimum, a competent soil-site
 technician should be consulted in
the planning stage of woodland
drainage projects.
The fact that the trees grew better
during wet rather than dry periods
would suggest that loblolly pine can
develop better on wet sites. But
how wet? Some plant-soil-water
relation studies indicate that lob­
lolly pine grows better on deep,
permeable, poorly drained soils
with a fluctuating water table than
on well-drained soils. Investigators
also point out the remarkable ability
of loblolly pine to withstand flooding
if the water table fluctuates and
does not remain above the surface
too long. Seemingly in contrast, it
has been shown that too high a
water table can hinder pine growth
and that drainage can greatly im­
prove growth of residual trees.
These results do not necessarily
conflict, and in summary it ap­
ppears that for loblolly pine to make
good growth in the presence of a
high water table, the root zone must
be aerated frequently to some yet
undefined depth.
We have seen an example of lob­
lolly pine response to high average
water table levels that do not com­
pletely inundate the root zone. It
even appears—for the plots studied
—that average growing season water
table levels of -0.6 and -0.8 foot
appear to be more beneficial to the
trees than those averaging one to
two feet lower. However, the water
tables were continuously fluctuating
to depths down to two feet, and it
is unlikely the same results would
have occurred if constant water
table levels had been maintained.
Because of the limited number of
sampling locations and the short
period of time covered by the study,
we cannot definitely recommend
these levels or any average water
level or system of fluctuation as the
most suitable for growth of loblolly
pine. Nevertheless, the land-owner
should be aware of loblolly pine’s
affinity for water when advising the
drainage engineer of conditions de­
sired in his woodlands.
Table 1.—Summary of measurements collected on two drained wetland forest plots

<table>
<thead>
<tr>
<th>Plot and season</th>
<th>Height growth</th>
<th>Diameter growth</th>
<th>Average water table levels¹</th>
<th>Minimum water table levels¹</th>
<th>Maximum water table levels¹</th>
<th>Rainfall</th>
<th>Average rainfall²</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Feet</td>
<td>Inches</td>
<td>Feet</td>
<td>Feet</td>
<td>Feet</td>
<td></td>
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<tr>
<td>Clay loam plot</td>
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<tr>
<td>1963 growing season</td>
<td>3.3</td>
<td>0.41</td>
<td>-2.6</td>
<td>-0.7</td>
<td>-4.8</td>
<td>21.3</td>
<td>31.6</td>
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<td>1964 growing season</td>
<td>3.9</td>
<td>0.96</td>
<td>-0.6</td>
<td>+0.1</td>
<td>-2.4</td>
<td>55.3</td>
<td>35.6</td>
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<td>Loamy sand plot</td>
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<tr>
<td>1963 growing season</td>
<td>1.3</td>
<td>0.19</td>
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<td>-0.3</td>
<td>-3.0</td>
<td>25.1</td>
<td>31.6</td>
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<td>0.38</td>
<td>-0.8</td>
<td>+0.1</td>
<td>-2.0</td>
<td>50.1</td>
<td>35.6</td>
</tr>
</tbody>
</table>

¹With reference to ground surface.

²From long-term weather records for period.