SOIL MOISTURE STRESS AND TRACHEID LENGTH IN LOBLOLLY PINE

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Little has been reported on the effect of environmental factors upon tracheid lengths in pines. Wellwood (1960) found no effect of site upon tracheid lengths in western hemlock, and Goggans (1961) concluded, after reviewing the literature, that environmental factors account for very little of the between tree variations that is found in tracheid lengths. On the other hand, Goggans (1962) concluded that summerwood tracheid length is correlated with heredity.

This paper reports the results of an experiment conducted in southern Illinois to determine the effect of soil moisture stress on the tracheid lengths of 18-year-old plantation-grown loblolly pine (*Pinus taeda* L.). At the beginning of the experiment, the dominant trees in the stand averaged from 6 to 7 inches d.b.h. and were about 40 feet in height. There were about 820 stems per acre with a basal area of 160 square feet. All trees were naturally pruned up to 27 feet in height. The soil under the stand is a silt loam with an impervious fragipan horizon 24 inches below the surface. Competition among individual trees for root space is severe, resulting in rapid soil water depletion during the summer months.

Six treatments were replicated three times on 1/20-acre plots in a randomized block design as follows:

1. Soil moisture was maintained near field capacity (F.C.) in the spring and near the wilting point (W.P.) during the summer.

2. Soil moisture was maintained near the wilting point in the spring and near field capacity during the summer.

3. Soil moisture was maintained near field capacity at all times.

4. When 30 percent of the available moisture in the top 24 inches had been used, the soil was watered to field capacity.

5. When 60 percent of the available moisture in the top 24 inches had been used, the soil was watered to field capacity.

6. Control; normal rainfall.

Trenching was used to prevent lateral movement of moisture and the growth of roots from one plot to another, and plastic covers were used over the soil surface on plots maintained under drought conditions. Soil moisture of the top 24 inches was monitored with a d/M nuclear gauge.

The dominant trees were sampled on each plot. Twelve-millimeter increment cores were taken from the north and south sides of each tree at 4.5 feet above ground so that wood from the last three years growth was included. Two

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wood samples were taken from each increment core, and the tracheids were macerated in a hot hydrogen peroxide-acetic acid solution. Tracheids were mounted on glass slides as described by Echols (1961) and measured using an ampliscope (Echols, 1959) that amplified the tracheids 62.5 times. Duplicate slides of mounted tracheids were made of each wood sample, and all tracheids were measured on each slide (about 25 tracheids per slide). This procedure resulted in approximately 600 measurements for each treatment.

The range and averages of tracheids in each treatment is shown in Table 1. The longest tracheids were found in plots maintained near field capacity, but there was no statistical difference in the averages between treatments. The results from this experiment substantiate conclusions drawn from other studies (Goggans, 1962) that heredity is the dominant influence in determining tracheid length of conifers.

Table 1.--Tracheid lengths according to treatments

Treatment	Range	Average
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F.C. in spring, W.P. in summer	2.59-3.57	3.04
W.P. in spring, F.C. in summer	2.59-3.50	3.08
F.C. at all times	2.72-3.81	3.06
When 30 percent moisture used, watered to F.C.	2.75-3.47	3.09
When 60 percent moisture used, watered to F.C.	2.46-3.34	2.90
Control, no treatment	2.80-3.54	3.09

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