Selecting White Oaks as Parent Stock for Growing High-quality Logs

by

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One of the major objectives of the tree-improvement program of the Central States Forest Experiment Station of the U.S. Forest Service is Co select and breed hardwood trees that are inherently capable of producing wood of high quality. To begin this program we must select from natural stands and plantations the best possible parent trees. In recent years we have developed a method for identifying white oak trees (*Quercus alba* L.) that have the highest probability of being inherently superior stock for producing high-quality logs.

Working together with Experiment Station utilization research scientists we have established the fact that knots cause most degrade in white oak logs. From a number of studies we now know that the number of lateral buds and branches occurring on the butt- log of white oak trees ranges widely and is relatively independent of site conditions. Branches are formed by the growth of lateral buds that are in turn produced under the control of inherent mechanisms in the plant. We therefore feel it is possible to select strains of white oak trees that have the inherent potential for producing few knots outside of a small central core of the stem.

Franklin G. Liming and I found that all of the branches on white oak trees develop from buds that are formed by the primary tissues of the terminal shoots 1/. Lateral buds are formed and are left along the main stem as the terminal shoot expands during height growth. In the axils of normal-sized leaves the buds grow to a large size. These large buds eventually grow into large branches of the crown or they die. In the axils of hair-like leaves, usually near the base of shoots, the buds remain small in size. These small buds rarely grow into crown branches. Some of these small buds die but others live for many years. As the main stem grows in diameter each year, these small buds elongate just enough to equal the radial growth of the stem. These small buds, hereafter called "suppressed buds", Pare held in suppression by compounds formed in the crown and transported down the main stem of the tree. Most of the knots formed in the outer part of white oak logs are formed by branches that grow from suppressed buds. The number of suppressed buds is therefore a very important characteristic to consider when selecting trees that are inherently superior for high-quality logs. We desire strains of trees that either form few or no suppressed buds or strains of trees that retain suppressed buds for only a few years.

1/ Boyce, S. G. and F. G. Liming. 1960. Dormant buds on oak trees. Unpublished report on file at the Central States Forest Experiment Station, Carbondale, Illinois.

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All suppressed buds cannot be seen because they are imbedded in the bark. Since suppressed buds are held in suppression by compounds formed in the crown and moved down the stem, removing the crown will release the buds on the stem remaining. The buds will grow into branches that can be counted.. However, for tree-improvement-program reasons we want to retain the crown so that acorns and scion wood can be collected.

On potential parent trees we stop the downward movement of compounds from the crown with a narrow girdle that will later close and permit the crown to continue living. The trees are first pruned to 17 feet in height. At this height a handsaw is used to make a girdle 1 inch deep and the width of the saw blade. The girdle is covered with a narrow strip of plastic and a length of wire is used to pull the plastic into the girdle and hold it in place. This girdle stops the movement of compounds down the stem through the phloem tissues.

Girdling is done in the spring before the leaves expand. After the first growing season the new branches below the girdle are counted. The number of branches indicates the number of buds previously held in suppression. The wire and the plastic are then removed. During the next growing season the girdle closes and the crown continues to live without serious injury to the tree. This makes it possible to select those trees that have the smallest number of suppressed buds in the butt log.

However, we still needed some basis for deciding how many branches and suppressed buds can be tolerated on the butt log of trees selected for the tree-improvement program. Recently James G. Schroeder and I solved this problem by calculating the probabilities of butt logs occurring in one of three log grades when different numbers of defects were present (Table 1) 2. From these data we decided that no more than eight branch-caused defects could be allowed on the lower 16-foot log of parent trees selected for the tree-improvement program. The butt log must also have a scaling diameter of at least 13 inches since the probability values were determined for logs of this diameter or larger. We also found that the greatest gains in log quality could be made by selecting among trees that had four to eight branch-caused defects in the butt log. Within this range, the selection of strains of trees that have on the average of one less defect in the butt log increases the probability that these logs will qualify for grade 1 by 11 to 15 percent.

CONCLUSION

Let me summarize our method for selecting white oak trees that are superior for high-quality logs. First we locate trees that have eight or less branches in the lower 16-foot log. The scaling diameter of the butt log must be at least 13 inches. Before the buds open in the spring, we remove all branches from the butt log and girdle the tree, as previously explained, at 17 feet. In the fall, we count the new branches below the girdle and remove the wire and plastic from the girdle. If the number of original branches plus the number of new branches is eight or less, the tree is included in the tree-improvement program. This method indentifies white oak trees that have the highest probability of being inherently superior for high-quality logs. This is a very limiting method and we expect to locate few trees that

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2/ Boyce., S. G., and J. G. Schroeder. 1962. Assess the value of reducing log defects in hardwoods. Unpublished report on file at the Central States Forest Experiment Station, Carbondale, Illinois. Manuscript submitted to Forest Science.

qualify. Each selected tree will be used in "progeny tests" that will prove or disprove the ability of the tree to produce seedlings that are inherently capable of growing logs of higher than average quality.

Table 1.--The probability of the lower 16-foot log occurring in 1 of 3 log grades by the number of grading defects present

Number of defects	Log grade 1	2	3
0	1.00		
1	1.00		
2	1.00		
3	.894	.106	
4	.807	.193	
5	.697	.303	
6	.589	.411	
7	.449	.551	
8	.302	.698	
9	.223	.772	.005
10	.179	.810	.011
11	.127	.828	.045
12	.093	.827	.080
13	.065	.795	.140
14	.039	.742	.219
15	.013	.697	.290
16		.630	.370
17		.555	.445
18		.475	.525
19		.400	.600
20		.320	.680
21		.250	.750
22		.200	.800
23		.140	.860
24		.090	.910
25		.050	.950
26		.010	.990
27		.005	.995
28			1.000
29			1.000
30			1.000