A SEARCH FOR BORER-RESISTANT BLACK LOCUST

by

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One phase of our research in black locust at the Northeastern Forest Experiment Station is concerned with evaluation of borer resistance and the comparative influences of genetic composition and site. If site influence is predominant, we may want superior trees for a given site. However, if borer resistance appears to be a genetic trait, we may want to breed superior hybrids.

In either case we need standards to measure advances by. The lack of such standards and the resulting confusion is evident in the literature. Pertinent data on tree growth, borer counts, and infested-tree ratios have not been reported by year and site for duplicate plantings of identifiable clonal selections.

Information of this kind is submitted here on the performance of ten black locust clones.

Annual measurements are very important for understanding the changing ecology of a black locust planting and for deriving conclusions about the nature of resistance to insect attack. The obvious major change in stand character from an open to a closed stand is the annual increase of tree size, which influences light intensity and lowers the temperature of stems in the shade. Hall pointed out that when air temperature is below 80°F. the beetles were seen most often on the side of the trunk exposed to the sun, but above 80°F. they were found mostly on the shaded side.

Another change is in bark character, from smooth to rough. This favors the borers because they lay their eggs singly by wedging them in bark crevices. A third physical factor that may have influence is drought. When drought occurs, the borer changes habit, from a xylem borer to a cambium borer. Then borers that previously only weakened the tree will kill it by girdling. What may have been considered a borer-resistant tree is suddenly changed by a site factor into a susceptible tree.

Considering such changes that affect black locust from seedling to maturity, when shall we measure resistance to the locust borer? If we select for propagation a black locust that is outstanding for growth rate, form, and freedom from apparent borer damage, we may make an unwarranted assumption that this tree has in its past been exposed to borer attack and has emerged unharmed. We do not know this history.

So it is logical to propagate some outstanding trees vegetatively to produce clones in which each tree has the same genetic combination. When these clones are planted in randomized blocks on a variety of sites, we can measure and record the history of clone response to site and borer infestation.

Such a program, begun in 1960, revealed a rather general infestation on all sites the first year of 17 percent of the trees. Exceptions were two clones showing no infestation. These were attacked the second year. Thus we learn that judgement on borer resistance should be rendered too early in the life of black locust.

We have found by dissecting a series of infested pole-size black locusts that borers are most common in 2-inch branches—about four times as many as in 7-inch trunks. This disparity was greater in older trees. In these trees, all borer attacks were in limbs 11/2 to 5 inches diameter. The average height of borer holes was 30 feet, and no holes were found below 12 feet. Three-fourths of the attacks were found at heights ranging from 34 to 44 feet.

When considering the available information on the varying interactions between the ever-present locust borer and black locust at different life stages, it would seem that the basic requirement for drawing conclusions and making recommendations is for complete data on this interaction to at least the pole stage of tree growth. We have data for only 6 years of juvenile growth on four randomized plots in Ohio. A part of these data is summarized in the table.

All these plots are located on slopes because black locusts grow better here than on ridges or in valleys. However, the spoil-bank slope in which the Cadiz plot is located is shifting, and this is damaging the root systems. This may indirectly cause increased borer attack in the weakened trees. The Zanesville plot is surrounded by slightly higher ridges that prevent air drainage, so a frost pocket may occur here. This could account for the average tree diameter here being the lowest of all plots. The range in average diameter between sites is 3.2 to 4.9 inches. Tree survival is high, ranging from 83 to 99 percent.

The data have not been analyzed to reveal significant differences. But more important than the present performance of the black locust clones in these plots is the trend of infestation and tree survival, and what the situation will be when the trees are pole size.

Table 1.—*Locust borer population in twenty sampled trees*

Clone No.	*Zanesville plot*	*Delaware plot*	*Wooster plot*	*Cadiz plot*	*All plots*
4191	10	7	89	763	869
4192	5	23	58	656	742
4193	13	9	56	200	278
4194	3	9	41	605	658
8295	18	17	49	594	678
8316	7	10	97	469	583
8449	16	5	60	478	559
8450	4	1	37	441	483
8452	3	5	18	480	506
8470	5	0	49	719	773
Total	84	86	554	5405	6129

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