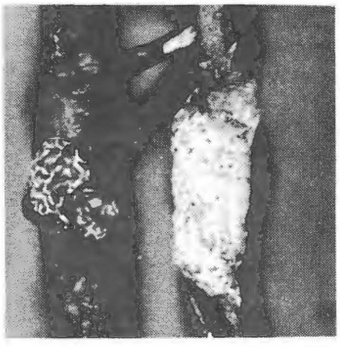
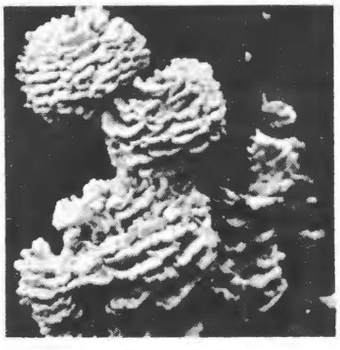
Forest Tree Diseases of Virginia

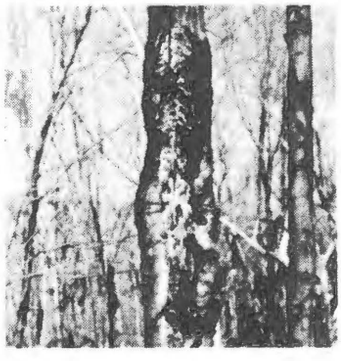


RUST

DECLINE



DECAY



CANKER

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Growth Loss of Scarlet Oak Due to Oak Decline in Virginia

by

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In Virginia, 53.2% of the total growing stock of the forest is comprised of various oak species. The red oak group (Erythrobalanus) alone comprises 44% of this total (1). During the past several decades, oaks have been dying at alarming rates throughout the mountainous sections of Eastern United States (2, 5). A recent study of oak decline in Virginia has indicated that 103,800 acres of mortality exist in the George Washington National Forest and 5,840 acres of oak have died in the Jefferson National Forest (3). This loss of oak has been termed oak decline, oak dieback, oak mortality, and oak blight, but all define the same problem (4). The decline is caused by a combination of factors including insect defoliation, drought, root rot, frost, and subsequent invasion of weakened trees by decay fungi and wood-boring insects (2, 5).

Nichols (2) conducted an extensive study of mortality and growth loss in 70 areas of Pennsylvania. Using the 5-year period prior to growth decline as a base period of normal growth, he reported a maximum radial increment growth loss of 85% following decline initiation. Staley (5) reported similar downward trends of radial growth rate following decline onset.

The study being reported was initiated to measure the growth reduction of scarlet oak, Quercus coccinea, in southwestern Virginia for comparison with the previous reports from West Virginia and Pennsylvania.

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FIGURE 1. Oak decline area used in 1970 study. Note that most large trees are dead. Understory is predominantly white oak.

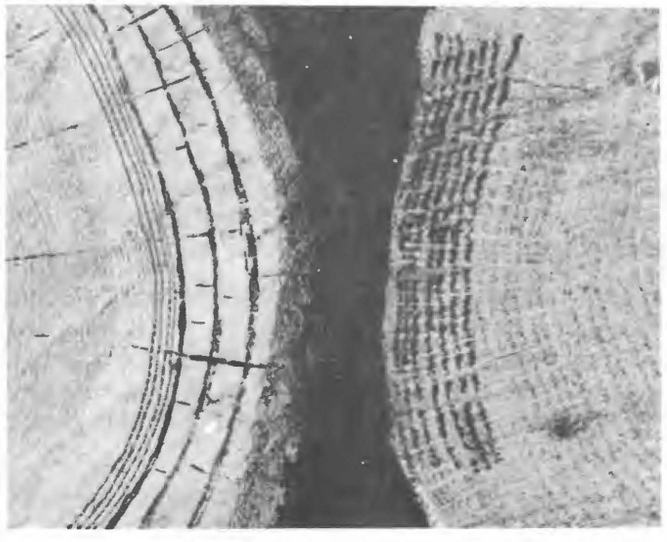

FIGURE 2. Disc removed from dead scarlet oak (R) and disc removed from understory released white oak (L). Dark lines mark annual increment growth.

death. An equal number of years preceding decline was measured for each tree. A few white oaks were sampled in the understory for determining increased growth rates following release due to the death of overstory scarlet oaks.

RESULTS

Stand basal area for the 1970 plots was found to be 90-100 ft^2 for healthy trees and 50 ft^2 of dead timber/acre. The basal area of the 1971 plot was 60-70 ft^2 healthy and 20 ft^2 dead scarlet oaks/acre. Site indices were 60 and 55 for scarlet oak on the two sites, respectively.

The 1970 and 1971 studies are summarized in Tables 1 and 2, respectively. Combined averages are presented in Table 3.

Small-diameter trees declined more slowly than large-diameter trees, but average mm growth loss was greater for large trees. The larger trees were of codominant crown classes and exhibited peaks of growth during several stages of their growth, but suppressed trees had a very uniform and minimal growth rate for their entire existence. Released white oaks (Q. alba) in the understory exhibited dramatic increases in growth rates (Fig. 2). Polyporus gilvus was by far the most abundant wood decay fungus found. Several other species of Polyporus and Irpex cinnamomeus were also abundant.

Table 1. Average annual increment before and after decline initiation in scarlet oak. 1970 data.

dbh Class (inches)	No. Trees	No. years' Decline[a]	Average Annual Increment (mm) Before	After	% Decrease
4	4	11	1.1	0.6	49
6	4	9	1.3	0.7	45
8	4	5	1.7	0.8	55
10	4	4	1.5	0.8	47
12	4	5	1.7	1.2	23

[a]Period during which no increase in annual increment occurred over previous year's growth until tree death occurred.

Table 2. Average annual increment before and after decline initiation. 1971 data.

dbh Class (inches)	No. Trees	No. years' Decline	Average Annual Increment (mm) Before	After	% Decrease
4	5	13	1.2	0.5	60
6	5	10	1.4	0.8	44
8	5	10	1.8	0.8	57
10	5	6	2.3	0.9	59
12	5	6	2.2	1.3	45

Table 3. Average annual increment before and after decline initiation. 1970 and 1971 combined averages.

dbh Class (inches)	No. Trees	Avg Age (yr)	No. years' Decline	Average Annual Increment (mm) Before	After	% Decrease
4	9	50	12.0	1.2	0.5	54
6	9	57	9.5	1.4	0.8	45
8	9	60	7.5	1.8	0.8	55
10	9	63	5.0	1.9	0.9	54
12	9	62	5.5	2.0	1.3	36

DISCUSSION

The results of this study agree with previous studies conducted in Pennsylvania and West Virginia (2, 5). Decline of growth rate occurred in both of our study plots on a very uniform basis. Four small plots containing trees in each diameter class (1970 study) and one large plot covering many acres with sampling in each diameter class (1971 study) produced similar results. The rate of tree decline and subsequent death and related reduced annual increment growth appears to be associated more with tree position in the stand (that is, dominance) than with tree age or tree diameter. Suppressed trees died over a period of time approximately twice that of the decline-death period of larger diameter trees of nearly the same age.

These results and those of others suggest that severely affected stands of scarlet oak should be clearcut to allow understory trees a chance for increased growth rates. Released white oaks responded favorably following death of the large dominant scarlet oaks. These data also indicate that stands in initial stages of decline should be examined carefully, and if decline continues the scarlet oak should be cut if economically feasible. The presence of numerous sapwood decay fungi soon renders a tree worthless for timber, pulp, or firewood sale.