EPICORMIC BRANCHING:

Seasonal Change, Influence of Fertilization, and Frequency of Occurrence in Uncut Stands

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EPICORMIC BRANCHES—the sprouts that form on the trunk of a tree—may degrade the quality of the logs that can be obtained from the tree.

Patterns of epicormic branches that develop on trees left in and around a cut stand have been reasonably well defined. However, very little is known about epicormic branching in uncut stands that have been fertilized.

Experiments done in cut stands have shown that the degree of branching is a function of height on the bole and of dominance class *(3, 5, 6, 7, 8, 9)*; that certain species are more prone to branching than others *(5, 6, 7)*; that formation of epicormic branches may be influenced by genetic composition *(1, 9)*; and that tree size, within a dominance class, bears little relation to the number of epicormic branches that may develop after release *(2, 9)*.

Kormanik and Brown *(4)* found that suppressed buds of young sweetgum *(Liquidambar styraciflua* L.) were stimulated by heavy fertilization to form epicormic branches, but information about other species and age classes is lacking. Because ultimate evaluation of forest fertilization practices must include changes in log quality as well as changes in growth rate, there is a need for more knowledge about this.

In a study made in West Virginia, we learned: (1) that numbers of small epicormic shoots in uncut stands vary within the growing season; (2) that fertilization with N, P, and K does not stimulate epicormic branches to form; and (3) that certain branching relationships established for cut stands also hold for uncut stands.

METHODS

Data for this study were collected from 78 red oak *(Quercus rubra* L.) and 199 yellow-poplar *(Liriodendron tulipifera* L.) trees located in 65 forest-fertilization test plots spread throughout the northern mountain section of West Virginia. Study trees varied from 10 to 20 inches in diameter at breast height and were estimated to range in age from 50 to 80 years. All belonged to either dominant or codominant crown classes and had developed under even-age stand conditions (fig. 1). For either species, only minor changes in site quality existed between the different test locations.

Fertilization treatments were arranged in randomized complete blocks. There were four blocks for red oak and seven for yellow-poplar, each located on independent test sites. Treatments included: (1) the untreated control, (2) P at 87 pounds per acre (lb./acre), (3) N at 300 lb./acre, (4) N and P at 300 and 87 lb./acre, respectively, and (5) N, P, and K at 300, 87 and 83 lb./acre, respectively. Urea, triple superphosphate, and muriate

Figure 1.—An even-aged upland hardwood stand, showing stems similar to those used for the study.

of potash fertilizers were used as nutrient sources. Because the triple superphosphate contained 18 percent Ca, all plots treated with P also received 78 lb./acre of Ca.

For each sample tree, the number of epicormic branches on the first and second logs was recorded separately. Three separate counts were made. The initial measurements were made in the spring immediately after fertilization as soon as the trees had fully leafed out. The second count was made in the same year in autumn, prior to leaf fall, to determine whether or not significant changes in numbers had occurred within the season. The third set of measurements were made during the following spring (second growing season after fertilization) and were used with the first-year data to determine whether or not fertilization had stimulated epicormic branches to form. General observations of growth and vigor of the epicormic branches were made by climbing 45 sample trees for each treatment late in the summer in which fertilizers were applied.

An epicormic branch was defined as any live shoot or bud cluster with leaves occurring upon the bole. Branches varied from young succulent shoots to several years old.

RESULTS

Seasonal Change

Many epicormic branches died during the growing season. For red oak, branch numbers declined 75 percent and 18 percent on the first and second logs, respectively (fig. 2). For yellow-poplar, numbers declined by 25 percent and 9 percent on the first and second logs—far less than for red oak. For both species, the actual numbers of shoots still alive in the fall were significantly related ($P < .001$) to the initial number present at the beginning of the season.

Field observations indicated that mortality was almost entirely limited to short current-season shoots, which had developed from clusters of dormant or adventitious buds on the bole. Frequency of occurrence and mortality of these short shoots was greater on the first log than on the second for both species and was greater for red oak than for yellow-poplar.

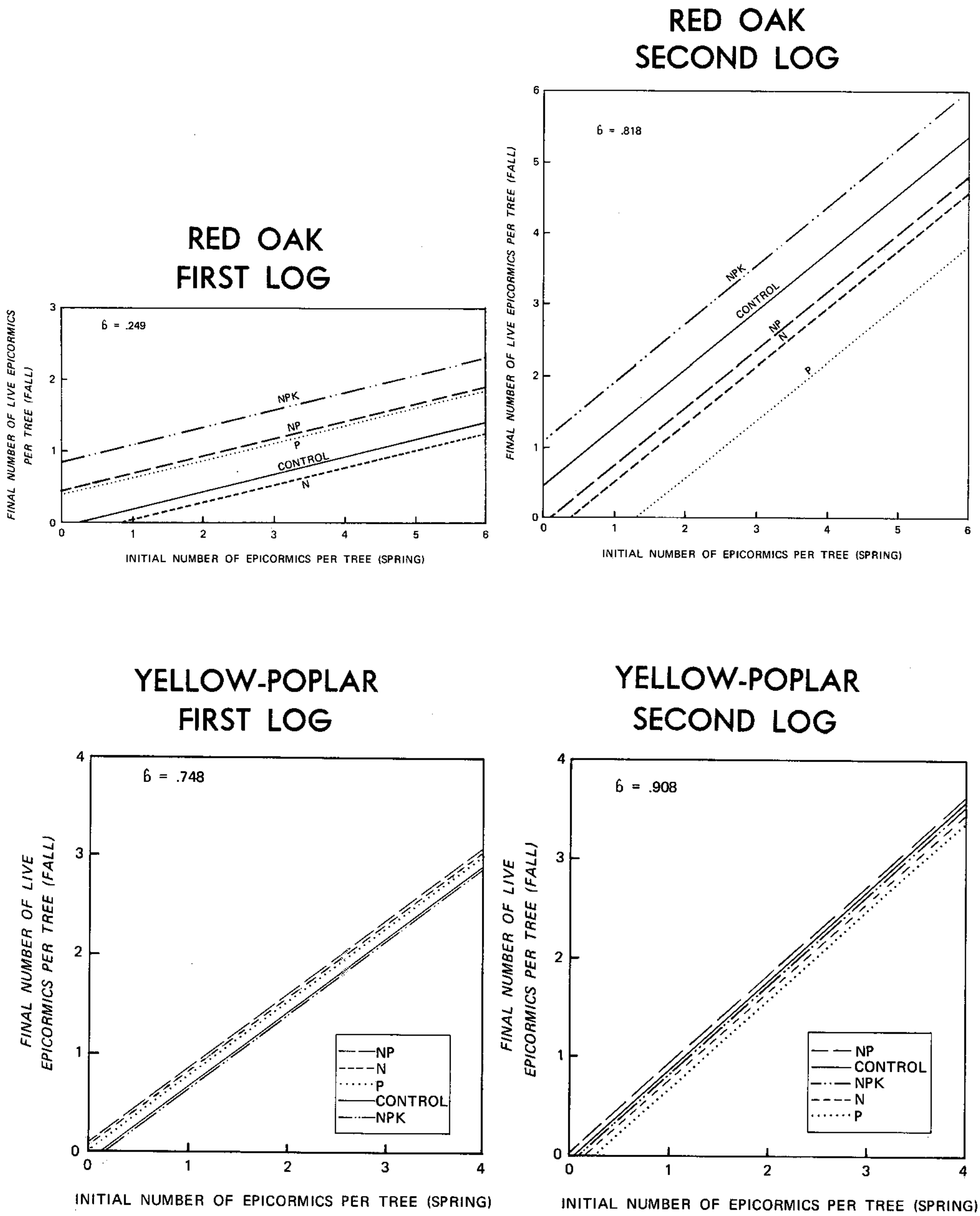


Figure 2.—Relationship between initial branch numbers in the spring and final branch numbers in the fall as affected by fertilizer treatments.

These findings suggest that repeated measurements of epicormic branch numbers in future studies should be limited to definite time intervals to achieve valid comparisons.

Effects of Fertilization

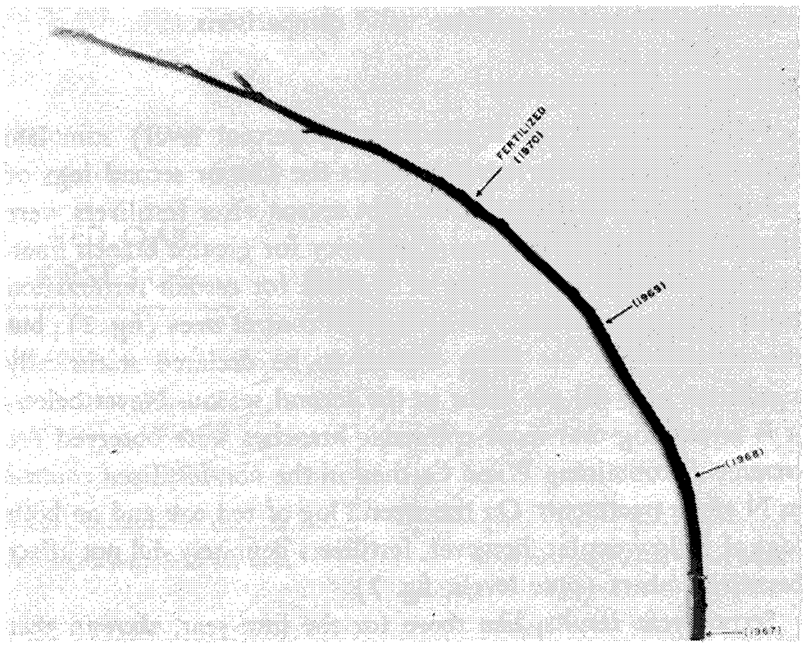
Fertilization did not significantly (5 percent level) stimulate epicormic branches to form on either the first or second logs of red oak or yellow-poplar in the first season after fertilizers were applied. However, there was a tendency for greater branch numbers to occur on the first log of red oak for certain fertilization treatments (particularly NPK) than on control trees (fig. 2); but the increase was not large enough to be declared statistically significant and did not occur in the second season. Nevertheless, it is interesting that more epicormic branches were observed for treatments containing P and Ca than in the non-fertilized control or N alone treatments. On the second log of red oak and on both logs of yellow-poplar, however, fertilizers definitely did not affect branch numbers (note levels, fig. 2).

Second-year results, like those for the first year, showed that epicormic branch numbers were not significantly (5 percent level) increased by any of the fertilization treatments.

Although fertilizers had little effect on stimulating dormant buds to form new branches, in both species, all treatments that included N had a strong tendency to increase vigor and growth of existing epicormic branches located above the first two logs (fig. 3). Simultaneous addition of P and K with N did not produce noticeable differences in either leaf size or growth of these branches over the increase resulting from N alone.

Increased branch growth resulting from fertilization was a function of height on the bole. General observations indicated that growth of existing epicormic branches on the first and second logs were not stimulated nearly as much as those occurring closer to the base of the live crown (indicating a possible interaction with light). Because N increased vigor and growth of these higher branches, there is a possibility that fertilization treatments that contain N may prolong their existence.

Figure 3.—Effect of nitrogen fertilization on growth of epicormic branches.



Branching Frequency

Branching patterns in uncut stands generally paralleled those reported after cutting, except that the degree of branching was substantially less than in cut stands. The data (table 1) illustrate that: (1) red oak was more prone to branching than yellow-poplar (6½ times more epicormic branches occurred on the first

Table 1.—*Means and standard deviations for epicormic branch numbers in uncut stands by species and log position*

Species	First log		Second log	
	Mean	Standard deviation	Mean	Standard deviation
Red oak	1.76	3.11	3.68	4.38
Yellow-poplar	0.27	0.70	1.07	2.18

log, and 3½ times more occurred on the second log of red oak as compared to yellow-poplar); (2) branch numbers were more variable on red oak than on yellow-poplar and showed wider variability on the second log than on the first; and (3) bole sprouting was greater on the second log than on the first, for both species.

Relationships between tree diameter and branch numbers on the bole at the beginning and close of the growing season were examined separately by species for each log. There was no apparent correlation between tree diameter and the number of epicormic branches present in the spring or fall of the year on either the first or second logs for either species.

Although there are many other possible factors besides tree size that might influence branch numbers, these variables could not be identified in the field by comparing individual trees having sprouts against individual trees lacking sprouts for identical site conditions. This suggests and supports hypotheses from other studies *(1, 9)* that the tendency of individual trees to form epicormic branches may be under considerable genetic control.

SUMMARY

Study of seasonal changes of epicormic branch numbers, effects of fertilization, and frequency of occurrence in uncut middle-age Appalachian hardwoods showed that:

- Large numbers of current-season epicormic branches died during the growing season. Reduction was greater on the first log than on the second for both species, and it was greater for red oak than for yellow-poplar.

- N, P, or K fertilizers did not stimulate epicormic branches to form during either the first or second season after fertilization, but N did increase vigor and growth of established epicormic branches on high sections of the bole.

- The number of epicormic branches on individual stems in uncut stands was a function of species and log position, but may also be influenced by genetics. Branch numbers were unrelated to tree size within the d.b.h. range of the dominant and codominant trees sampled.

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