SPROUTING of DORMANT BUDS on border trees

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AS PART OF an evaluation of silvicultural systems used in managing Appalachian hardwoods, we are studying degrade of border trees surrounding harvest-cut openings made in the patch cutting and group selection systems. One facet of this research dealt with determining what portion of visually evident dormant buds on border tree boles sprouted when the openings were cut. Increased knowledge in this area, along with more information about other aspects of bole sprouting, should lead to forest practices better designed to protect log quality.

As a result of this research on dormant buds, we learned that a higher proportion of buds sprouted on red oak than on yellow-poplar, that a higher proportion sprouted on exposed than on unexposed bole faces, that bud sprouting increased with height on the bole, and that most bud sprouting occurred in the growing season after release.

Study Procedure

The study was made on border trees surrounding 12 clearcut openings 200 to 250 feet in diameter (fig. 1). The openings were made in early summer, 1965, in a 50-acre stand of even-age mixed hardwoods near Parsons, West Virginia. The undisturbed and well-stocked stand was about 60 years old and had a site index of between 70 and 80 feet for oak (*Schnur 1937*).

For study trees, we designated at random 29 northern red oaks (*Quercus rubra* L.) and 21 yellow-poplars (*Liriodendron tulipifera* L.) that were between 10 and 22 inches d.b.h. Because crown dominance has been shown to affect the extent of epicormic branching that occurs when tree boles are suddenly exposed, we limited our selection of study trees to the codominant class and thus eliminated crown class as a study variable.

Figure 1.—Patch cutting opening.

Figure 2.—Epicormic branches on exposed half of a codominant red oak, 2 years after patch cutting. Buds and branches were marked with paint as they were tallied.

Initially, for each study tree, we recorded species and d.b.h. Also, we tallied all the dormant buds that were visible on the bole surface and circled them with paint. We did this to a height of two (16-foot) logs, separately for the half-bole circumference facing into the opening and for the half facing into the stand; these were designated the "exposed half" and the "unexposed half".

We considered dormant buds as any visually identifiable live buds, or bud clusters (buds in a cluster were counted as one bud) on the surface of the bark or embedded in it. For a more detailed explanation of the different types of buds, their origin, and their sprouting characteristics, readers should refer to a recent paper by Kormanik and Brown (*1969*).

After 1½ growing seasons (in the fall of 1966) and again after 3 more growing seasons (in October 1969), we repeated the d.b.h. measurement, counted new dormant buds that had appeared in the interim, and tallied the dormant buds that had sprouted since the previous measurement (fig. 2).

Results

PERCENT OF VISUALLY EVIDENT DORMANT BUDS THAT SPROUT

We tested the effect of several variables on bud sprouting: (1) species; (2) position on bole in relation to release, i.e. exposed versus unexposed half; (3) height on bole; and (4) elapsed time from release.

In considering the results of this study, readers should keep in mind that this study was limited to two species and to middle-aged trees of codominant crown class. Other species, younger trees, and stems of more subdominant crown classes would undoubtedly react differently under the same conditions.

Species

Over the 4½-year study period, a higher percentage of originally tallied buds sprouted on red oaks than on yellow-poplars. For the exposed halves of the first two logs, the figures were 18 and 7 percent (table 1). The difference was significant at the 1-

Table 1.—*Average number of initial dormant buds and percent of buds that sprouted per 16-foot log section*

Species	First log		Second log		First and second logs	
	Dormant buds	Sprouted	Dormant buds	Sprouted	Dormant buds	Sprouted
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
			EXPOSED HALF			
Red oak (29 trees)	37	15	37	20	74	18
Yellow-poplar (21 trees)	4	4	10	11	14	7
			UNEXPOSED HALF			
Red oak (29 trees)	37	6	32	9	69	8
Yellow-poplar (21 trees)	4	5	10	6	14	6

percent level. For the unexposed halves, the percentages were 8 and 6, a difference of only 2 percent (and not significant at the 5-percent level).

In addition to indicating that release triggered a higher percentage of red oak (than yellow-poplar) domant buds to sprout, the study showed that at the time of release red oaks had a greater number of buds (table 1). The results of this phase of the study were summarized and published by Smith (*1967*).

Exposed Half vs. Unexposed Half

For red oak, based on the first two logs, the exposed half had an average sprouting rate of 18 percent compared to 8 percent for the unexposed half. The difference was statistically significant at the 1-percent level. For yellow-poplar, the sprouting percentages were 7 for the exposed and 6 for the unexposed halves, and the difference was not significant at the 5-percent level.

Not only did the exposed sides of the boles sprout more profusely on the average, but sprouting on the unexposed half was concentrated near the borders of the exposed half. Moreover, where sprouting was heavier on the side of the bole facing into the stand (normally the unexposed face), this face had usually been unavoidably exposed when the openings were cut.

Height on Bole

The study showed that on the exposed boles of both species, the percent of originally tallied buds that sprouted increased with height on the bole.

For red oak, 15 percent of the buds on the first log sprouted, compared to 20 percent that sprouted on the second log; this difference between logs was significant at the 1-percent level. For yellow-poplar, 4 percent of the buds sprouted on the first log, and 11 percent sprouted on the second; the difference was not significant at the 5-percent level (possibly because so few trees had buds that sprouted).

The trend toward more bud sprouting with increased height on the tree bole conforms to previous work showing that released trees increase in epicormic branching with height above ground

(*Jemison and Schumacher 1948; Wahlenberg 1950; Smith 1965 and 1966*).

Elapsed Time after Release

About 1½ growing seasons passed between the initial count of dormant buds (taken shortly after release) and the first tally of buds that had sprouted in the interim; 3 more growing seasons passed before the next tally. For the exposed halves, we found these relationships between time since release and occurrence of sprouting:

Red oak.—On the first log, an average of six initially tallied buds sprouted. Of these, 77 percent sprouted in the first 1½ growing seasons. The second log had an average of 8 buds sprouting; 78 percent of them sprouted in the first 1½ growing seasons.

Yellow-poplar.—This species had little sprouting. In fact, the first log had practically no new sprouts. On the second log an average of one bud sprouted per tree. Nearly all sprouting (88 percent) on both logs occurred during the first measurement period (1½ years after exposure).

These data show that most post-release sprouting took place shortly after the trees were released. Had the study been continued, it is likely that very few additional buds would have been found to sprout. Moreover, our observations indicated that, after the first 2 years, mortality among sprouts probably exceeded in number the additional buds sprouting; although we did not count them at the last measurement, we noticed a great many dead epicormic branches.

DORMANT BUDS vs. BUDS SPROUTING

We calculated the correlation coefficients between the number of original buds and the percent of buds that sprouted in an attempt to discover if factors producing greater numbers of buds also operated to produce a higher sprouting rate. We made this test for the exposed halves of the first and second logs of red oaks. (Oaks had enough buds for tests of this nature to be meaningful; yellow-poplars did not). In both cases, the coefficients were small and not statistically significant, indicating that little, if any, relationship existed.

Summary

From a study of dormant bud sprouting made after release on 29 red oak and 21 yellow-poplar codominant border trees, we determined that:

- A higher percentage of dormant buds sprouted on red oaks than on yellow-poplars.
- A higher percentage of buds sprouted on the exposed than on the unexposed half of the tree bole.
- A higher percentage of buds sprouted on the second log than on the first log.
- Of the buds that sprouted in 4½ years after release, most sprouted during the first 1½ years.
- On the exposed half of the first and second logs of red oaks, no significant correlations existed between number of dormant buds and percentage of buds sprouting.
- The sprouting percentage of the few new buds that appeared during the study was higher than the sprouting percentage of the original buds.

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