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EFFECT OF GROWING SEASON ON SPROUTING OF BLUE HUCKLEBERRY

Melanie Miller

ABSTRACT

Vaccinium globulare, blue huckleberry, was clipped on five dates from May 19 to August 4. All clipping treatments caused more lateral bud release than occurred in control plants. May, June, and early July treatments caused the same amount of dormant bud release. The amount of shoot growth from released buds corresponded to the amount of growing season remaining after treatment. Irregularity between plants in shoot development after the July 8 treatment and the lack of bud development after the August 4 treatment are attributed to the onset of seasonal bud dormancy.

KEYWORDS: shrub response, fire effects, larch/Douglas-fir forest

Vaccinium globulare Rydb., blue huckleberry, reproduces vegetatively after fire. Normally, growth substances manufactured in the upper part of the plant inhibit the development of buds on lower stems and rhizomes (underground stems). Death of the plant top allows these buds to elongate into shoots. Energy comes from carbohydrate stored in rhizomes.

The number of Vaccinium globulare sprouts after spring and fall understory burns in a larch-fir forest type was closely related to fuels, fire characteristics, and forest floor moisture (Miller 1977). The ability of Vaccinium to produce new shoots did not seem to vary between spring or fall fire treatments or among any of the spring treatments, although seasonal fluctuations in sprouting potential are common in many other woody species (Berg and Plumb 1972). A clipping study was carried out to test this apparent lack of variation in sprouting ability, because any fluctuation would be an important consideration in prescribed fire planning for Vaccinium management.

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LITERATURE REVIEW

Fields of Vaccinium angustifolium, eastern lowbush blueberry, are periodically pruned with fire to increase commercial blueberry yields. The morphology and observed sprouting behavior of V. globulare resembles that documented for V. angustifolium. The physiological processes controlling plant growth stages and responses to pruning are probably similar.

V. angustifolium plants pruned with fire after July 1 did not produce sprouts until the following spring. The number of sprouts that appeared approximated that following spring or fall burns when plants were dormant (Eaton and White 1960).

Barker and Collins (1963) planted deleafed cuttings of V. angustifolium. Dormant buds on plants collected before July 1 grew into vegetative shoots. Plants collected in late July and early August showed irregular growth patterns.

Trevett (1962) observed that some lateral buds of V. angustifolium grow out after the late June or early July death of the terminal bud. Nitrogen application within 2 weeks of terminal bud death increased the amount of branching. Subsequent applications had no effect because buds had become dormant and could not respond.

STUDY AREA AND TREATMENT

The study area is located northeast of Missoula, Montana, in a western larch/Douglas-fir forest type, on a north aspect. Vaccinium globulare is the understory dominant, with occasional spiraeas, (Spiraea betulifolia (Pall.) var. lucida Dougl.), snowberry, (Symphoricarpos albus (L.) Blake), and Rosa species.

In early May of 1975, five clones of V. globulare were selected for homogeneity of Vaccinium density, slope, and aspect. All were located within forest openings (fig. 1). Six treatment plots were placed within each clone, at least 2 meters distant from each other. Plots were randomly selected for treatment.

Figure 1.--Representative clone of Vaccinium globulare, within which six sampling plots were located.
Figure 2.--Sample plot after clipping. Plastic markers locate the clipped stems that were observed for lateral bud development and shoot growth.

A treatment consisted of clipping all shrub and herbaceous vegetation from a 1-m² plot within each of the five clones (fig. 2). Six Vaccinium stems nearest the center of each plot with diameters between 0.15 and 0.35 cm were marked for observation, a total of 30 plants per treatment. (Average V. globulare stem diameter is 0.25 cm (Brown 1976).) Any developing buds were removed from Vaccinium stubs after clipping. Table 1 lists clipping dates and plant phenological state at the time of clipping. Thirty control plants were also marked, and the number of elongated buds noted.

Plants were examined for stored carbohydrate. Stems and about 70 cm of attached rhizome were collected in early June, a time when plant growth requirements should have caused some depletion in carbohydrate reserves, and again in early July. Plants were brought to the lab, and thin sections taken at 10 cm intervals, beginning at the base of the first leafy shoots. The sections were stained and examined with a binocular microscope for starch grain presence.

On September 28, a 10 cm long stem-rhizome section was cut from each clipped and unclipped control plant. The number of shoots was counted, and the length of each shoot measured to the nearest millimeter from the stem base to the shoot tip.

Table 1.--Clipping dates and plant growth stage

<table>
<thead>
<tr>
<th>Date</th>
<th>Growth stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 19, 1975</td>
<td>Initial leaf expansion; flower buds well developed.</td>
</tr>
<tr>
<td>June 1, 1975</td>
<td>Leaves 1/3 full size; flowers opening; branches elongating.</td>
</tr>
<tr>
<td>June 15, 1975</td>
<td>Leaves full size; flowering completed.</td>
</tr>
<tr>
<td>July 8, 1975</td>
<td>Berries 1/3 to 1/2 full size.</td>
</tr>
<tr>
<td>August 4, 1975</td>
<td>Berries ripe or almost ripe.</td>
</tr>
</tbody>
</table>
DATA ANALYSIS

Bartlett's test for homogeneity of variance was used to test sample variances. Analysis of variance was used to determine whether there were differences in the average number of new shoots per plant and the average amount of shoot growth on each plant. Anova tests were made for differences between clipping treatments and the control, and for interaction between treatments and the clones of shrubs, using an error term adjusted for the zero variance in two control plots. When significant differences were found, the Student-Newman-Keuls test (Sokal and Rohlf 1969) was used to make comparisons between individual mean values. Natural log values were used for analysis of variance and the Student-Newman-Keuls test for amount of shoot growth because sample variances were not homogeneous.

RESULTS AND DISCUSSION

The rhizome sections collected in early June had abundant starch grains, despite the high energy requirements of leaf expansion, flower development, and shoot elongation. Comparable amounts of starch were also present in rhizomes gathered in early July. Considering the amount of stored energy available to these Vaccinium plants, it seems unlikely that carbohydrate supplies limited plant growth after any of the clipping treatments.

Buds usually began to swell within a few weeks of stem clipping. Buds that developed were always those nearest the point of stem removal. The rate of bud elongation into shoots varied (fig. 3, 4, and 5).

Figure 3.--Swelling bud during initial stages of shoot elongation.
Analysis of variance found no interactions between clones and clipping dates. Any environmental and genetic differences between clones did not significantly affect *Vaccinium* sprouting. Significant differences (0.001 level) did occur between clipping treatments and control in both the number of lateral buds stimulated to develop into shoots and total shoot growth per plant (tables 2, 3).

Data for the average number of new shoots per plant and average shoot growth (mm) per plant for each clipping treatment are listed in table 4. Means followed by different letters were found to be significantly different at the 0.05 probability level by the Student-Newman-Keuls test.

There were no differences in the number of buds that began to develop after May, June, and early July clipping treatments (table 4). The May and June treatments resulted in more bud release than occurred after the August 4 treatment or in control plants, although a few shoots did develop on the unclipped plants. Additional buds may have developed on August treated plants during the subsequent growing season.

The greatest shoot growth occurred after the first clipping treatment (May 19), although statistically no greater than that following the second clipping on June 1 (table 4). The June 15 and July 8 treatments resulted in statistically less growth than the first two treatments but more than the August 4 treatment.
Table 2.--Analysis of variance for number of buds stimulated to develop

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of squares</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clipping treatment</td>
<td>150.844</td>
<td>5</td>
<td>30.169</td>
<td>18.520</td>
<td>0.001</td>
</tr>
<tr>
<td>Clone (block)</td>
<td>6.756</td>
<td>4</td>
<td>1.689</td>
<td>1.037</td>
<td>NS</td>
</tr>
<tr>
<td>Interaction (Treatment x clone)</td>
<td>38.044</td>
<td>20</td>
<td>1.902</td>
<td>1.168</td>
<td>NS</td>
</tr>
<tr>
<td>Error</td>
<td>228.000</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted error</td>
<td>228.000</td>
<td>140</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.--Analysis of variance for transformed* average shoot growth per plant

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of squares</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clipping treatment</td>
<td>468.717</td>
<td>5</td>
<td>93.743</td>
<td>81.022</td>
<td>0.001</td>
</tr>
<tr>
<td>Clone (block)</td>
<td>2.363</td>
<td>4</td>
<td>.591</td>
<td>.510</td>
<td>NS</td>
</tr>
<tr>
<td>Interaction (Treatment x clone)</td>
<td>33.447</td>
<td>20</td>
<td>1.672</td>
<td>1.445</td>
<td>NS</td>
</tr>
<tr>
<td>Error</td>
<td>161.969</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted error</td>
<td>161.969</td>
<td>140</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* L = Ln(L + 0.5)

Table 4.--Treatment summaries and mean comparison tests--number of new shoots and total shoot growth per plant

<table>
<thead>
<tr>
<th>Date of treatment</th>
<th>Number of Shoots</th>
<th>Shoot Growth (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>5-19-75</td>
<td>2.97a*</td>
<td>1.27</td>
</tr>
<tr>
<td>6-01-75</td>
<td>2.63a</td>
<td>1.00</td>
</tr>
<tr>
<td>6-15-75</td>
<td>2.70a</td>
<td>1.44</td>
</tr>
<tr>
<td>7-08-75</td>
<td>2.20ab</td>
<td>1.30</td>
</tr>
<tr>
<td>8-04-75</td>
<td>1.47b</td>
<td>1.57</td>
</tr>
<tr>
<td>Control</td>
<td>.30c</td>
<td>.75</td>
</tr>
</tbody>
</table>

* Treatment means followed by different letters are significantly different at the 0.05 probability level.
The standard deviation of shoot growth from released buds following the July 8 treatment (table 4) was much greater than after previous treatments, reflecting an increasing irregularity in individual plant response to clipping. The release of buds treated August 4 and lack of subsequent elongation into shoots does resemble the response of eastern lowbush blueberry to pruning. Because carbohydrate reserves seemed adequate in *Vaccinium globulare* even at a time of high growth rates, it is likely that development of bud dormancy in an increasing proportion of plants caused the decreased bud release and shoot elongation that occurred later in the growing season.

Shoot growth following pruning with fire would probably be much greater than growth following hand clipping. Smith and Hilton (1971) found no differences in bud initiation between clipping and burning treatments of *V. angustifolium*. However, dry matter production was much higher after burning. They attributed differences to the effect of nutrients released in ash and favorable microclimatic changes.

Miller (1977) stated that a spring fire would increase the density of *V. globulare* if fine fuels are dry enough to carry fire, and duff and soil wet enough to protect rhizomes. Conditions may be too wet to carry fire early in the season when plant growth potential is greatest. If later fires cause sufficient nutrient release to promote additional shoot growth, some compensation may be made for reduced *Vaccinium* growth potential.

**SUMMARY AND CONCLUSIONS**

A clipping study was conducted to test the hypothesis that sprouting of *V. globulare* after prescribed fire was not affected by seasonal variations in sprouting potential. There was no difference in the ability of *V. globulare* to initiate new shoots after clipping during the most active part of the growing season. The number of new shoots was the same after all clipping treatments made prior to August 4. Shoot growth that occurred after the first three clipping treatments was related to the amount of growing season remaining after treatment. Decrease in average shoot growth after the July 8 treatment was caused by limited growth in some plants, although others grew as much as those clipped earlier in the growing season. Buds on plants clipped August 4 were released, but very little shoot growth followed. The development of lateral bud dormancy probably affected bud release and shoot elongation after the July 8 and August 4 treatment. No change in growth was observed that could be related to expected high carbohydrate demands during early parts of the growing season. Plant growth stage apparently does not affect the number of shoots produced after prescribed fire removes aboveground plant parts.
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