Hexazinone on Weeds and on Lowbush Blueberry Growth and Yield

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Additional index words. Vaccinium angustifolium, weed control

Abstract. Hexazinone was applied preemergent, after pruning, at 1.1, 2.2, 4.5, or 9.0 kg/ha to a commercial lowbush blueberry (Vaccinium angustifolium Ait.) field. Visual ratings indicated a quadratic decline in grasses and a linear increase in blueberry injury associated with hexazinone application. Counts of weed populations showed a highly significant linear decline in meadowsweet (Spiraea latifolia Borkh.) and goldenrod (Solidago sp.) with an increase in hexazinone rate. Hexazinone treatments did not affect the density of blueberry stems, but flower buds and yield followed a quadratic trend. Hexazinone provided excellent control of common weed species accompanied by a significant increase in blueberry yield. Chemical name used: 3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione (hexazinone).

Lowbush blueberry fields in Maine and Canada have been developed from naturally occurring stands. The types of weeds present and methods of control are different in established lowbush blueberry stands vs. those in cultivated fields. The cultural practice of pruning the fields in alternate years promotes many early successionary species including meadowsweet and goldenrod. Although not identified as a problem weed in Maine (7), meadowsweet was described as a major weed problem in lowbush blueberry fields in Canada (1).

Over the past 10 years, the use of 5-chloro-3-(1,1-dimethylethyl)-6-methyl-2,4(1H,3H)-pyrimidinedione (terbacil) controlled many grasses, sedges, and some flowering herbaceous weeds (10). Weed control provided by terbacil has resulted in a doubling of blueberry yields when combined with high fertility management (2). Because of the reduced competition of the grasses and sedges and the stimulation of the added fertility, many flowering herbaceous and woody weeds have increased in both density and distribution in Maine’s blueberry fields. High fertility management under these circumstances could result in a decrease in yield (3).

Hexazinone has been reported effective in controlling many woody species in both lowbush (5, 11) and highbush blueberries (V. corymbosum L.) (4). This experiment tested the efficacy of several rates of hexazinone to control grasses, meadowsweet, and goldenrod and measured effects on blueberry growth and yield.

A coastal blueberry field in Jonesport, Maine, with a history of goldenrod and meadowsweet problems was selected as the experimental site. Plots measuring 2 × 8 m, with 2 × 8 m alleyways, were established on a field which had been pruned by burning the previous fall. Experimental design was a randomized complete block with 5 treatments and 10 replications. Soil samples were collected from which pH and easily oxidizable organic matter (OM) were determined. Hexazinone was applied on 6 May 1980 to blueberry and weed emergence at 1.1, 2.2, 4.5, or 9.0 kg/ha a.i. in 468 liters/ha water at 276 kPa pressure with a hand pushed pneumatic sprayer.

Observations were made on weed injury and blueberry growth throughout the summer of 1980. On 17 Sept. 1980 visual ratings on a 0 to 10, scale were made, on the blueberry stand, blueberry plant injury and degree of grass control. All goldenrod and meadowsweet stems in the plots were counted. Two 0.1 m² samples of blueberry stems per plot were collected in October of 1980. The number of stems, their length, and number of flower buds per 0.1 m² were determined from these samples. Yield samples were obtained by hand raking plots in Aug. 1981. Data were analyzed by analysis of variance and orthogonal coefficients with an F test at one degree of freedom to determine the trend and level of significance (6).

Visual assessments indicated a reduction in grasses for all hexazinone treatments vs. the control (Table 1). Data for grass control were not normal so parametric statistics are not presented. Hexazinone at 1.1 kg/ha provided more than 90% grass control. Counts of weed populations revealed a highly significant linear decline in numbers of meadowsweet and goldenrod stems with an increase in hexazinone rate. Meadowsweet was reduced from 66 stems per 16 m² for the control to 0 stems at the 9.0 kg/ha hexazinone rate. Goldenrod likewise was reduced from 21 plants on the untreated plots to 4.5 kg/ha hexazinone.

Preemergent hexazinone application gave excellent grass control at 1.1 kg/ha and control of goldenrod at 2.2 kg/ha. These observations are in agreement with Jensen et al. (5) who reported excellent control of native grasses and most common herbaceous weeds with spring applications of 1 to 2 kg/ha hexazinone. Jensen (4) noted similar results in a highbush plantation on an established Somerset sand (OM < 1%) treated with hexazinone.

Increasing the hexazinone rate from 1.1 to 9.0 kg/ha resulted in a highly significant linear increase in blueberry injury from 0.7 to 3.8 on a 0 to 10 scale (Table 2). Blueberry stand per 0.1 m² was not affected by hexazinone treatment. Blueberry flower buds did show a highly significant quadratic trend associated with hexazinone rate. Number of flower buds increased from 123 per 0.1 m² on the untreated control to 190 at 2.2 kg/ha hexazinone, but then declined to 134 at the 9.0 kg/ha hexazinone treatment.

Blueberry yield exhibited a highly significant quadratic trend related to hexazinone rate (Table 2). Yields increased from 2144 kg/ha on the untreated plots to 3554 kg/ha at the 4.5 kg/ha hexazinone rate but declined to 2900 kg/ha at 9.0 kg/ha (Table 2). This decrease in yield reflects the increasing toxicity of the herbicide to the blueberry plants.

Injury observed on blueberry plants included leaf chlorosis and necrosis resulting from leaf abscission occurring in an acropetal sequence. Blueberries exhibited a linear increase in injury associated with hexazinone rate. The same injury trend was found in another study in Deblois, Maine (11), but to a lesser extent (0.6 in Deblois vs. a 2.2 injury rating in Jonesport at the 4.5 kg/ha rate of hexazinone). Because poor drainage would result in an increase in injury, this differential may be related to the well drained nature of the soil at the Deblois site vs. the poorly drained soil in this experiment.

Observations indicated that some blueberry clones were injured whereas others were not. Because wild blueberry fields are com-

### Table 1. Effect of hexazinone on weed populations.

<table>
<thead>
<tr>
<th>Hexazinone rate (kg/ha)</th>
<th>Grass control (0–10)</th>
<th>Meadowsweet stems/16 m²</th>
<th>Goldenrod stems/16 m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1.3</td>
<td>66</td>
<td>21</td>
</tr>
<tr>
<td>1.1</td>
<td>9.3</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>2.2</td>
<td>9.4</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>4.5</td>
<td>10.0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>9.0</td>
<td>9.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F Test</td>
<td><em>...</em></td>
<td>L**</td>
<td>L**</td>
</tr>
</tbody>
</table>

*0 = none, 10 = 100% control.

*...*, L**, Data not normal, linear trend by orthogonal contrast, and significant at 1% level, respectively.
posed of many different clones, differences in tolerance to hexazinone is expected. The same type of differential susceptibility in crop injury has been reported among highbush cultivars by Jensen (4).

In this study, meadowsweet was controlled effectively at a 4.5 kg/ha rate on a poorly-drained, Scarpent glacial outwash soil (OM 10%) (9). In a similar study with lowbush blueberries, Yarborough and Ismail (11) obtained complete control of meadowsweet with 2.2 kg/ha on a Colton sandy loam (OM 7%). Scalza (8) indicated the rate of degradation is determined by the OM content of the soil, so that increased rates of hexazinone may be required for weed control on soils with high OM.

From 2.2 to 9.0 kg/ha hexazinone, injury to and a decline in numbers of sheep laurel (Kalmia angustifolia), willow (Salix sp.), trembling aspen (Populus tremuloides), rose (Rosa sp.), and black chokeberry (Pyrus melanocarpa) were observed. Plant populations were inadequate in experimental blocks for suitable statistical analysis, however, so no quantitative data are presented. Overall, the spectrum of herbaceous and woody weeds controlled in this experiment concurs with observations made by Canadian researchers in lowbush blueberries (5).

Blueberry plant stand, estimated from counts made the fall after pruning, indicated no decrease from hexazinone treatments at rates up to 9.0 kg/ha. Blueberry flower buds per 0.1 m² increased up to the 2.2 kg/ha hexazinone rate but declined at the 4.5 and 9.0 kg/ha rates. A similar increase in flower buds was reported with terbacil treatments up to 3.6 kg/ha (3). The plant stand and flower bud data substantiate observations made by Jensen that most lowbush blueberries are tolerant from 1.5 to 3.0 kg/ha hexazinone applied after pruning and before blueberry plant emergence.

Hexazinone provides selective weed control of many woody and herbaceous species not effectively controlled by terbacil or 2,4-D. The optimal rate of hexazinone for any site would vary depending on the weed composition, soil type, OM, and drainage. It is the first selective herbicide that will control both herbaceous and woody weeds in lowbush blueberry fields.

### Table 2. Effect of hexazinone on blueberry injury, stems, and flower buds.

<table>
<thead>
<tr>
<th>Hexazinone rate (kg/ha)</th>
<th>Blueberry injury (0–10)</th>
<th>Stems/0.1 m²</th>
<th>Blueberry flower buds/0.1 m²</th>
<th>Yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>62</td>
<td>123</td>
<td>2144</td>
</tr>
<tr>
<td>1.1</td>
<td>0.7</td>
<td>79</td>
<td>154</td>
<td>2919</td>
</tr>
<tr>
<td>2.2</td>
<td>1.0</td>
<td>81</td>
<td>190</td>
<td>3142</td>
</tr>
<tr>
<td>4.5</td>
<td>2.2</td>
<td>67</td>
<td>174</td>
<td>3554</td>
</tr>
<tr>
<td>9.0</td>
<td>3.8</td>
<td>61</td>
<td>134</td>
<td>2900</td>
</tr>
<tr>
<td>F Test</td>
<td>L**</td>
<td>NS</td>
<td>Q**</td>
<td>Q**</td>
</tr>
</tbody>
</table>

*0 = none, 10 = 100% injury. L = Linear, Q = Quadratic, NS = Nonsignificant by orthogonal contrast, ** = significant at 1% level.

### Effects of Year and Genotype on Flowering and Ripening Dates in Rabbiteye Blueberry

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Additional index words. Vaccinium ashei, cultivar breeding

**Abstract.** Seventeen rabbiteye blueberry clones observed for 4 years at Gainesville, Fla., showed much year-to-year and clone-to-clone variation in flowering and ripening dates. If, however, year effects were removed by expressing flowering and ripening dates as deviations from year means, the sequence in which the 17 clones flowered and ripened was highly repeatable, with little clone × year interaction.

Flowering dates and fruit-ripening dates are important characteristics of fruit cultivars. Flowering date affects the harvest season and thus influences economically important characteristics of cultivars to late spring frosts and also influences harvest season. Flowering date influences the type of weather to be expected during harvest. With perishable fresh fruit, a long harvest season allows growers to make efficient use of harvest labor, equipment, and markets. By studying year-to-year variations in ripening dates of 17 rabbiteye blueberry clones in Gainesville, Fla., showed much year-to-year and clone-to-clone variation in flowering and ripening dates.

The breeder’s ability to control ripening date through cultivar development is reduced by environmental factors. The importance of these nongenetic influences can be assessed by studying year-to-year variations in ripening dates. This paper reports 4 years of data on ripening dates of 17 rabbiteye blueberry clones in Gainesville, Fla., and assesses the importance of genetic and nongenetic influences on ripening date.

The 17 clones used in this study were growing at the Univ. of Florida Horticultural Unit, Gainesville, Fla. Four clones (F80-141, F80-146, F80-150, and F80-153) were represented by single plants which were about 5 years old from seed when the first data were taken in 1981. The other 13 clones were represented by 20 plants per clone and were

Received for Publication 27 Sept. 1984. Univ. of Florida J. Ser. No. 5874. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.


