Agriculture Research Initiative

Final Report
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Wild Blueberry Renovation

Prepared by: Karen Kennedy, M.Sc.(Agr.), P.Ag.
Fruit Crop Development Officer

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Executive Summary

Lowbush blueberry production was a major asset to the agricultural industry in NL, but in recent years, production has plummeted. Due to the low price for berries, some blueberry producers do not even partake in the pertinent pruning practices to develop the two-year production cycle that ensures fruit set and maximizes yields. An experiment was initiated whereby two pruning techniques (burning and mowing) and three levels of fertilizer (0 kg N/ha, 20 kg N/ha of 14-18-10, and 20 kg N/ha of MESZ) were applied to experimental plots to determine their effects on weed populations, blueberry leaffier (*Croesia curvalana*) populations, and blueberry yields.

It appeared that as the summer progressed, % coverage of blueberry increased more vigorously in the fertilized plots compared to the unfertilized plots, with the unfertilized plots containing a larger percentage of bare ground.

Significantly fewer blueberry leaffier moths were present in the burned plots compared to the mowed plots and the control. The number of leaffier moths present in the mowed plots and the control were not significantly different, indicating that mowing does not remove blueberry leaffier eggs from an area, nor control leaffier populations.

Burned plots had significantly higher blueberry fruit buds/stem compared to mowed plots, and fertilized plots produced higher fruit buds/stem compared to the control, with no significant difference between fertilizer blends.

1.0 Introduction

Lowbush blueberries are generally managed on a two-year production cycle; in the first year of production, fields are pruned (sprout or prune year) and in the second year fields are harvested (crop year), (Barker et al. 1964). Fields are usually separated into two production years so that half of the acreage is harvested in any one year (Kinsmen 1993; McIssac 1997). Fields are pruned (via mowing or burning) in the late fall or early spring of the prune year, before blueberry bud break (Barker et al. 1964; Eaton 2005), which stimulates the production of vigorous new shoots from underground rhizomes (Hall et al. 1972). The shoots grow rapidly until the early or middle part of the summer (usually July) at which time they undergo tip die-back (Bell 1950). Buds then develop into either vegetative of flowering buds during the latter part of August and early September (Bell and Burchill 1955). The type of bud that develops depends on which year the shoot arises and vegetative buds tend to be three times larger than floral buds (Kinsmen 1993).

On the Island of Newfoundland there are approximately seven commercial blueberry producers. In 2005, wild blueberry production on the Island totaled 2,100 acres, but as of 2010 production plummeted to 901 acres (Stats Canada, 2011). The blueberry leaffier (*Croesia curvalana*) is a common pest in Newfoundland blueberry fields, that overwinter in the leaf litter and causes significant crop losses for NL (Ponder and Seabrook 1988), but it not a significant pest of Maritime blueberry fields.

MicroEssentials fertilizer is constructed to contain all essential macronutrients on one granule of fertilizer. In theory, this is supposed to enhance the nutrient availability to crops, as all essential nutrients are contained in granule of fertilizer as opposed to several separate granules. The Mosaic Company (2012), states that every patented MicroEssentials granule has the same analysis, so that plants will get balanced nutrition, as it eliminates nutrient segregation common with traditional blends. In addition, MicroEssentials fertilizer combines two forms of...
sulfur; sulfate and elemental sulfur, in every granule to ensure sulfur availability throughout the growing season (Mosaic Company 2012).

In 2013, 100 acres were burned at a commercial blueberry farm and the producer mowed an additional 4 acres of land. After all fields were pruned, the 104 acres received an application of Velpar at the recommended rate of 2.56 kg ha\(^{-1}\) for residual weed control, and fertilizer will be applied to ensure fruit set (Eaton 1994) at three different rates. Randomized plots were setup within the mowed and burned fields to assess the effects of burning versus mowing on weed populations, blueberry leaffter populations and blueberry yields.

2.0 Project Objectives
The main objective of this project is to determine the effect of burning versus mowing in conjunction with agrochemical application on:

a) weed populations;
b) blueberry leaffter populations, and
c) blueberry yields.

In addition, the traditional 14-18-10 ammonium sulphate fertilizer (AS) and a new MicroEssentials (MESZ) fertilizer will be compared to determine the differences on blueberry growth and yields.

3.0 Funding and Partnerships
Funding for this project was provided by the Agriculture Research Initiative, a cost-shared program between the provincial and federal government.

4.0 Methodology

Study site. This experiment was the first year of a two-year study, which took place at Jumper’s Brook Blueberry Farm Inc. in Grand Falls, NL.

Experimental design. The experimental design was a 2x3 Factorial Design in 4 blocks. The treatments consisted of a management technique at two levels (mowing or burning) in conjunction with the addition of fertilizer at three levels (0, 20 kg N/ha of 14-18-10 and MESZ @ 20 kg N/ha). Each treatment was replicated four times. Velpar 75DF was applied at a rate of 2.56 kg/ha in a water volume of 200 L/ha (1.9 kg of the active ingredient, hexazinone). Plots were 2 x 6m in size.

Data collection. Percent cover. After agrochemical application, each 2 x 6m plot was assessed via percent cover twice per month throughout the growing season. Percent cover was divided into % bare ground, % \textit{Vaccinium angustifolium}, % \textit{Cornus canadensis}, % \textit{Kalmia angustifolia}, % \textit{Rumex acetosella}, % grasses, and % other. This parameter was assessed to show the effects of mowing or burning with fertilizer addition on weed populations and blueberry cover over time.
Blueberry leaftier monitoring. Blueberry leaftier (Croesia curvalana) populations were monitored throughout the prune year. In the prune year, adult moths were monitored using pheromone traps baited with blueberry leaftier pheromone. This determined if insecticide application was required in the following crop year. Three to six traps were placed within each burned and mowed field as per scouting guidelines (Crozier 1996) and six traps were placed in the control field, defined by not undergoing any pruning technique in the past three years. Traps were monitored every two weeks from mid-June to mid-August, and the number of leaftier moths were recorded.

Floral bud counts. Twenty blueberry stems were collected from each 2 x 6m plot using a line transect that extended diagonally across each plot. The transect was marked at 40cm intervals and one stem directly below each mark was collected. The number of vegetative and floral buds were recorded and yield inferred until yield data can be collected in the succeeding crop year.

Statistical Analysis. The data was analyzed using a two-way Analysis of Variance (ANOVA) in JMP®. Least Squares (LS) means differences were used to test for treatment differences using a probability level of \( p \leq 0.05 \).

5.0 Results and Discussion

Percent cover. From qualitative observational analysis, it appeared that as the summer progressed, % coverage of blueberry increased (via stem density) more vigorously in the fertilized plots compared to the control.

Unfertilized plots appeared to have a larger percentage of bare ground, and blueberry percent cover was low. Both the AS and MESZ fertilizers increased blueberry cover over time, and the percentage of bare ground decreased. This is likely due to a response in nitrogen, which the plants absorbed thereby increasing their stem lengths and density to expand in size, and fill in the bare ground (Kennedy 2010).

Though, not analyzed statistically, it appeared that the blueberry plants in the MESZ fertilized plots produced longer internodes on the blueberry stems compared to the blueberry plants that received the 14-18-10 AS fertilizer. In addition the floral buds produced on the blueberry stems in the MESZ plots appeared to be larger in size than those in the standard AS plots.

Blueberry leaftier monitoring. Moths were collected on three different trap dates, July 3, July 17, and August 19. There was no significant difference between leaftier numbers among the three treatments in the first two trap periods (\( p=0.1328, p=0.3541 \), respectively; Table 1). In the final trap period, there were significantly fewer leaftier moths present in burn-pruned field compared to the mowed field and the control (Table 1); (Ponder and Seabrook 1988). This indicates that burning can effectively control blueberry leaftier numbers as burning can remove the overwintering larvae found in the organic duff layer on the surface of the ground. There was no significant difference in leaftier numbers between the control and the mowed field (Table 1), thus indicating that mowing and having no pruning technique does not effectively manage or control blueberry leaftier numbers.
Table 1. The effect of pruning on blueberry leaffier moth numbers at three trap dates.

<table>
<thead>
<tr>
<th>Pruning Treatment</th>
<th>Trap Date #1</th>
<th>Trap Date #2</th>
<th>Trap Date #3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># moths/trap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>0.00 a&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.30 a</td>
<td>3.00 a</td>
</tr>
<tr>
<td>Mow</td>
<td>0.60 a</td>
<td>0.00 a</td>
<td>3.33 a</td>
</tr>
<tr>
<td>Burn</td>
<td>0.00 a</td>
<td>0.00 a</td>
<td>0.75 b</td>
</tr>
</tbody>
</table>

<sup>1</sup>LSmeans within a column (within trap date) with the same letter are not significantly different (p=0.05)

**Floral bud numbers.** The main treatment effects had a significant affect on floral bud numbers (p=0.0311, Figure 1), but there was no interaction effect between fertilizer and pruning method (p=0.3288). Significantly higher floral buds numbers were observed in the burn-pruned plots compared to the mowed plots (Figure 1).

These findings are similar to the finding of Penney et al. (1997) and Ismail and Hanson (1982), whom observed higher yields in burned plots compared to unburned plots.

![Figure 1. Effect of pruning method on average floral buds numbers. Means with the same letter are not significantly different (p≤0.05).](image)

Fertility significant affected floral bud numbers (p=0.004). Higher floral buds numbers were observed in the fertilized plots compared to the control (Figure 2). Unfertilized plots obtained an average of six buds stem<sup>-1</sup>, compared to eight and ten buds stem<sup>-1</sup> in the MESZ and AS fertilized plots, respectively. This indicates that blueberry plants will experience a higher fruit set when fertilized, as higher floral bud numbers translates to higher flower initiation. It is important to note that all plots were treated with Velpar application, which could have also aided in higher floral bud numbers, as it removed competing weeds.

In this study, there was not a significant difference in blueberry floral bud numbers between the MESZ fertilized plots compared to the AS fertilized plots (Figure 2). This indicates that the
two fertilizers produced the same number for blueberry floral buds per stem and should in theory produce yields that are not significantly different from one another.

These findings indicate that it may be more beneficial to use the standard AS fertilizer for lowbush blueberry crops, as there were no significant difference in floral bud numbers, and the price of MESZ fertilizer is more expensive than the traditional AS fertilizer.

It is important to note that the effect of MESZ fertilizer on stem densities was not assessed during the first year of study, and visual observations indicated that plots treated with MESZ fertilizer appeared to have longer internodes and larger-sized floral buds. This aspect should be assessed further in the next study.

Figure 2. Effect of fertilizer treatment on average floral bud numbers. Means with the same letter are not significantly different (p≤0.05).

6.0 Conclusion and Future Recommendations

Blueberry leaffier monitoring. The blueberry leaffier lays its eggs in the leaf litter of blueberry fields. Blueberry land has a significant amount of leaf litter and organic matter. Fields that are not pruned, or those that are mowed, will have significantly more litter compared to those that are burned. In this study, significantly fewer blueberry leaffier moths were present in the burned plots compared to the mowed plots and the control. This indicates that pruning by burning effectively removed the blueberry leaffier eggs. The number of leaffier moths present in the mowed plots and the control were not significantly different, indicating that mowing does not remove blueberry leaffier populations from an area. The effective management technique to remove and maintain leaffier populations on blueberry land is to burn-prune (Campbell 2004; Ponder and Seabrook 1988).
Floral bud numbers. In this study, burn pruning resulted in significantly higher floral bud numbers compared to mowing. The fields that were pruned in this study were left untouched for three or more years, and had a significant amount of organic matter on top of the duff layer. This could explain why the burned plots resulted in higher floral bud numbers compared to the mowed plots. Pruning is an essential management technique that aids in blueberry stem growth. Since blueberry floral bud numbers are an indicator of potential yield, blueberry yields must be assessed in the next year of study to determine if pruning technique had a significant effect as floral bud numbers is an indicator. Whether a field is opted to undergo burning or mowing is producer-specific decision, and largely depends upon time, health of the field, diseases or pests present in the field, and money. Burning pruning is significantly more costly than mowing due to the cost of either oil or imported straw to conduct the burn (Gomez 1988).
Literature Cited


