Wild Blueberry Research Program
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Cropping Phase of Production Use of Foliar-Applied Silicate Products in Wild Blueberry Production and Impact on Yield Components and Harvestable Berry Yield

Executive Summary and Conclusions

- The field trial examining the effectiveness of CropSIL® and other formulations of silicone products on wild blueberry yield components and harvestable berry yield was conducted in a replicated field trial conducted at the Wild Blueberry Research Centre in Debert, NS, in 2020.
- Treatments were applied to the wild blueberries at a height of 50 cm above the canopy with a R&D field sprayer equipped with Teejet 8002 Visiflo flat fan nozzle tips at a rate of 210 $L \cdot ha^{-1}$ treatment solution at a pressure of 220 kPa using carbon dioxide as a propellent.
- There were no significant treatment effects on the number of berries per stem, number of set fruit per stem, or the number of small, unmarketable berries (i.e., “pinheads”) per stem.
- Harvestable berry yields were affected by the treatment applications with the Canagro 3% silicic acid treatment applied early (anthesis) and late (fruit set) having harvestable berry yields that were 21.7% greater than the untreated control. The CanAgro Silicic Acid powder treatment applied early had harvestable berry yields that were 15.6% greater than the untreated control.
- Application timing also had an effect on harvestable berry yields with the early + late treatment applications, and early treatment applications having harvestable berry yields that were 19.5 and 23.9% greater respectively than those applied late.
- Differences in harvestable berry yields between the formulation of products examined were present with the Canagro 3% Silicic Acid Solution and Canagro Silicic acid powder treatments having harvestable berry yields that were 1.7 and 11% greater than CroSIL respectively.
- Therefore, results from the study illustrate that applications of silicate products in the cropping phase of production can increase the harvestable berry yields of wild blueberries.

Introduction

Silicon is the second most abundant element in the earth’s crust and is found in significant quantities in the soil. Acquisition of silicone by plants is predominately in the form of mono-silicic acid compounds. Most dicot plants (e.g., broad leaf plants) including blueberries take up small quantities of silicon that typically constitute less than 0.5% of their the tissue weight (dry weight basis). Some monocots (grasses) such as rice and other wetland grasses accumulate up to 5-10% silicon in their tissue, which is higher than normal ranges for nitrogen or potassium.

Silicon seems to benefit certain plants when they are under stress. It has been found to improve drought tolerance and delay wilting in certain crops where irrigation is withheld and may enhance the plant's ability to resist micronutrient and other metal toxicities (i.e. aluminum, copper, iron, manganese, zinc, etc.). Applications of silicon have also been reported to increase resistance of various plant species (e.g., sunflower, cucumber roses, etc.) to fungal pathogen attack and suppress diseases including powdery mildew and phytophthora. Prior research of foliar applied silicone products on disease control of wild blueberries was inconclusive with no clear and consistent effects of silicone treatment applications on Monilinia and Botrytis blight diseases. However, applications of the silicone treatments have resulted in wild blueberry yield increases in several replicated field trials.

Given the range of silicone based products available, a study was completed in the 2020 field season to examined the include of various foliar-applied formulations applied at the full bloom (anthesis) and fruit set stages of wild blueberry growth and development.

Methods and Materials

Fungicide treatments were applied using a Bell Spray Inc.©, hand-held research sprayer equipped with a two-meter boom and 4, Tee Jet Visiflow 80-02VS nozzles. Carbon dioxide was used as a propellant at a pressure of 220 kPa, and an application rate of 210 $L \cdot ha^{-1}$. Two fungicide applications were applied to the plots at anthesis (full bloom) and fruit set.

For each assessment, fifteen stems per plot were collected at 30 cm intervals, using line transects placed diagonally across each plot, and kept at 4 °C until assessed. Yield potential including fruit set and unmarketable berry number were determined. Harvestable yield was determined by raking four randomly selected one-square-meter quadrats per plot using a forty-tine, commercial wild blueberry hand rake, at harvest time.

Analysis of variance for all the data collected from the experiment was completed using the PROC GLIMMIX procedure of SAS (SAS Institute, Cary, NC, version 9.4) (α=0.05).

Additional field site and treatment application details consisted of the following:
Location: Wild Blueberry Research Centre – new site (mid way to munition shed along the road)

Geographical Reference:	45°26'30"N, 63°26'49"W
Elevation:	58 m
Field Type:	Commercial wild blueberry field
Owner:	County of Colchester and leased by Dalhousie University
Number of Treatments:	10
Number of Replications:	5
Experimental Design:	Randomized Complete Block Experimental Design with 5 replications, a plot size of 4 x 6 m and 2 m buffers

Treatments:

1. Untreated Control
2. CropSil Early (Full bloom: Application rate of 3.5 mL/2L bottle)
3. CropSil Late (Fruit Set)
4. CropSil Early + Late
5. CanAgro Silicic acid 3% solution early (application rate of 3.5 mL/2L bottle)
6. CanAgro Silicic acid 3% solution late (application rate of 3.5 mL/ 2L bottle)
7. CanAgro Silicic acid 3% solution early + late (application rate of 3.5 mL/2 L bottle)
8. CanAgro Silicic acid powder (3%) applied early (application rate of 3.5 g/2L bottle)
9. CanAgro Silicic acid powder (3%) applied late (application rate of 3.5 g/2L bottle)
10. CanAgro Silicic acid powder (3%) applied early + late (application rate of 3.5 g/2L bottle)

Application Timings:

Early: Full bloom (anthesis)
Late: Fruit set

First Application Date (Early)

Treatment Application Date:	June 16, 2020
Application Time:	1 pm
Wind Speed and Direction:	1.2 km·hr^{-1} (W)
Relative Humidity	31%
Soil Temperature at Time of Application:	15.4 °C
Presence of Dew:	No
Cloud Cover:	Clear
Air Temperature:	23 °C
Plant development stage:	80% F6

Second Application Date (Late)

Treatment Application Date:	June 24, 2020
Application Time:	10 a.m.
Wind Speed and Direction:	1.80 km·hr^{-1} (W)
Relative Humidity:	73 %
Soil Temperature at Time of Application:	13.4 °C
Dew:	No
Cloud Cover:	Overcast
Air Temperature:	20 °C
Plant development stage:	Set fruit (2 weeks post anthesis)

Application Rates:

CropSil:	6.3 g a.i.·ha-1 appled at 210 L·ha^{-1}
CanAgro 3% Silicic acid:	3.5 mL per 2 L bottle applied at 210 L·ha^{-1}
CanAgro Silicic acid powder:	3.5 g per 2 L bottle applied at 210 L·ha^{-1}

Yield components collection date: **July 20, 2020**
Harvest date: **August 12, 2020**

Plot Plan:

Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
9	2	7	8	1
3	4	1	5	6
7	6	3	10	2
1	8	9	4	7
8	9	2	7	5
10	5	6	3	8
4	7	10	9	3
6	1	8	1	10
2	3	5	6	4
5	10	4	2	9

Results and Discussion

Results from the field trial conducted at the Wild Blueberry Research Centre (Debert, Nova Scotia), illustrated the benefits of applying the various formulations of silicate products on harvestable berry yield. Although there were no significant treatment effects on the number of berries per stem, number of set fruit per stem, or the number of small, unmarketable berries (i.e., "pinheads") per stem, this was in part due to the reproductive components (flowers) being in place and pollination underway when the initial treatment application was made.

Table 1. Influence of silicone formulation and timing on the yield components and harvestable berry yield of wild blueberries from a field trial conducted at Debert, Nova Scotia during the 2020 field season.

Treatment	Total berry number per stem	Number of set fruit per stem	Number of "pinheads" (small, unmarketable berries per stem)	Harvestable berry yield ($g \cdot m^{-2}$)
1. Untreated control	20.0	18.9	1.1	993ab
2. CropSil early (full bloom)	13.8	13.0	0.82	988ab
3. CropSil late (fruit set)	17.9	16.6	1.3	878bc
4. CropSil early + late	18.8	17.4	1.5	1070ab
5. CanAgro 3% Silicic acid solution early	17.8	16.6	1.5	1056ab
6. CanAgro 3% Silicic acid solution late	14.6	14.4	0.21	722c
7. CanAgro 3% Silicic acid early + late	21.5	20.4	1.2	1208a
8. Canagro Silicic acid powder early	19.3	17.9	1.4	1148a
9. Canagro Silicic acid powder late	19.6	18.7	0.97	1071ab
10. Canagro Silicic acid powder early + late	20.5	19.2	1.3	1032ab
ANOVA	**NS**	**NS**	**NS**	**TRT (0.0333)**

Interesting treatment effects on harvestable berry yields were present with the applications with the Canagro 3% silicic acid treatment applied early (anthesis) and late (fruit set) having harvestable berry yields that were 21.7% greater than the untreated control. Similarly, the CanAgro Silicic Acid powder treatment applied early had harvestable berry yields that were 15.6% greater than the untreated control. Upon examining the influence of timing, notable differences were present with the early + late treatment applications, and early treatment applications having harvestable berry yields that were 19.5 and 23.9% greater respectively than those applied late.

Differences in harvestable berry yields between the formulation of products examined were present with the Canagro 3% Silicic Acid Solution and Canagro Silicic acid powder treatments having harvestable berry yields that were 1.7 and 11% greater than CropSIL respectively. These results illustrate that other silicone containing products can provide equivalent or better results that the CropSil in wild blueberry production when used during bloom and the fruit set stages of flower and berry growth and development. Therefore, results from the study illustrate that applications of silicate products in the cropping phase of production can increase the harvestable berry yields of wild blueberries.