FINAL VERSION

BLUEBERRY REPORT

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INTRODUCTION:

Lowbush Blueberry:

The lowbush blueberry is a perennial, native fruit that grows in barren fields and burned-over areas of north-eastern North America.

Lowbush blueberry fruit is rich in antioxidant compounds that fight cancer, heart disease and premature aging and which may be protective against metabolic syndrome and diabetes. These small berries are also high in vitamin C, manganese and fiber. *(Crop Profile for Lowbush Blueberry in Canada, 2014)*

BLUEBERRY IN CANADA

Blueberries rank as the number one fruit crop in Canada with respect to area under production.

Table 1:

Canadian Production 2014	96,527 Tons
Production Area 2014	64,214 Hectares
Farm Gate Value 2014	$136 Million

Source: Statistics Canada. Table 001-0009 - Area, production and farm gate value of fresh and processed fruits by province, annual, CANSIM (database). (Accessed 2016-09-30)

PRODUCTION REGIONS

Lowbush blueberries are produced commercially in eastern Canada, in the provinces of Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador and Quebec.

FACTORS LIMITING PRODUCTION

Abiotic: Pollination, temperature & drought stress.

Biotic: Stress from diseases, insects, mites, weeds & vertebrate pests.

ABIOTIC

Pollination: Pollination is critical for successful blueberry production. Poor pollination may result from adverse weather conditions or a low number of pollinators.

Temperature: Frost and cold temperatures during bloom (June) and prior to harvest later in the summer or fall, can cause yield losses.

Drought: Dry, hot conditions in the summer can affect fruit quality and reduce yields by as much as 50 percent.

BIOTIC

Disease:

There are major fungal diseases which may infest blueberries during the growing season, such as, Powdery Mildew, Leaf Rust, Septoria leaf spot, Botrytis Blight, Monilinia Blight, etc.

Insects:

There are major insects which may infest blueberries during the growing season, such as, Blueberry Maggot, Blueberry Flea Beetle, Spotted Wing Drosophila, Blueberry Trips, Span Worms, etc.

SOLUTIONS

In most cases, monitoring, scouting, and pesticide spraying are the most common solutions for these issues. Unfortunately, these methods increase the number of chemical applications, which result in the resistance of the pests against them. This factor creates a need for the development of alternate IPM methods, in order to enhance the conventional approaches to the pest management.

The benefits of these alternative IPM Methods are:

- Promote strengthened and healthy plants
- Promote sustainable bio-based pest management alternatives
- Reduce the potential for air and ground water contamination
- Protect the non-target species through reduced impact of pest management activities
- Reduce the need for pesticides by using several pest management methods
- Reduce or eliminate issues related to pesticide residue
- Decrease workers, tenants and public exposure to pesticides
- Alleviate concern of the public about pest & pesticide related practices
- Maintain or increase the cost-effectiveness of pest management programs.

HEALTHLY PLANTS

The most important goal of pest management is to maintain healthy plants. A healthy plant is less vulnerable to pests and disease infestation. Therefore, the main objective of the farmer is to create conditions that help to keep a plant healthy.

Knowledge of plant health, as well as, pest and disease ecology helps the farmer to utilize effective preventative crop protection measures. Since many factors influence the development of diseases and infestation of insects in plants, it's crucial to intervene at the most sensible point. This will be accomplished through (1) the correct timing and management practices (2) an appropriate combination of different methods or (3) the choice of a unique selective method.

One of the most important preventive crop protection measures is to enhance plant defense mechanism. This may be done by adding a bio-stimulator in the plant nutrient program.

WHAT IS AN AGRICULTURAL BIO-STIMULANT?

"Agricultural Bio-stimulants include diverse formulations of compounds, substances and micro-organisms that are applied to plants or soils to improve crop vigor, yields, quality and tolerance of abiotic stresses." (Source: Wikipedia)

*One of those elements that is utilized as a bio-stimulator in plants nutrient program is "**Silicon**".*

SILICON (Si)

THE BIO-STIMULATING EFFECTS OF SILICON ON PLANTS

- Si improves growth and development of horticultural crops exposed to abiotic stress.
- Si acts on oxidative damage, water relations, photosynthesis, ion uptake and hormones.
- Si acts mainly through silica deposition in tissues that provide mechanical strength.
- Si is applied to plants via foliar spraying, incorporation to soil, or fertigation

"Silicon is reported to increase and enhance yield, growth, and production of plants. It improves some morphological and mechanical characteristics (height, stature, root penetration into the soil, exposure of leaves to light) in several plant species. Silicon reduces transpiration and enhances plant resistance to drought stress, salinity, and metal toxicity, and increases enzyme activity" (Datnoff t et al., 2007).

"On the other hand, regarding biotic stresses, the accumulation of silicon in plant plays an important role in plant defense against insect herbivores. Several herbivorous insects suffer adverse effects when feeding on silica-rich plants" (Reynolds et al., 2009).

"Moreover, silicon has been shown to improve resistance in many plants to various fungal, viral and bacterial pathogens" (Rodriges and Datnoff, 2005; Silva et al., 2010; Zellner et al., 2011; Van Bockhaven et al., 2013).

"Most interesting, silicon protects plants against a multitude of stresses without the occurrence of resistance trade-offs and/or growth and yield penalties" (Fauteux et al., 2005; Ma and Yamaji, 2006; Epstein, 2009; Van Bockhaven et al., 2013).

CROPSIL

WHAT IS CROPSIL?

Cropsil is an agricultural bio-stimulator produced from Silicon, which is found virtually in all kinds of soil. However, it has not been available to plants until now. Monomeric Silicic Acid is the fundamental component of Cropsil, which is the only available form of silicon utilized by the plant cells.

Cropsil, will strengthen plant's cell walls and produce a much stronger and healthier plant with massive root systems. It also increases resistance to biotic and abiotic stresses.

BLUEBERRY TRIAL IN NEW BRUNSWICK, CANADA

INTRODUCTION

Canagro Solutions Inc. (official distributor of Cropsil in Eastern Canada), in collaboration with Maritimeagro Solutions (Cropsil distributor in Maritime Provinces), designed a trial protocol to test Cropsil and evaluate its impact on wild blueberries.

TRIAL PROTOCOL

Field study to evaluate the impact of Cropsil, a silica-based bio-stimulator, on blueberries:

- Study coordinator: Mr. Conrad LeBlanc (MaritimeAgro Solutions)
- Sponsor: CanAgro Solutions Inc.

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1. OBJECTIVES

1.1. To evaluate the efficacy of Cropsil as a silica-based foliar fertilizer on blueberries.

1.2 To evaluate fruit quality standards (size, weight, firmness, brix) of blueberries in Cropsil-treated and control areas.

2. STUDY RESPONSIBILITIES

Responsibility	Contact Details	Location
Trial Coordinator	MaritimeAgro Solutions Mr. Conrad LeBlanc	15, rue Du Marais, Memramcook, N.B. E4K 3Y2 (506) 758-8118
Applicator	M & S Wild Blueberry Farm (Ltd) Mr. Murray Tweedie	29 Sullivan Road, Kouchibouguac, N.B. E4X 1L7 (506) 876-4537
Leaf Sap Analysis Lab	PEI Analytical Laboratories	23 Innovation Way, P.O. Box 2000, Charlottetown, P.E.I. C17 7NB (902) 620-3300
Fruit Analysis Lab	Department of Plant, Food, and Environmental Science Dalhousie University Dr. David Percival	PO Box 550, Truro, N.S. B2N 5E3 (902) 893-7852
Sponsor	CanAgro Solutions Inc. Mr. Reza Boroomand B.	10 Maureen Court, Richmond Hill, Ontario L4B 3H9 (416) 829-4101

3. STUDY SCHEDULE

Activity	Target Week	Year
Study Plan Approval	W1, April	2017
Study Start	W1, May	2017
Study Completion	W4,October	2017
Fruit Data Submission	W1,October	2017
Final Report	W2, November	2017

4. MATERIALS & METHODS

4.1. **Crop**: Blueberry

4.2. **Test assessment:**

4.2.1. Yield and Berry size

4.2.2. Brix, firmness & phenolic content

4.2.3. Foliar nutrient evaluation

4.3. **Location**: St. Ignace Field, N.B., Canada

4.4. **Replications**: 4

4.5. **Plot size:** 5.8 Acres

4.6. **Mode of application**: Spray

4.7. **Time of first application**: May 22nd, 2017

4.8. **Number of consecutive applications**: 4

4.9. **Intervals of applications**: 4 weeks, 3 weeks & 2 weeks

4.10. **Assessment, description and methods**:

- Berry size, weight, brix, firmness and phenolic material
- Foliar nutrient evaluation (leaf test analysis).

4.11. **No. of Assessments**:

- 1 fruit test
- 5 leaf tests.

5. TESTED PRODUCT

Product	Active Ingredient	Active Ingredients %	Formulation Type
Cropsil	Monomeric Silicic Acid	3%	Solution

6. APPLICATIONS & TESTING SCHEDULE

Crop Field: Blueberries (low-bush)
Date: May 01, 2017

Activities	Plant Stages	Planned Dates (2017)	Completed Dates (2017)
Application 0	Green tip	May 10	Not sprayed (field too wet)
Application 1	Pre-Bloom	May 25	Sprayed on May 22nd
Leaf test 1	Fruit setting	June 10	Leaves collected on June 9th
Application 2	Fruit setting	June 15	Sprayed on June 23rd
Leaf test 2	Developmental 1	July 5	Leaves collected on July 6th
Application 3	Developmental	July 12	Sprayed on July 17th
Leaf test 3	Developmental 2	August 5	Leaves collected on Aug. 2nd
Application 4	Harvest period	Mid-August	Sprayed on Aug. 3rd
Leaf test 4	Developmental 3	Sept. 5	Leaves collected on Aug. 29th
Application 5	Fall Booster	Sept. 25	Application cancelled
Leaf Test 5	Harvest period	Oct. 5	Leaf test cancelled
Fruit Test	Harvest period	August 20	❖ Fruits collected on August 22nd ❖ Fruits remitted to David Percival on August 23rd

7. FRUIT TEST RESULTS

Fruit size, weight, composition and quality results of wild blueberry fruits in untreated control section (samples 1 to 6) and Cropsil-treated section (samples 7 to 12).

	Average berry diameter (mm)	Average berry weight ($g \cdot berry^{-1}$)	Average berry firmness ($g \cdot mm^{-1}$)	Soluble sugar content (^oBrix)	Total phenolic ($mg \cdot L^{-1}$)
Control (samples 1 to 6)	6.9b	0.320	6.90b	13.7	4148
Treated (samples 7 to 12)	7.7a	0.407	7.73a	13.9	3865
ANOVA results	Significant (p=0.0508)	Significant (p=0.1025)	Significant (p=0.0532)	NS	NS

8. FINAL OBSERVATIONS

In the leaf sap analysis results, the compatibility and synergy of Cropsil with the plant's natural growth mechanism was clearly evident. This phenomenon, led to the availability of the proper nutritious elements to the plant, in the right amount and at the right time.

According to the scientific fruit analysis results performed by the University of Dalhousie, the average weight, size, and firmness of the berries collected from the treated plants had a significant increase in comparison to the control section plants. This significant difference was due to the availability of the proper amount of micro-nutrients to the plants. These elements play a very important role in the fruit-setting process, which is obviously proven by the leaf sap analysis results.

The following highlights outline the impact of Cropsil on the treated section:

A. During our visit on July 15th, 2017 more growth and vegetation improvement of treated plants, was clearly evident, in comparison with the control plants.

B. In the treated plants, the number of fruits had increased very much due to better pollination. As a result, the field's owner was very pleased with such improvement.

C. Based on the fruit test results:
   i. The average size of the berries increased by 11%
   ii. The average weight of the berries(yield)increased by 32%
   iii. The average of the firmness increased by 12 %.
   According to Dr. Percival, a professor at Dalhousie University, this is very impressive: ***"The fruit firmness values are of particular interest given that I've found these to be pretty unresponsive to other soil amendments over the years. There were not differences in soluble sugars of the berries or total phenolic (which are closely related to antioxidant potential). Therefore, with the yield responses you observed, part of this was undoubtedly due to larger berries in this treatment."***

After a final review of the results, the optimal effect of CropSIL on improving the growth conditions and increasing the final yield of the product is clearly visible and proven.

PICTURES

TREATED VS. CONTROL