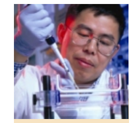

Gypsum as an Organic Amendment in Lowbush Blueberry Production

The lowbush, or wild blueberry (*Vaccinium angustifolium* Ait.) is native to North America. Canada's lowbush blueberry industry is centered in Eastern Canada, particularly in Quebec, Nova Scotia, Prince Edward Island, Newfoundland and New Brunswick. Canada is the world's largest producer of this berry crop, producing some 55,000 tonnes worth almost $67 million at the farm gate in 2003.

Research into developing sustainable production systems for high value crops such as berries is a key theme of Agriculture & Agri-Food Canada's (AAFC) research program. In recent years, there has been an increased interest in developing organic farm practices. Research into organic farming methods will provide Canadian farmers with more options to meet consumer demands for agricultural products.

Gypsum is a natural substance permitted for use in organic crop production in Canada. It is also a common soil amendment used to supply calcium (Ca) to the soil. Its application has been shown to increase yields in fertilized lowbush blueberry stands. AAFC researchers in Charlottetown, in collaboration with Dr. Leonard Eaton at Nova Scotia Agricultural College in Truro, conducted a study to assess the effect of applying gypsum to lowbush blueberries stands on:

- nutrient uptake
- plant growth
- production

Lowbush blueberries on Prince Edward Island

Additionally, they evaluated the differences between gypsum and standard chemical fertilizers on lowbush blueberry growth and production.

V. angustifolium prefers soils that are generally acidic (pH 3.5 to 5.5), infertile and having well developed organic layers. Cultural practice is a biennial production system where year one (sprout year) is vegetative and year two (crop year) mature fruit is harvested.

Five experimental sites, representative of lowbush blueberry stands in Prince Edward Island and Nova Scotia, were selected and evaluated for two cropping cycles (1998-2001). The treatments applied were:

(1) control (no fertilizer or gypsum),
(2) 10-10-10 fertilizer at 300 kg per ha,
(3) gypsum at 4 tonnes per ha; and
(4) 10-10-10 fertilizer at 300 kg per ha plus gypsum at 4 tonnes per ha.

The 10-10-10 fertilizer was commercial grade and the gypsum was agricultural grade (calcium (Ca) = 22%; sulphur (S) = 18%).

The fertilizer or gypsum was broadcast-applied by hand on the soil surface in early to mid-May of 1998 and reapplied to the same plots in the spring of 2000. All experimental sites were managed according to a commercial two-year production cycle and pesticides were applied by individual growers as necessary.

Leaf samples of *V. angustifolium* plants were randomly collected from all plots in the Sprout year (1998 and 2000). Leaf samples

Were taken at tip dieback and were obtained by taking the top 5 to 10 leaves from approximately 50 stems in each plot. Soil samples were also taken at all sites during the sprout year of each crop cycle.

Vegetative growth was estimated from samples collected from each site in early spring of the crop year (1999 and 2001). During August of the crop year, yield data was obtained by hand-raking all of the plots when fruit were 95 to 100% mature.

Lowbush blueberries in blossom

Results

Cycle 1

The gypsum and gypsum with fertilizer treat-ments significantly increased tissue nitrogen (N), phosphorus (P), potassium (K), Ca, manganese (Mn) and S, and significantly decreased mag-nesium (Mg) and iron (Fe) in comparison to the control and fertilizer treatments (Table 1). Ca was significantly different for the gypsum treatment only compared to the control. Higher concen-trations of elements in the plant tissue contributes to healthier plants and stronger foliage.

- Applying gypsum with fertilizer significantly increased tissue P in comparison to the other treatments.
- Gypsum with fertilizer treatment significantly increased stem length and the number of live buds, total buds and total blossoms per stem in comparison to the control.
- All treatments with fertilizer significantly increased total number of buds per stem compared to the control.
- The gypsum with fertilizer treatment significantly increased stem length in comparison to all other treatments. Longer stems will facilitate mechanical harvesting by making it easier for the harvester head to get under the fruit.

Cycle 2

- Tissue P and K concentrations were significantly increased by all treatments when compared to the control; both were increased with the gypsum with fertilizer treatment in comparison to the other treatments.
- Gypsum and gypsum with fertilizer significantly increased tissue Ca, Mn and S; tissue Mg was decreased compared to the control and fertilizer treatment.
- Total number of buds, live buds, dead buds and blossoms per stem were not affected by any treatment.
- The gypsum with fertilizer treatment significantly increased stem length in comparison to all other treatments.

Overall, fertilizer application increased soil P and K, while gypsum application increased soil Ca and S, but decreased soil Mg, Zn, Mn and pH (Table 2). Marketable yield in the first and second cropping cycle ranged from 6.03 to 6.51 tonnes per ha and 4.36 to 4.69 tonnes per ha respectively, and was not affected by treatment.

The results of this study indicate that gypsum application, with or without fertilizer application, is an effective method to increase nutrient uptake in the lowbush blueberry. Gypsum significantly influenced nutrient uptake and general plant health more than any other fertilizer application evaluated in this region.

Increased nutrient levels in the plants should also result in a higher yield potential, and possibly greater yields. Previous research has indicated that yield response is site specific, therefore yield response may happen depending upon the location. Regardless of yield, if the objective is to have stronger plants with sufficient nutrient levels for good growth and health, then gypsum is a good management tool for growers to investigate.

In addition, gypsum is a permitted materials listed product for organic crop production and would be compatible with organic management of the lowbush blueberry.

Table 1. Nutrient content of lowbush blueberry tissue samples.

Treatment	N	P	K	Ca	Mg	S	Mn	Zn	Cu	Fe	B
	mg g^{-1}						µg g^{-1}				
Cycle 1 - 1998 sprout year											
No fertilizer or gypsum	15.9	1.21	4.7	4.7	1.4	1.3	321	6.7	3.1	20.0	30.0
Fertilizer[1]	16.1	1.23	5.0	4.6	1.4	1.4	301	7.4	2.8	22.2	26.1
Gypsum[2]	17.3	1.34	5.7	5.3	1.2	3.7	435	7.0	3.0	15.8	29.5
Gypsum with fertilizer[3]	17.4	1.40	5.8	4.9	1.2	3.4	400	6.9	2.6	17.7	27.4
LSD[4]	0.6	0.05	0.3	0.3	0.1	0.4	57	NS	0.3	2.4	2.4
Cycle 2 - 2000 sprout year											
No fertilizer or gypsum	17.1	1.22	4.7	4.1	1.6	1.2	438	12.4	4.3	23.3	28.2
Fertilizer[1]	18.2	1.32	5.2	4.1	1.6	1.2	436	13.5	4.1	44.9	26.2
Gypsum[2]	17.7	1.32	5.8	5.0	1.5	3.6	632	13.9	4.4	21.5	28.2
Gypsum with fertilizer[3]	18.8	1.42	6.2	4.6	1.5	3.5	587	13.7	4.2	22.2	26.8
LSD[4]	0.7	0.06	0.5	0.4	0.1	0.9	59	NS	NS	NS	NS

[1]300 kg/ha 10-10-10. [2]4 t/ha gypsum. [3]4 t/ha gypsum + 300 kg ha 10-10-10-10. [4]n = 20 df = 12 P = 0.05 NS = not significant.

Table 2. Effect of gypsum and fertilizer on lowbush blueberry soil nutrients (µg g^{-1}) and pH.

Treatment	P	K	Ca	Mg	Zn	Mn	S	pH
	µg g^{-1}							
Cycle 1 - 1998 sprout year								
No fertilizer or gypsum	50	51	260	51	3.1	32	38	4.57
Fertilizer[1]	56	56	256	47	2.9	34	41	4.56
Gypsum[2]	50	47	400	33	2.4	27	61	4.56
Gypsum with fertilizer[3]	61	54	439	37	2.4	27	57	4.53
LSD[4]	7	6	86	9	0.6	7	11	NS
Cycle 2 - 2000 sprout year								
No fertilizer or gypsum	44	51	228	53	3.3	30	43	4.54
Fertilizer[1]	53	70	242	52	3.0	33	42	4.52
Gypsum[2]	45	49	692	43	2.2	23	271	4.31
Gypsum with fertilizer[3]	55	58	645	42	2.0	25	222	4.28
LSD[4]	9	7	201	9	0.7	NS	101	0.07

[1]300 kg/ha 10-10-10. [2]4 t/ha gypsum. [3]4 t/ha gypsum + 300 kg ha 10-10-10-10. [4]n = 20 df = 12 P = 0.05 NS = not significant.

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