Lime trial 2011 - evaluating changes in soil pH and crop yields of soybeans and potatoes following applications of three types of limestone to acidic soil on PEI

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Abstract / brief summary of lime research in 2010 and 2011

2010

Lime trials were initiated in 2010 on acidic soil (pH 4.7) in Green Bay, PEI to compare the effect of calcitic and dolomitic lime to increase soil pH and to verify effects on yields of potatoes and soybeans. Soil samples revealed very low concentrations of calcium and magnesium. Spring applied lime at 2 tonnes per acre increased soil pH during the growing season, improved plant growth of potatoes, soybeans, canola, beets, barley and greatly improved marketable yields of two varieties

of soybeans and five varieties of potatoes. Potato petioles and whole plant soybean samples contained higher concentrations of magnesium from plants growing on soil treated with dolomitic lime, compared to calcitic lime and no-lime treatments. When scab free seed of the potato variety Shepody was planted, there was no increase in scab when either type of lime was added. When scabby seed of Shepody was planted, scab increased on daughter tubers in both lime treatments. The non-limed plots had negligible scab on Shepody tubers.

Spring applied lime “works” the first year to increase soil pH and improve crop yields in acidic soil. Some crops such as barley, canola and beets will not grow in acidic soil. Greatly improved yields of these crops occurred in response to spring applied lime.

2011

In 2011, a replicated trial was established on similar acidic soil (pH 4.7) to assess the yield response of 4 varieties of potatoes and one variety of soybeans to 3 lime treatments (calcitic, dolomitic, Hydra-lime) and non-limed check. For observation purposes, indicators crops of beets, barley, canola and sweet corn were planted. All lime products were applied at 2 tonnes per acre, prior to planting, and the lime were rototilled into the top 6” of soil.

In the soybean trial, the dolomitic lime gave the highest yield of beans. When compared to the dolomitic lime treatment, on a percent basis, the yields were as follows: check 46%, calcitic 82%, and hydra lime 68%. Nodulation (N fixing bacteria) were abundant on soybean plant roots in lime treated plots and were negligible in plant roots growing in non-limed plots. This may have affected available nitrogen for protein production in plants. On a dry matter basis, the percent crude protein was 40.4 % in the check, 42.4 in the hydra lime, 43.1 % in the dolomitic and 43.6 in the calcitic lime treatment. Concentrations of P and K in soybeans only varied slightly among lime treatments.

The biological yield (weight of all tubers) of the four varieties of potatoes increased in response to all three lime treatments. A higher percentage of small potatoes (< 2inch diameter) occurred in the non-limed treatment for all four varieties. Similar to the 2010 trial, the variety Shepody and Yukon Gold gave substantial increased biological and marketable yields following application of the three types of lime. Although the Pr 07-11-1 seedling gave the best growth and highest yields in the non-limed plots, it also gave higher biological and pay yields in the limed plots.

The incidence of hollow heart/brown center was low in Shepody and Pr 07-11-1, moderate in Yukon Gold and extremely high for Russet Burbank. The application of three different types of lime did not reduce the high frequency of HH in Russet Burbank.

There have been some debates/ misunderstandings in the farm community if applications of lime will affect crop growth in the season of application. In all crops evaluated, plant growth was much less in the non-limed plots. In both years (2010, 2011), lime "worked" in the first year to improve growth of all crops. The soil test in the spring of 2011 showed a pH of 4. 7 and the recommended rate of lime to raise the pH to 6.0 was 5 tonnes per hectare (2 tonnes per acre). When calcitic or dolomitic lime was added at 2 tonnes per acre in 2010, the pH did increase to the 6.0-6.2 range by December of the same year. Soil samples collected in midsummer 2011from plots limed in the spring of 2011, revealed the pH to be 4.6 for check, 5.7 for calcitic, 5.2 for dolomitic and 5.0 for Hydra lime. Soil samples collected in December revealed the pH to be 6.0 for calcitic, 6.2 for dolomitic, 5.5 for hydra lime and 4.9 for non-limed check. Although Hydra lime was only tested in 2011, it did not raise the soil pH as much as calcitic and dolimitic lime, when the soil was tested mid-summer and again in December. Among the three lime treatments, the growth of indicator crops (canola, beets barley) was noticeably less vigorous in the Hydra lime treatment.

Lime is often overlooked when growers are planning their fertility programs. On acidic soils, the correct use of lime can be more important than fertilization practices with N, P and K. This research has shown that some crops (barley, beets, and canola) will not grow in acidic soil even though adequate fertilizer was added. Although soybeans and potatoes will grow in acidic soil, liming substantially improved crop yields in the year of lime application

Introduction and objectives

Lime trials were conducted at Green Bay, PEI in 2010 and 2011 on acidic soil that was low in calcium and magnesium.

A preliminary research project was initiated in 2010 to generate data to answer the following questions:

- Does spring applied lime "work" in the first year to raise soil pH, when applied to acidic soil?

- What effect does lime have on crop growth and yield of barley, potatoes, canola, beets, corn and soybeans?

- Do different types of lime affect the development of scab on potato tubers?

- Does dolomitic lime increase available magnesium in the soil and prevent magnesium deficiency in crop plants

The trials in 2011 were conducted at Green Bay PEI. In both instances (2010,2011), the land had been farmed until from the mid 1800s until 60 years ago, had reverted back to coniferous forest and was cleared in advance of planting the lime trials. A complete report for the 2010 trials, with a brief literature review, is found in the appendix and also in the Proceedings of the North East Potato Technology Forum (March, 2011).

The lime trial, in 2011, was planted on a parcel of land comprising one-half acre. The soil type was Charlottetown soil series.

Soil samples were collected, in the spring before planting, from the field and submitted to the PEI Soil and Feed Testing Lab. Results of the soil test (2011) revealed a pH of 4.7, organic matter 4.9%, and very low concentrations of calcium (244 ppm) and magnesium (32 ppm). The soil test client , for this test, is 419466 and lab accession # is 17952 .Recommendations from the PEI soil test lab were that lime should be applied at 5 tonnes per hectare (2 tonnes per acre)to raise the pH to 6.0.

The experimental design of the experiment (2011) was a randomized block design with 4 replications for each treatment. Each block consisted of four plot islands , each plot island receiving a different lime treatment at 2 tonnes per acre. The lime treatments were:

1. Non-limed check plot
2. Calcitic lime
3. Dolomitic lime
4. Hydra Lime Plus

Samples of the three lime products had been submitted in May, 2011 to the Charlottetown Soil and Feed Testing Laboratory. The results of the lab tests are summarized in the attached table. The sulfur component of the Hydra lime was obtained from the gypsum (calcium sulfate), which is part of the hydra lime mixture.

It is recognized that the finer the grind of limestone products, the more quickly the product works to increase the soil pH. Current regulations stipulate that at least 50% of any limestone product should pass through a 100 um mesh screen.

Table – Laboratory assessment of three sources of lime used in 2011 experiment

Product	**%calcium**	**%magnesium**	**%sulfur**
dolomitic	23	12	-
calcitic	42	0.5	-
hydralime	34	5	7

Prior to applying the limestone products, a total of 16 plot islands were staked. Twelve of the plot islands were 14 X 25 feet and one set (4) was 16 X 25feet. Lime products were weighed and carefully spread by hand within the staked plot islands to give a spreading rate of 2 tonnes per acre (4,400 pounds).

After spreading, the lime was incorporated into the soil by rototilling to a depth of 5-6 inches.

The crops in all plot islands were comprised of soybeans (Lynx variety from Coop Atlantic, same as variety A in 2010 lime trial) and four genotypes of potatoes. The potatoes were:

- Russet Burbank (major use variety or table and French fries)
- Shepody (used mainly for French fries)
- Yukon Gold (premium round yellow –fleshed variety for table use)
- Pr 07-11-1 (long, netted, seedling from Privar Farm Inc. potato breeding program). This seedling
has been observed to grow well on acidic soil conditions.

All of the potato seed had been produced at the Green Bay farm in 2010

The soybeans were planted as one row of 25 feet in length in each of 16 plot islands. Seeds were planted at approximately 12 seeds per running foot of row. Soybean seeds had been treated with a nitrogen fixing inoculant (bacteria culture) prior to planting.
In the larger observation plots, small rows of sweet corn, canola, table beets and barley were planted for each of the 4 lime treatments.
The potato seed pieces were planted at 12" spacing in 38" rows. Ten seed pieces of each genotype of potatoes were planted in each plot island. All seed pieces grew and produced plants.
Prior to planting the plot islands, granular fertilizer (ammonium nitrate based 17-17-17) was
Broadcast at 400 pounds per acre and harrowed into the soil. An additional application of 300 pounds
per acre of the granular fertilizer was broadcast over the potato rows before the final hilling.
The late blight prevention program, for potatoes, was accomplished by applying chlorothalonil (Bravo) and mancozeb (Manzate) protectant fungicides every 6-7 days throughout the summer.

Potato foliage was top-killed with Reglone top-killer on October 3. Potato tubers were harvested on October 22 and 23. The potatoes were graded to determine the total yield, weight of tubers less than 2 inch diameter (smalls) and > 2 inch diameter (marketable size). Twenty tubers for each variety, in each replication, were cut open to document both the number and weight of tubers with hollow heart and/or brown center. Data was summarized in the yield tables and is reported two ways 1. the percent number of tubers with hollow heart i.e. 20/80 = 25% 2 .the % weight of tubers with hollow heart i.e. 2 pounds from 12 pound sample of 20 tubers = 16.7%.

Observations and assessments during the growing season

Tours were provided a number of times during the growing season to potato growers, Federation of Agriculture representatives, researchers and extension personnel. An explanation was provided to visitors that the 4 main treatments in the replicated plots were three types of limestone and a non –limed check treatment. By walking through the larger observation plots consisting of 6 crop species,

visitors were asked if they could find the non-limed plot. Visitors quickly and consistently found the non-limed plot due to the readily detectable poorer growth of all crops. In the remaining plots consisting of calcitic ,dolomitic and Hydra lime, visitors consistently picked the Dolomitic lime plot due to the more evident improved plant growth and absence of magnesium deficiency (yellow crinkled leaves); especially evident in soybean and canola leaves.

Similar to observations in the 2010 lime plots, the table beets and barley in the non-limed plot (2011) were a total crop failure. Germination and emergence of all seed crops was excellent in all lime treatments. However, the foliage of beets in the non-limed plot turned dark red, the plants remained very stunted and gradually the plants died during the summer.

The barley plants (2 rowed Island variety) in the non-limed plot were stunted and paler coloured than in the limed plots. No seed was formed in barley plants growing on the non-limed plot.

The growth of Canola was severely stunted on the non-limed plot. Canola plant growth appeared normal in the calcitic and dolomitic treatments but mottled and stunted growth of Canola leaves was evident in the Hydra lime treatment and the check plot. To investigate what was happening, leaf samples were collected from Canola plants in all treatments along with corresponding soil samples. Results indicated that the highest concentration of nitrogen in leaf tissues was in the limed plots; especially in the dolomitic treatment. Leaf tissues in the dolomitic treatment had the highest concentration of magnesium.

Tissues tests on Canola leaves (August 5, 2011)

Treatment	calcitic	dolomitic	Hydra +	check	
Nitrogen %	4.77	5.36	4.66	3.78	
Phos %	0.32	0.34	0.34	0.22	
Potassium %	2.33	2.98	2.93	3.06	
Calcium %	4.08	2.76	3.85	1.74	
Magnesium %	0.17	0.80	0.44	0.26	

Soil tests, late July, 2011 from the 2011 trial

Type of lime	calcitic	dolomitic	Hydra +	"Check" No lime	
pH	5.7	5.2	5.0	4.6	
Calcium ppm	1456	350	553	155	
magnesium	19	130	38	29	
Org matter	4.0	4.2	4.4	5.2	

Leaf samples collected from one plot island of each treatment. Composite leaf sample comprised of 20-25 Canola leaves, soil sample was a composite of 10 sub-samples in each plot island.

The plots escaped a killing frost until October 11. Soybeans had reached physiological maturity before the killing frost as extensive leaf drop had started to occur by early October. Similar to the 2010 lime trial, delayed maturity of soybean plants in the non-limed plots was evident due to presence of plants with green leaves in mid October (photos taken in 2010 and 2011). Soybean plants in the non-limed plots were shorter than in the limed plots. As well, there were often only 1-2 beans per pod in the non-limed plots compared to limed plots often having three beans per pod. Examination of root samples revealed a very low frequency of nodulation (N fixing bacteria) in the non-limed plots and much more numerous nodules on roots in the limed plots; especially in the dolomitic treatment. To determine soybean yields, four foot sections of row were harvested from each treatment. Whole plants were cut 1" above the soil level with shears and the whole plants, with pods attached, were dried in onion bags until threshed at the AAFC research station in Harrington PEI. Threshed beans were weighed and samples submitted to the PEI Soil and Feed testing lab for a feed value analyses (F4 package, protein, mineral analyses).

Results and discussion

Soybeans

The average yield (4 replications) of soybean seeds (table 1) reveals the lowest yield in the non-limed treatment and the highest yield in the Dolomitic lime treatment.

Table 1. Soybean yields and feed value assessment

Lime treatment	Yield, grams of seed from 4 feet of row, average of 4 reps	% yield, based on highest yielding treatment	% Crude protein on dry matter basis(dumb)	% calcium on dry matter basis	% mag on dmb	% phos on dmb	% potas on dmb
Check	198.2	46	40.4	0.15	0.26	0.66	1.85
Calci	354.6	82	43.5	0.16	0.23	0.58	2.00

tic							
doli mitic	430.7	100	43.1	0.14	0.25	0.57	1.90
hydr a	297.5	69	42.4	0.15	0.25	0.64	1.93

The application of lime improved the harvested yield of beans. Based on the square feet of land from a 4 foot row (16 square feet), the extrapolated yield per acre for the dolomitic lime would be approximately 1.2 tonnes per acre. The yield per acre for the non-limed treatment would be 0.55 metric tonnes per acre(1.2 X 0.46). With soybeans selling in the fall

Of 2011 at $400-450.00 per tonne, applications of limestone at two tonnes per acre, the cost of liming highly acidic soil would be profitable, in the same year for the dolomitic lime treatment. Raising the soil pH would also have advantages for following crops in the rotation.

A number of future crops would benefit from increased pH, more calcium, from all lime products; and more Mg if dolomitic lime was used.

Feed value analyses of the soybeans revealed improved protein content in all lime treatments (2-3 %).This would have positive implications for preparing livestock rations.

<u>Potatoes</u>

In assessing the response of the potato crop to different fertility and limestone applications, the crop yield response in tubers can be measured on a biological basis and on a commercially acceptable basis (pay yield). The biological basis would be the total biomass of potatoes produced whereas the commercial assessment would be the weight of tubers in the acceptable size category (>2”diameter) with deductions (dockage) for unacceptable defects i.e. hollow heart, brown center. Most contracts prefer to have tubers greater than 2” in diameter.

Observations during the growing season revealed that plant growth was generally slower and paler in the check plots for Russet Burbank, Shepody and Yukon Gold variety. The PR 07-11-1 selection displayed the most vigorous growth in the non-limed plots. This seedling from the Privar Farm Inc. breeding program had previously been selected for high yields when grown on low pH soil with moderate fertility applications. This same phenomenon was observed in this lime trial in 2010.

The four genotypes of potatoes, used in this experiment represent genetically diverse types.

Russet Burbank – long netted tubers, widely grown variety in Canada and USA for fresh market and French fries

Shepody –long type variety ,used mainly for French fries

Yukon Gold - round type yellow fleshed tubers, table market, moderate yields

Pr 07-111 -selection from Privar Farm Inc. breeding program, selected to give high yields under acidic soil with moderate fertilization.

From each of four replications for each genotype, data was generated for the total biological yield of tubers. By using a tuber sizer template, the weight of tubers less than 2 inch diameter (referred to as smalls) was determined. From each replication, 20 tubers were cut from those in the > 2” diameter category. Both the number of tubers and the weight of tubers with hollow heart (HH) and brown center were recorded. The percentage of HH, on a weight basis was determined by the weight of tubers with hollow heart divided by total weight of the 20 tuber sample.

Hollow heart was negligible in all lime treatments for the Shepody and Pr 07-11-1 plots. There was a low incidence in Yukon Gold.

Hollow heart and Brown center was very high in all lime treatments for the Russet Burbank variety. Yield data for tubers > 2" diameter is summarized before and after dockage for hollow heart.
The soil tests, for this experiment, revealed low concentrations of available calcium prior to liming. Calcium is an essential nutrient for plant growth and is a component of plant cell walls. The addition of different calcium sources from lime did not reduce the high frequency of hollow heart in Russet Burbank in this trial. Other factors may have led to the high frequency of hollow heart in the Russet Burbank variety.
The Russet Burbank variety, similar to other yield trial, often has a substantial portion of the tuber yield comprised of small tubers, less than 2 " in diameter.

e North East Potato Technology Forum (March 2011).

rior to the establishment of the trial. The soil sample

Table --Summary of yield data for potatoes (before dockage for hollow heart and brown center, on weight basis). Each value is average of 4 replications

Treatments and variety	**Total biological yield in pounds from 10 foot row**	**➢ 2" size Marketable before dockage for HH and BC**	**< 2" size, smalls**	**%smalls by weight**	**% of tubers with hollow heart, brown cente**	**% of tubers with hollow heart, brown cent**	**Weight of marketable > 2" after dockage for HH and BC Cwt./acre**

					r, by number	er by weight	
PR 07-111							
Check	45.5	39.3	6.2	13.6	4/80 = 5	7.6	363
Calcitic	54.8	51.25	3.5	6.4	0	0	513
Hydra lime	42.5	39.1	3.4	8	0	0	391
Dolomitic	49.4	45.0	3.9	7.9	1/80 = 1.25	1.5	443
Shepody							
Check	33.5	28.3	5.25	15.6	1/80 =1.25	2.2	277
Calcitic	47.0	44.75	2.25	4.8	3/80 =3.75	6.6	418
Hydra Lime	40.1	38.0	2.1	5.2	1/80 =1.25	1.4	375
Dolomitic	44.4	41.6	2.8	6.5	0/80 =0	0	416
Yukon Gold							
Check	23.75	21.0	2.75	11.6	9/80 =11.5	16.3	176
Calcitic	30.56	28.6	1.9	6.2	1/80 =1.25	2.8	278
Hydra Lime	30.6	28.8	1.8	6.2	7/80 =8.8	14.7	245
Dolomitic	24.4	22.5	1.9	7.8	1/80 =1.25	2.5	219
Russet Burbank							
Check	34.8	23.7	11.1	31	14/80 =17.5	25.5	177
Calcitic	44.8	39.2	5.5	12	20/80 = 25	28	282

Hyra Lime	40.8	32.6	8.2	20	19/20 = 23.75	31.3	224
Dolomitic	36.5	27.4	9.1	24	28/80 = 35	37.5	174

Key observations in response of potatoes to lime treatments

Four non –related varieties of potatoes, with different growth habits and yield potential, were tested.

In all of the 4 varieties tested ,the highest percent weight of smalls occurred in the non-limed check plots. In all of the four lime treatments, Russet Burbank had the largest amount of small potatoes.

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In all varieties, applications of lime increased the total biological yield and yield of marketable
sized tubers (greater than 2" diameter), before dockage for HH and BC was done.

The Russet Burbank variety, in this trial had the largest number and weight of tubers affected by
Hollow Heart and Brown center (photos taken).

In the non-limed treatment, the Pr 07-11-1 seedling had the highest yield of the four varieties. Previous research has documented this variety performs well in acidic soil conditions whereas Yukon Gold performs poorly in acidic soil conditions on this farm. (See lime report for 2010).

The frequency of Hollow Heart was very low in PR 07-11 and Shepody, moderate in Yukon Gold and very high in Russet Burbank. During the grading of the potatoes, some small patches of surface scab were observed in all lime treatments for PR-07-11-1 and Shepody. Although Russet Burbank has good field resistance to surface scab, a few tubers in all lime treatments were observed to have scab. Yukon Gold variety has moderate susceptibility to scab;

but no tubers with scab were observed on Yukon Gold tubers in this trial. It is recognized that there are at least three genetically different strains of surface scab on PEI (Univ. of Moncton study, Dr. Martin Filion). Possibly, the strain(s) of scab that colonizes Yukon Gold was not present in this trial. All of the seed potatoes for this trial in 2011 had been grown at the Green Bay farm in 2010.

The results of the 2010 trial, in similar acidic soil, revealed large increases in the yield of Shepody tubers when either calcitic or dolomitic lime was applied to the soil at the same 2 tonne per acre rate. The Shepody response, in the 2011 trial, gave large increases in both the biological and pay weight in response to calcitic and dolomitic lime. Although, a yield increase was observed to the hydra lime, it was less than the calcitic or dolomitic treatments.

Changes in soil pH and concentrations of calcium and magnesium following applications of three types of lime

Lime trial, 2011Green Bay PEI, Potato Consulting Services Inc.

Soil test, May, 2011 before planting (PEI soil and Feed test lab, client 419466 , accession # 17952

Type of lime				Check (no lime)	
pH				4.7	
calcium				244 L-	
magnesium				32 L	
Org matter				4.9	

Soil tests, samples collected December 8, 2011

Type of lime	calcitic	dolomitic	Hydra	Check (no lime)
pH	6.0	6.2	5.5	4.9
Ca, ppm	1312	574	642	143
Mg, ppm	15	212	53	22
O M %	4.3	4.7	5.2	5.3

-Soil and tissue tests conducted at PEI Dept. of Agr. Soil and Feed testing laboratory

- Visitors to the plots in early July observed that Canola leaves were uniformly large and deep green in dolomitic lime plot. Considerable mottling of white and green shades in calcitic and Hydra lime plots. Considerable “whip tail” in check plots as well as smaller plants(smaller leaves, less flowers). Whiptail in *Brassica* plants (cabbage, cauliflower, broccoli ,canola family) is characterized as small off-coloured leaves with a cup appearance. It is linked to low availability of molybdenum (essential nutrient) in low pH soils. Leaf samples were collected from Canola plants in the four lime regimes and submitted for analyses. Lab results indicated that leaves in the dolomitic lime plots had considerably higher magnesium concentrations compared to the other treatments. Canola leaves from the check plots had the lowest concentration of calcium and nitrogen. See table.

-Similar to 2010 Lime trial at Green Bay, there was no harvestable crop of beets or barley in the “check” treatment. The seeds germinated well but plants grew poorly in the non-limed plot.

Most varieties of beets and barley will not grow in acidic soil (< pH 5.0) regardless of how much fertilizer is added. It is recognized that some varieties of barley have some tolerance to low pH soils i.e. Charlottetown #80, Herta, Chapais, Volla; but it is well recognized that good yields of barley generally require the soil to have a pH of 5.8 or higher.

- Soybean leaves in calcitic plots and check plots showed crinkled and mottled leaves (magnesium deficiency).

<u>Changes in soil pH (2011)</u>

Soil samples collected in July (2010, 2011) revealed increased pH values following the spring applications of lime.

Soil samples collected in December 2011 revealed further increases in pH values. In both sampling dates, the Hydra lime gave the least increase in soil pH.

After the acidic soil was treated with different lime products, the increase in the pH of soil is not always correlated in that the highest pH contained the highest calcium content. From several observations in 2010 and 2011 trials, the dolomitic lime increased the soil pH more than the calcitic lime, yet added less calcium to the soil but more magnesium. See soil tests from December, 2011 trial and measurements of soil pH in 2011 from the 2010 trial.

Both calcium and magnesium are positively charged cations and are attracted to soil colloids (negative charge). Both Ca and Mg displace hydrogen ions (H^+) from colloids, thus increasing the soil pH.

Soil samples were also collected in August, 2011 from the 2010 site approximately 14 months after lime was applied in 2010. The soil samples show the highest pH in the dolomitic treatment, but the calcium content in the soil was considerably lower than in the calcitic lime treatment. Similar to many other observations on this farm, magnesium concentrations are often high in the soil after applications of dolomitic lime.

Sample information	Calcitic lime	Dolomitic lime	Non-limed check
pH	5.5	5.9	4.8
Calcium ppm	994	559	171
Magnesium ppm	43	202	22

Client 4822, accession 18155, date submitted 8/22, 2011

Table ----Changes in soil pH, calcium, magnesium, Phosphorous and potassium following application of lime and fertilizer (2010 trial)

Soil test values	**Non-limed Spring, before fertilizer added**	**Non-limed summer**	**Dolomitic summer**	**Calcitic summer**		
pH	4.7	4.1	5.5	5.2		
calcium	200 L-	111 L-	668 L	1007 M		
magnesium	30 L	17 L	273 H	31 L		
phosphorous	70 L	239 M+	283 H	287 H		
potassium	64 L	146 H	155 H	146 H		
% organic matter	4.1	4.9	5.5	5.7		

<u>Philosophical discussions/justifications and value of lime research</u>

Most people who visited the lime trial recognize the need to develop data from local experimentation rather than making assumptions. The valuable role of limestone in obtaining improved plant growth and improved use of nutrients has often been overlooked in farm fertility programs. Most agreed that the data from the lime research treatments would help in developing nutrient management guidelines for different crops and bring recognition for the value of soil testing. Some people who visited the lime trial indicated that it was conducted on land that was more acidic than normal and may have been atypical. The writer responded to the comment by indicating the original lime trial had been initiated by the writer to provide credible data on liming practices and improvement in crop growth (yields, quality) under the acidic soil conditions that existed on this farm. There had been too many speculatory answers, without defendable data on current varieties of crops, provided when the writer had asked questions on lime several years ago.

Major findings

Based on two years of trials at Green Bay, PEI where lime was applied in the spring to acidic soil before planting, the following observations occurred each year:

- Finely ground limestone products “work” the first season; specifically 1. to improve crop growth, 2 to raise soil pH and 3. to increase soil calcium content
- In acidic soil receiving adequate fertilizer, beets and barley would not grow unless lime stone was applied
- Dolomitic lime prevented the development of magnesium deficiency symptoms in foliage of soybeans, beets, canola and potatoes
- Nodules of nitrogen fixing bacteria were much more numerous on soybean roots growing in plots receiving limestone treatments
- Yields of soybeans improved dramatically in the limed soil compared to non-limed soil
- Due to the low magnesium content in the soil, dolomitic lime (containing both Ca and Mg) gave the greatest yield increase in soybeans and compared to calcitic lime

- Both the biological yield and pay yield of potatoes in the 4 varieties tested were lower in the non-limed soil.

Just as has been demonstrated that some varieties of barley will grow in acidic soils (Charlottetown #80, Herta, Volla and Chapais) some genotypes of potatoes (PR 07-11-1) will grow well with high tuber yields in acidic soil.

Report prepared by Potato Consulting Services Inc., March, 2012