Muskoka Limestone Study- 2005-2008

Purpose:

The Study aims to establish whether productivity and management of the highly acid agricultural soils on the Canadian Shield, and particularly in Muskoka, can be effectively sustained through higher than recommended rates of agricultural limestone.

Specifically, this study will examine:
if there is long term economic benefits to spreading lime at higher rates than recommended and,
if there are related environmental benefits including retention and availability of soil nutrients, particularly micronutrients and organic matter buildup through increased rates of lime.

A minimum study period of three years is required to determine trends following limestone application.
This study is also expected to increase awareness of the importance of using agricultural limestone on Muskoka soils.

Several generations of Muskoka farmers have applied agricultural limestone. These applications have generally produced some effect in reducing soil acidity, improving nutrient availability and increasing crop, hay and pasture yields. Yet, there are numerous anecdotal reports that lime applied at recommended levels is not as effective in increasing pH levels as expected, or that the beneficial effect from lime is transitory, and lost after only two or three years. The effects of limestone have been well researched. Yet evidence from several published sources indicates that increased lime levels may be needed to achieve sustained benefits.

Soils on the Canadian Shield are generally poorly buffered. This is partly attributed to the number of years of exposure to acidic rainfall and the igneous rock found below the shallow soils. This differs from southern Ontario where the limestone base provides some buffer to the overlying soils.

Methods:

Each farmer is to mark out the study area into approximately equal plots in two replications. Treatments are randomized in each rep, and include application at the recommended rate, and application at double rate. Some farmers have applied a third treatment of 150% the recommended rate .Farmers were not asked to include zero rate treatment. However two farmers, who will apply lime next spring, plan to include a zero rate treatment. All lime comes from the same quarry (Georgian Aggregates with an Ag index of 66). Farmers use their own methods to estimate weights and apply the lime (detailed below). Crop growth data is obtained through visual estimation and counting number of bales/ estimating bushels / crop weights. A soil test taken after harvest each year monitors changes in pH and nutrient status.

Results:

Six Muskoka farmers have agreed to participate in this study for three years. Each of the 6 farmers has taken a soil test representative of the trial area on their farms. A special arrangement has been set up with Agri-Food Laboratories in Guelph, to analyze each sample using AFL complete test to obtain initial status of macro and micro nutrient availability, CEC, OM as well as pH.

Information on each of the study sites is summarized in table1.

Table 1.

	Participating Farmer					
	Site1-GB	**Site2-KP**	**Site3-CH**	**Site4-HQ**	**Site5-DK**	**Site6-KR**
Soil Texture	sandy	Clay/ sandy	Sandy loam	Clay	Clay	Sandy loam
Planned crops	Green cut cereal/hay	Nurse grain/hay	Mixed grain/ hay	Mixed Grain/ Nurse/ hay	Vegetables	Vegetables
Initial pH	5.6	5.8	6.4	5.3	5.8	6.0
Recommend Lime t/ha	6	7	3	15	7	5
Trial area	4 ha	2.12ha		Spring 2005	Spring 2006	Spring 2006
No. of plots	4	6	6			
Treatments	2 (Rec/ double)	3(rec,150%, double)	3(rec, 150%,double	4(zero,50% rec,150%)	3(rec,150%, double)	3(rec,150%, double)

Site1-GB location area has been growing long term timothy/trefoil hay. Last limed 12 years ago. Received manure at 20t/ac every other year. Field plowed in the fall 2004. Lime applied May 29 2005 using a belt feed broadcaster. Lime was delivered wet, so the application rate was approximately 20% less than desired. (approx 6 t/ha and 12 t/ ha applied in 2 reps. Lime incorporated to 2" then barley/oats /rye and grass/legume hay mixture seeded. Good initial germination, but rather poor crop because of hot dry summer. Field is irregular shaped but all plots approx equal in size (1ha). The plots receiving the double rate were somewhat shaded, which could influence growth. Cereal crop cut green and baled (large 4x5' rounds).The recommended rate plots produced 5bales/ha,while the double limed area yielded 5.5 bales/ ha. The post- harvest soil test results are awaited.

Site2-KP. Study area was last cultivated 15 years ago. No known application of limestone. Lime applied Oct 18, 2005 with manure spreader by placing lime on top of well composted manure in the spreader. This method resulted in even application of lime. Because of field shape, 6 plots varying in width from 70 to 125 feet and 281 to 459 feet long. Ranging in area from .750 to 1.107 acres. Lime amount was successfully adjusted to provide targeted amount for each plot. Lime rates were 7t/ha, 10.5 t/ha and 14 t/ha in two reps Lime incorporated. Planting will be carried out in the spring. The soil test recommended magnesium, which will be applied as Kmag in the spring .Only organic inputs are applied on this farm.

Site3-CH Although the soil test (pH6.4) did not call for lime, Keith Reid recommended a rate of 3 t/ha. Trial field had grown a crop of oats in 2005; with haygrown the previous 5 years. Over the past 22 years, the field had received 4 applications of lime of 3 t/ha and 4 applications of manure. In the fall of 2005, the field was plowed and disced. Limestone was applied using an E_Z flow drop type 10' wide lime spreader. Rates were 3, 4.5 and 6 t/ha.

Lime was then incorporated to a depth of 5" .The trial area will be seeded to mixed grain , underseeded with hay seed in the spring.

Site4-HQ. Study area has reportedly never received lime. Soil test recommended a very high rate of 15t/ha. Farmer feels that a double rate (30t/ha will be too high. Instead he plans to apply 4 rates (0, 7.5,15 and 22.5 t/ha) in the spring.

Site5-DK. Plans to use a 1ha market garden area for the lime study in spring 2006.The plots will be planted to green and yellow beans This is an organic operation. The A recommended basal rate of 7 tons/ha will be applied.

Site6-KR. Plan to use a .4ha area for the study in spring 2006. The area has received annual applications of manure and fertilizer. Rep 1 will be planted to peas and rep 2 to beans. Will be used for a pick-your own operation.

Summary:

During 2005 season, all 6 participating farmers have identified their study areas, and collected initial soil samples and identified the lime recommended rates for their study areas. One farmer has applied lime treatments5 planted and harvested the crop, compared differences from the plot yields, and has taken soil samples from each plot. Two more farmers have applied the different lime rates, and will plant in the spring. The other 3 farmers will apply the lime and plant in the spring. The trial is attracting considerable interest among farmers.

Next Steps:

By spring 2006, all 6 farmers will have applied lime and planted the trial areas. Yield differences will be estimated through both visual ratings and yield comparisons. Soil tests, taken at harvest from all plots will indicate any changes in pH and nutrient status. This study is to be continued during 2007 and 2008 to obtain longer term effects of the lime applications. In the final year, tissue samples taken from the different plots will be analyzed to asses effects limestone rates on micronutrient status.

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