The Value of Maintaining a Good Soil pH

What's the value of using agricultural limestone to maintain a good soil pH in Nova Scotia soils? Let's look at the importance of liming, both in a general sense and then put some dollar values to your fertilizer efficiency losses when cropping at a 5.5 soil pH. First a quote from Atlantic Soils Need Lime (Publication No. 534-84) which states….

"Most agricultural soils in the Atlantic Region are naturally acidic and liming is essential if they are to be productive. Inadequate use of limestone has been a major limiting factor in crop production in this region since farming began. Failure to lime acid soils reduces crop yields and wastes much of the farmers' fertilizer investment."

What are the benefits of liming and having a soil pH in 6.3-6.8 range? The big benefits are liming improves fertilizer efficiency and also increases the activity of soil microorganisms to more rapidly release organic nitrogen and other crop nutrients, from manures and plant residues. Higher soil pH also enhances nitrogen fixation by legumes. Another benefit is liming reduces toxic aluminum levels, which is very important to sensitive crops such as alfalfa, both in yield performance and longevity. Liming is also one of the best suppliers of calcium and magnesium to crops, and improves soil aggregate stability, thus reducing soil erosion.

Table 1: Fertilizer Efficiency at Various Soil pH Values

Soil pH	**Nitrogen Efficiency**	**Phosphorous Efficiency**	**Potash Efficiency**	**Overall Fertilizer Efficiency**
pH = 6.5	95%	63%	100%	**86%**
pH = 6.0	89%	52%	100%	**80%**
pH = 5.5	77%	48%	77%	**67%**
pH = 5.0	53%	34%	52%	**46%**

Modified from Pub 534-84; Atlantic Soils Need Lime

Fertilizer prices have been trending upward in the past decade (see Table 2) due to increases in manufacturing/transportation costs, global food demands and the Canadian dollar currency fluctuations. In many crops, the commercial fertilizer portion can represent 25-30% of the total production, harvest and drying costs.

Table: 2 Nova Scotia Bulk Fertilizer Price Trends ($/kg)

Year	**Ammonium Nitrate**	**Phosphorous (P_2O_5)**	**Potassium (K_20)**
2014	**1.75**	**0.68**	**1.01**
2010	1.27	0.72	1.07
2005	1.34	0.75	0.68
2001	1.07	0.60	0.51

When you let soil pH slip below 6.5 it's likely going to cost you yield on forages, corn, soybeans and cereals. With a drop in yield, the machinery and labour costs per tonne of crop harvested goes up. With <5.5 soil pH the alfalfa longevity is greatly shortened, there is less nitrogen fixation, and likely lower protein quality in both legumes and grasses. It's not just your N-P-K fertilizer efficiency that declines when pH is in the 5.0-6.0 pH range, but the availability of most micro-nutrients to crops is also greatly reduced.

Table 3, shows the lost fertilizer efficiency in dollars per hectare ($/ha) at 5.5 pH and at 6.5 pH, if all the N-P-K soil nutrients removed by the crop were supplied by chemical fertilizer. The fertilizer $/ha losses (Table 3) were calculated by multiplying the crop removal values of N-P-K nutrients (Table 3), by the 2014 N-P-K fertilizer prices (Table 2), and then by fertilizer N-P-K 'in-efficiencies' at both 5.5 pH and 6.5 pH (Table 1). These values were then subtracted from a calculation of the total fertilizer investment ($/ha) you'd have with 100% overall N-P-K fertilizer efficiency, to determine lost fertilizer efficiency at 6.5 pH and 5.5 pH.

Table 3: Potential Economic Fertilizer Loss on Soils with 5.5pH

Crop	Dry Yield (tonne/ha)	N-P-K (kg/ha) Removed*	**Lost Fertilizer ($/ha) Efficiency at 6.5 pH**	**Lost Fertilizer ($/ha) Efficiency at 5.5 pH**
Corn Silage	12.5	133-50-128	**$ 24**	**$ 101**
Alfalfa (3 cuts)	10.5	+25-45-222	**$ 14**	**$ 78**
Grass (2 cuts)	8.8	133-33-100	**$ 20**	**$ 88**
Grain Corn	7.5	139-48-47	**$ 24**	**$ 84**
Soybean	3.3	+25-44-78	**$ 13**	**$ 44**
Winter Wheat	5	111-50-111^	**$ 22**	**$ 88**
Barley	3.8	70-31-67^	**$ 14**	**$ 55**

* nutrient removal amounts for phosphorous as P_2O_2 & potassium as K_2O (Canadian Fertilizer Institute)
+ alfalfa & soybeans remove more than 25kg/ha N, but most nitrogen removed is supplied by N-fixation.
^ nutrients removed by winter wheat/barley include what is in the grain and straw.

In Table 3, you can see that in not maintaining a 6.5 pH, and letting it drop to a 5.5 pH, you can lose $31-77/hectare of the fertilizer investment on these crops. At a 5.5 pH, these N-P-K fertilizer nutrients only have a 67% overall efficiency, because they either get converted to a non-usable type of nitrogen, or get bound so tightly to other clay particles, organic matter, and other nutrients, that a significant portion of N-P-K fertilizers are not available to your crop. **You need to lime, and maintain a soil pH of 6.5, or it's going to cost you in yield, fertilizer efficiency, feeding quality, machinery efficiency & profit!**

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