Nova Scotia Agricultural College

Soil & Crop Improvement Association of Nova Scotia

fact sheet

Pasture Fertility on a Budget

Cost is a factor in improving the soil fertility of pastures. In a 2007 survey, 74% of producers reported that cost was a barrier. Fertilizer and lime were most often reported as the highest costs. And, although producers reported they would be willing to change the management of their pastures to improve profitability, more than half reported that cost was their greatest concern about change.

The most striking observation from the survey was that the majority of producers spend 50% or less of the amount they would optimally like to invest in fertility treatments for their pastures.

Given the dollar amount of what you would like to invest in fertility treatments (e.g., lime, fertilizer, legumes), what percentage do you think you are currently spending?

12% invest 100% of what they would like to
15% invest 75% of what they would like to
26% invest 50% of what they would like to
36% invest 25% of what they would like to
5% invest 0% of what they would like to
6% don't want to invest anything

Overall, 73% of producers reported investing 50% or less than what they would like to.

Like all growing plants, the grasses and legumes in pastures need a supply of nutrients to support healthy growth. Fertilizer, lime, and legumes can improve soil fertility. However, when financial resources are limited, deciding how to provide nutrients can be a challenge.

A demonstration project was conducted on three sites over two years where less than an optimal budget for pasture improvement was used in different ways to answer the question: *When a budget is limited, what is the best way to improve pasture productivity?*

An optimal budget was calculated based on the recommended application rates of fertilizer, lime, and legume seed. For the demonstration, 30% of the optimal budget was taken and spent in six different ways on lime, nitrogen fertilizer, NPK fertilizer, legume seed, NPK fertilizer + lime, or legume seed + lime (Table 1). The budget was split evenly between fertilizer and lime in treatment 5 and between legume seed and lime in treatment 6. Since the budget was limited, application rates and the number of different inputs that could be applied together for the treatments were restricted.

Table 1: The six treatments

	Treatment	Application Rate
1	Lime	3 ton/ha**
2	Nitrogen fertilizer (34-0-0)	150 kg/ha*
3	NPK fertilizer (21-6-18)	200 kg/ha**
4	Legume seed (Sonja white clover)	4 kg/ha*
5	NPK fertilizer (21-6-18) + Lime	100 kg/ha** 1.5 ton/ha**
6	Legume seed (Sonja white clover) + Lime	4 kg/ha* 1.5 ton/ha**

* Recommended application rate
** Less than recommended application rate

The recommended rates of nitrogen fertilizer and white clover seed could be applied within the budget, but the rates of NPK fertilizer and lime had to be reduced, especially for the NPK fertilizer + lime and legume seed + lime treatments. Different proportions of the budget ended up being used for each treatment. In some cases the cost of the recommended rates for a treatment did not use the entire budget. In other cases the entire budget was not used because application rates were reduced to accommodate spreader accuracy.

For comparison, a control treatment where nothing was applied, and a treatment where the full recommended rates of fertilizer, lime, and legume seed were applied, were added to the demonstration.

Demonstration results

To determine the optimal investment, the total two-year increase in dry matter yield, relative to the control, and the two-year cost of each treatment were determined. The treatment with the greatest increase in yield per dollar invested, relative to a control, is the optimal investment (Table 2).

At Site 1, the optimal investment was NPK fertilizer + lime. At Site 2 it was NPK fertilizer. At Site 3 the optimal investment was lime, with nitrogen and NPK fertilizer also being very similar. The frequency of NPK fertilizer as an optimal investment highlights the importance of not only nitrogen as a plant nutrient, but phosphorous and potassium as well. Balanced nutrients are important for productive growth.

Table 2: Increase in yield per dollar invested

	Treatment	Yield increase per dollar invested (kg/ha/$) Site 1	Site 2	Site 3
1	Lime	-13.7	-12.4	**17.8**
2	Nitrogen fertilizer	7.7	-9.2	**17.3**
3	NPK fertilizer	11.1	**32.5**	**17.5**
4	Legume seed	9.8	-26.7	-4.5
5	NPK fertilizer + Lime	**12.9**	18.5	15.8
6	Legume seed + Lime	4.0	0.9	5.8
7	Full Recommendations	9.2	19.0	4.9

The optimal investment must also be less than the cost to purchase hay; otherwise, the investment is not worthwhile. The cost to produce a one tonne increase in dry matter yield for each treatment is given in Table 3. Compared to the current cost to purchase hay of about $120/dry matter tonne, the cost of the treatments identified as optimal investments is less than the price to purchase hay.

It is interesting to note that applying the full recommended rates of fertilizer, lime, and legume seed was only economical for Site 2 (Table 3). At Sites 1 and 3, the cost to apply the full recommended rates was more than the cost to purchase hay.

Table 3: Cost to produce a one tonne increase in of dry matter yield

	Treatment	Cost to produce a one tonne increase in dry matter yield ($) Site 1	Site 2	Site 3
1	Lime	-73.00	-81.00	**56.00**
2	Nitrogen fertilizer	130.00	-109.00	**58.00**
3	NPK fertilizer	90.00	**31.00**	**57.00**
4	Legume seed	102.00	-37.00	-222.00
5	NPK fertilizer + Lime	**78.00**	54.00	63.00
6	Legume seed + Lime	250.00	1111.00	172.00
7	Full Recommendations	109.00	53.00	204.00

Note the negative values in Tables 2 and 3. These negative values occur where the treatment yield was less than the yield of the control, and represent lost yield. This most often occurred for the treatments using lime or legumes. The use of lime seems to diminish yield in the short term. While an increase in soil pH may occur in the year of lime application, it may take several years for forage yield to respond to this increase in pH. Legume seeding was not successful at any of the sites. Seeding is not always successful, although no-till and frost seeding methods have been shown to effectively establish legumes in pastures.

Fertilizer is a short term investment, compared to lime or legumes, and was effectively evaluated as an investment in this demonstration. Lime and legumes provide longer term benefits. As a two year project, the benefits of investing in lime or legumes were not demonstrated.

Overall, NPK fertilizer, even at a low application rate, resulted in economic improvements in yield in the short term, compared to the other treatments. With continued monitoring of the effects of lime and legumes, it is expected that both of these would be considered good long term investments.

Remember, maintaining soil fertility will do little to improve pasture productivity unless proper grazing management is maintained as well. Rotational grazing with ample rest time between grazing for re-growth will ensure healthy productive pastures.

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