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Ranch Trial Results – Hay Fertilization Demonstration Project

December 2002

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Objectives:

- To evaluate the use of broiler litter applied to hayland on a BC Interior ranch.
- To demonstrate broiler litter value as a fertilizer replacement.
- To conduct a cost comparison of poultry manure to chemical fertilizer.

Results:

Design, Sampling and Analyses

This trial was conducted on two fields. On Field #1, there were 2 treatments, Check and Poultry Manure, whereas Field #2 had three treatments, Check, Poultry Manure, and Fertilizer. Treatments were placed in different areas of the field (as available) while trying to make the areas as representative as possible of field conditions.

In this demonstration, poultry manure (litter) was applied at about 3.8 tons/acre on May 15, 2002. Fertilizer was applied in the previous fall season at a rate of 46 lb N/ac, 25 lb P2O5/ac, 25 lb K2O/ac, and 15 lb S/ac.

Soil samples were taken at three times during the 2002 cropping season: May 14 (before manure application), August 14, and October 18. Soil was sampled in a Z pattern to a depth of 20 cm at eight to ten locations within each treatment.

Hay yield was calculated by collecting and weighing multiple 20 ft. long sections of a windrow for each treatment. Composite samples were collected from the windrow sections for dry matter and nutrient composition determination.

Soil and hay samples were sent to Norwest Labs, Langley, B.C.

Treatments

Nutrients Applied

Table 1 indicates nutrient application and manure application rates including estimates for nutrient availability for the trial, while Table 2 identifies the nutrient content of manure applied.

Table 1 Nutrient Application Rates and Estimated Availability at the Trial Site

Treatment	Total Nitrogen	Available Nitrogen	Total Phosphorus	Available Phosphorus	Total Potassium	Available Potassium	Poultry Litter
	---------- lb / ac ----------						- tons /ac -
Poultry Manure	240	120	180	90	120	110	3.8
Fertilizer	46	44	25	10	25	23	0

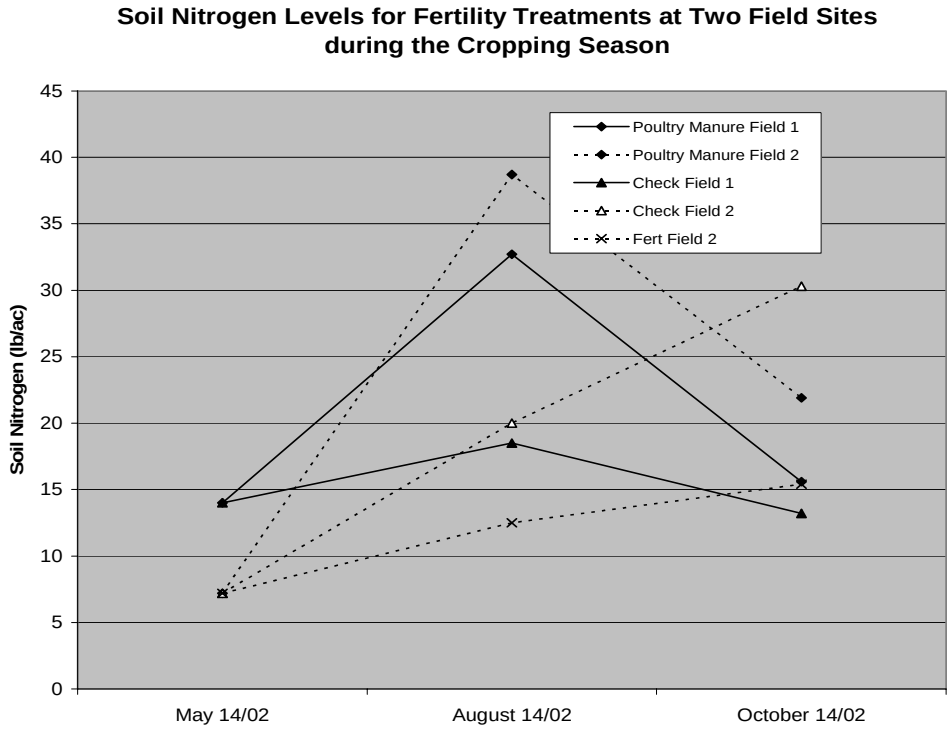
Table 2 Poultry Manure Analysis (as sampled – expressed as % unless otherwise indicated)

Elemental Composition	Concentration	Elemental Composition	Concentration
Total Nitrogen	3.16	Magnesium	0.38
Organic Nitrogen	2.36	Calcium	1.63
pH	6.6	Selenium	3.71 ppm
Total Sulphur	0.37	Sodium	0.23
P2O5	2.37	Moisture	29.9
K2O	1.57		

Soil Nitrogen - Response to Treatments

Figure 1 indicates the increases in soil nitrogen found at three different dates: May 14 – one day before manure application; August 14 - after first cut; and October 14 – at season end.

Figure 1



Results from the August 14 sampling show a higher level of soil nitrogen available for crop uptake in both fields treated with poultry manure (38 lb N/ac for field #1 and 33 lb N/ac for field #2) with correspondingly lower amounts for the Check (20 lb N/ac for field #1 and 18 lb N/ac for field #2) and Fertilizer treatment (12.5 lb N/ac). In both field situations, the addition of poultry manure increased the available nitrogen in August by about 20 lb N/ac over the Check treatment.

Results from the October sampling are less clear. While Field #1 responded in a typical manner to spring nitrogen addition i.e. highest nitrogen level in August with a corresponding drop in the fall, Field #2 results appear to be indicating that there is a large range of variability in soil chemical and physical conditions within this field. This is exemplified by soil nitrogen levels that continue to increase substantially from August to October sampling for the Check treatment (no fertilizer added) and slightly

for the Fertilizer treatment. The Poultry Manure treatment for Field #2 follows the typical pattern of reduced nitrogen levels in the fall.

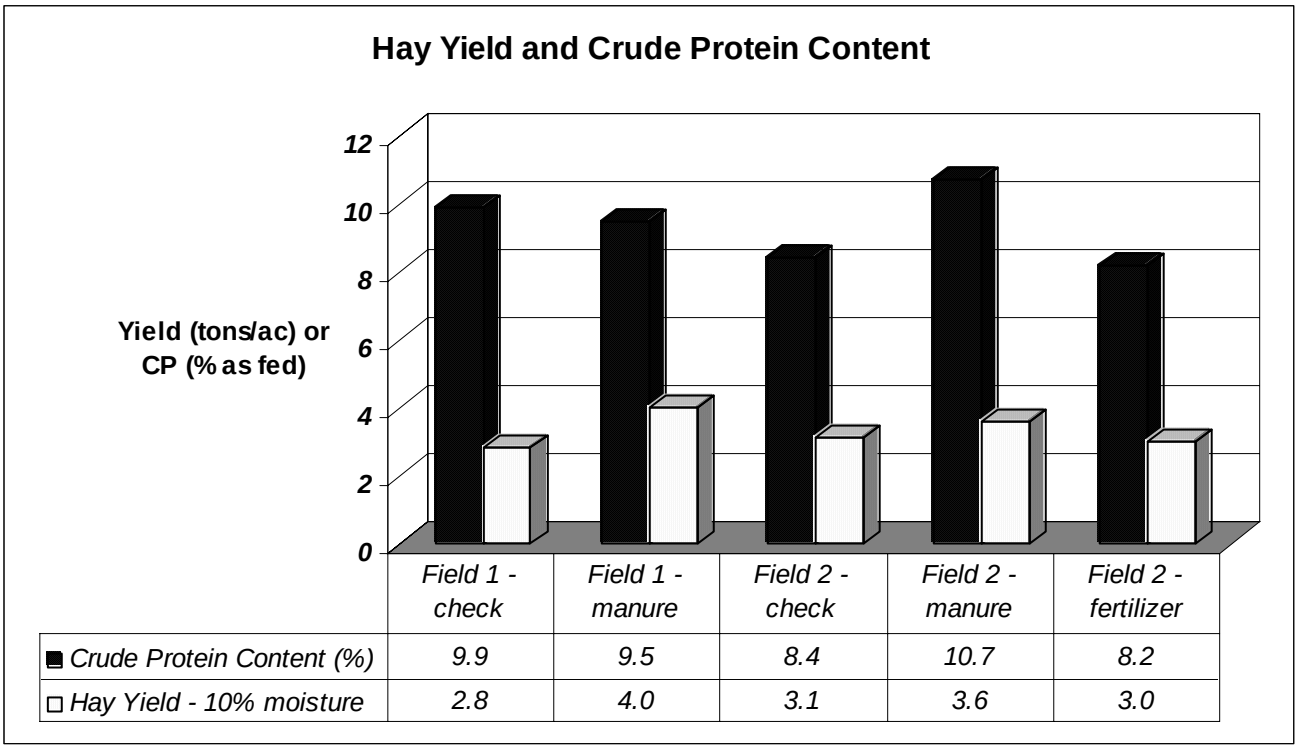
Hay Yield and Quality Results

In this evaluation, hay yields were higher for Poultry Manure treatments by 1.2 tons/ac for Field #1 and 0.5 tons/ac for Field #2. Fertilizer yields for Field #2 were similar to the Check treatment (see Fig.2).

Hay crude protein content followed a somewhat similar pattern to yield. A large increase in crude protein content for Poultry Manure was found for Field #1 (2.3 %) but a similar crude protein content was noted for the Check and Poultry Manure for Field #2. Fertilizer treatment crude protein content was similar to that of the Check for Field #2.

Hay yield and/or crude protein content results reflect soil nitrogen sampling results at the August 14 sampling date. In the case of the Poultry Manure treatments, soil nitrogen levels were higher in August at crop harvest time. These higher nitrogen levels resulted in either higher crop yield (both Field #1 and #2) or for crude protein, Field #1 had a higher level.

Figure 2



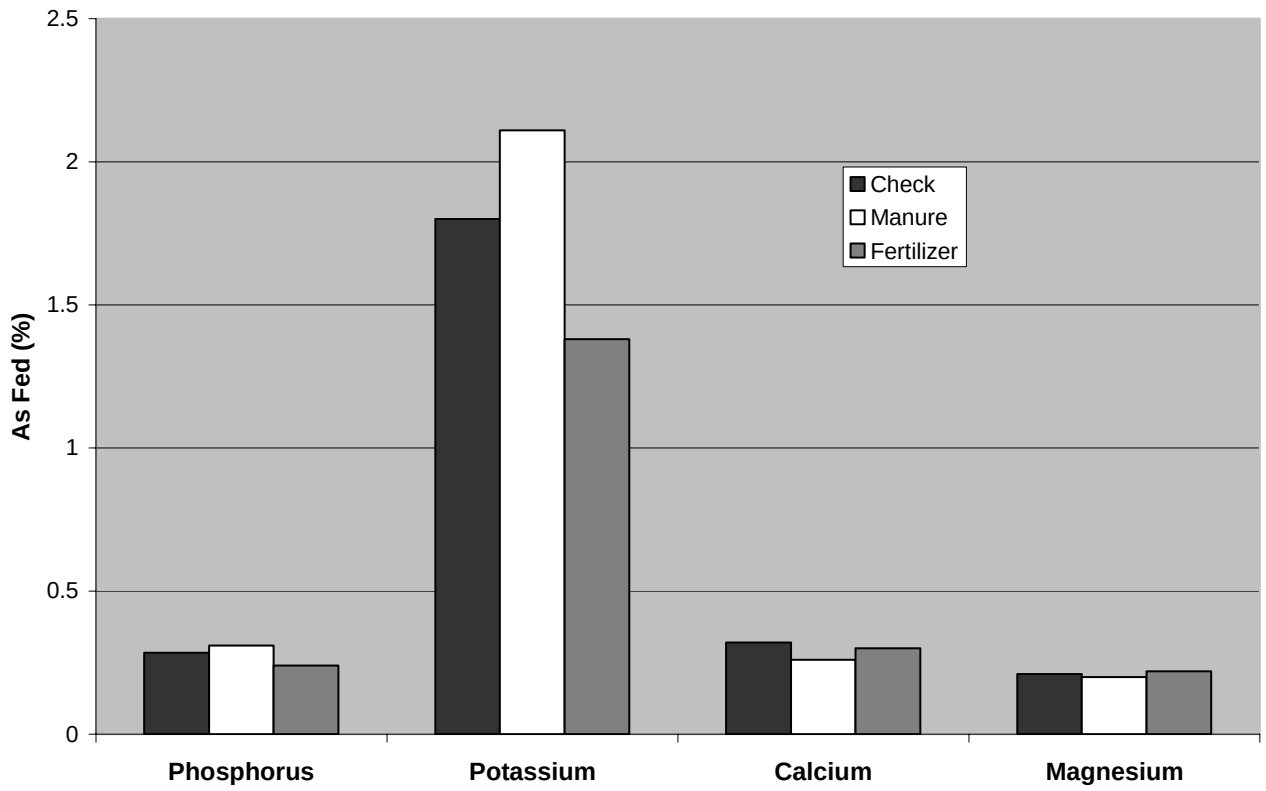
	Field 1 - check	Field 1 - manure	Field 2 - check	Field 2 - manure	Field 2 - fertilizer
■ Crude Protein Content (%)	9.9	9.5	8.4	10.7	8.2
□ Hay Yield - 10% moisture	2.8	4.0	3.1	3.6	3.0

Effect of Treatments on Other Nutrients

Crop Phosphorus

Figure 3 below identifies potassium, magnesium, calcium, and phosphorus levels found in the hay crop. Crop phosphorus level was enhanced by up to 16% for the Poultry Manure treatment over the Check and by 19% over the Fertilizer treatment. An increase in crop phosphorus is considered to be nutritionally beneficial to cattle. Potassium levels for Poultry Manure were also higher (15 to 28%) over those of the Fertilizer and Check treatments, respectively. Alternatively, both Fertilizer and Check treatment levels for calcium and magnesium were higher than Poultry Manure (from 5 – 13% higher for magnesium and 18-24% higher for calcium).

Figure 3



Grass Tetany

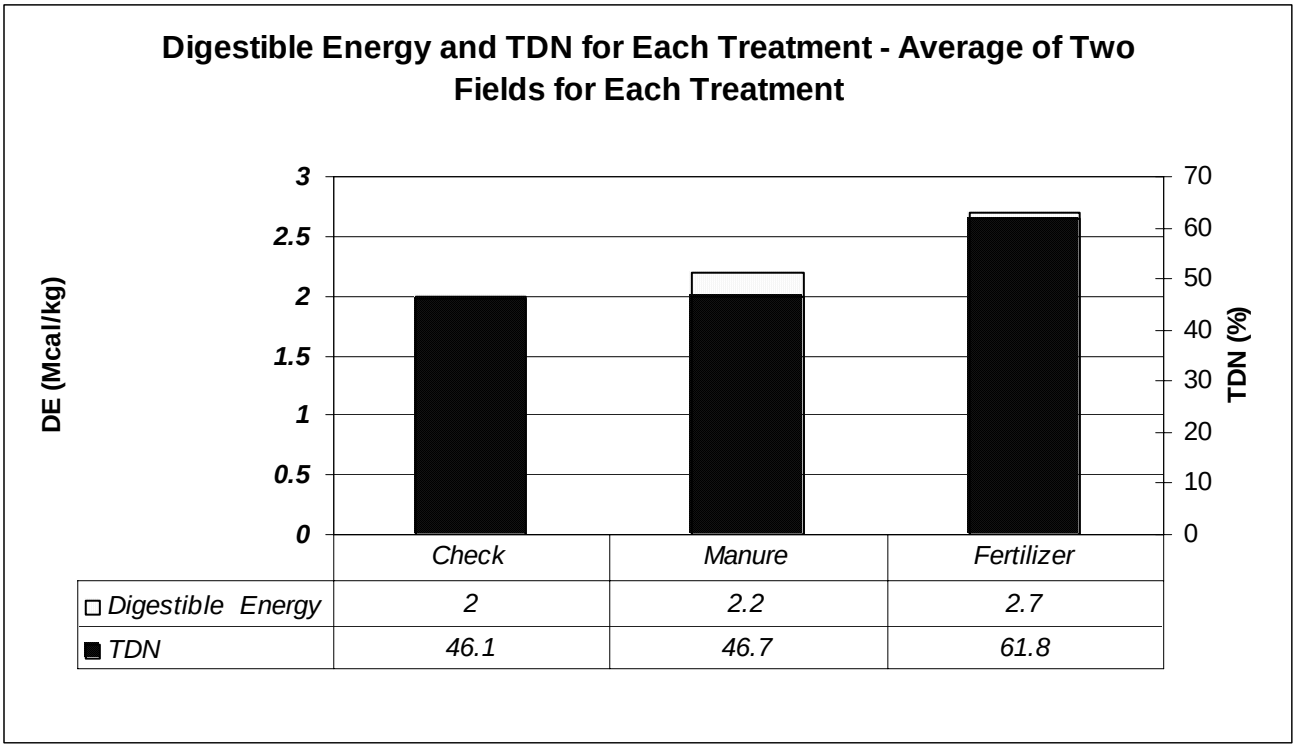
One method of examining potential grass tetany problems in hay is to compare identified crop magnesium level to that of a reference value. Using this method, magnesium levels greater than 0.2 % are not considered risky and suggest that a possible nutritional imbalance is not likely to occur possibly resulting in grass tetany. In this study, magnesium levels were found to be 0.195, 0.205, and 0.22 % for the Check, Poultry Manure and Fertilizer treatments, respectively. While the Poultry Manure treatment had the lowest magnesium level, little difference was found in magnesium level between the three treatments and all were close to 0.2 %. As such, they were considered marginal as a feed risk from the standpoint of inducing grass tetany in cattle.

Hay potassium content can also effect a nutritional imbalance possibly leading to grass tetany. In this trial, hay potassium content was in a similar range for all treatments. Average levels of potassium found were 1.8, 2.1, and 1.4 % for the Check, Poultry Manure, and Fertilizer treatments, respectively. All treatments had potassium levels significantly lower than 3 %. Hay potassium is considered risky when levels exceed 3 %.

TDN and Digestible Energy

Below, Figure 4 shows average Digestible Energy and TDN values for the hay crop from Fields #1 and #2. Digestible Energy and TDN, although slightly higher for the Poultry Manure treatment were only significantly increased in the Fertilizer.

Figure 4



Poultry Manure Use - Cost versus Benefit

Table 3 shows a simplified cost/benefit analysis for Fields #1 and #2 of the manure, chemical fertilizer and control treatments for a single cut of hay in August. From Table 3, yields and the crop value achieved are tabulated. These yields resulted in an increased value of $94 - 162/acre, and $0/acre for the Poultry Manure, and Fertilizer treatments, respectively over that of the Check treatment. There was no added crop yield value achieved for the Fertilizer treatment because it did not increase the crop yield over that of the Check treatment. After subtracting actual fertilizer product costs and estimated application costs, an actual return to treatment cost of $12 - 80/ac and -$40 for the Poultry Manure and Fertilizer treatments, respectively, was generated.

Table 3 Comparative Cost and Return from Manure and Fertilizer Treatments

	Field 1		Field 2		
	Poultry Manure	**Check**	**Poultry Manure**	**Fertilizer**	**Check**
			- - - - tons/ac - - - -		
Yield (10% moisture)	4.0	2.8	4.2	3.4	3.5
			- - - - $/ac - - - -		
Market Value of Crop	540	378	567	459	473
Differential Market Value[1]	162	na	94	0	na
			- - - - $/ac - - - -		
Cost for Fertility Addition	65	0	65	39	na
Cost for Application	17	0	17	10	
Total Fertility Costs	82	na	82	49	na
Return from treatment	**80**	**na**	**12**	**-49**	**na**

[1] Differential Market Value - the difference in crop market value (accruing from yield increase) obtained from that treatment over the check or control treatment

Cost and Benefit factors used in the analysis were as follows:

- delivered manure cost was considered to be $550 per load or $5.50 per cubic yard
- manure application rate of 3.8 tons per acre was considered equivalent to about 12 yards per acre
- chemical fertilizer costs were considered to be $0.50/lb N, $0.43/lb P2O5, and $0.05/lb K2O.
- manure application cost was estimated to be $1.50 per cubic yard
- no benefit was given to higher nutrient quality of hay achieved through manure application or to increased soil quality and nutrient status through the long-term addition of manure
- value of hay crop was considered to be $135/ton

Other Considerations

Residual nutrients - In this analysis, no mention has been made for the residual nitrogen value contributed from poultry manure to the crop in succeeding years. In the year after application, poultry manure is considered capable of releasing an amount equivalent to about 20 % of the total nitrogen (after losses) applied during the year of application. If this amount were factored in calculations, further cost-savings would result in the future, since manure application rates could be reduced. As well, phosphorus levels in the soil will slowly increase over time and increase the phosphorus level in the crop.

Fertilizer results – some caution is required in interpreting the fertilizer treatment results since only one field was examined in this trial.

Field variability – substantial field variability for field soil conditions was noted. Data generally conformed to typical soil chemical and crop yield and quality trends. However, it was found that October field soil nitrogen levels were not found to conform to established patterns.

Conclusions:

Yields and crop quality were increased through use of Poultry Manure over that of the Fertilizer and Control treatments. The Poultry Manure treatment had the highest yield and generally highest crop quality resulting in the highest return to treatment per acre.

Risk of Grass Tetany was found to be low due to Magnesium and Potassium crop levels that were within acceptable limits across all treatments.

The cost versus benefit comparison for the rates used were positive for the Poultry Manure treatment. The Poultry Manure ($12 - 80/ac) return was better in this trial than the -$40/ac return for the fertilizer treatment.

Recommendations:

Poultry manure application at 3.8 tons per acre provided a considerable cost saving for nutrient inputs in hay production relative to chemical fertilizer or no fertility input. Continued application of poultry manure at this application rate should continue to incease yields as higher nutrient levels become established in these fields yielding further cost savings.

Acknowledgements

Funding for this trial was made possible through contributions (direct and in-kind) from:

- Agriculture Environment Initiative
- Sustainable Poultry Farming Group
- Merv and Shirl Furlong