OM Environmental Products with Soil Amendment inside

2011 Field Trial Report

Williams, Ph.D.

Farm Name: Murray State University

Location: Western Kentucky

Principal: Jim Davis, Ph.D.

Crop: BMR Sorghum

Materials and Methods: The primary focus of this study was to determine the effectiveness of different methods of alternative pasture inoculation compared to traditional nitrogen fertilization on beef steer summer grazing performance and ADG. A twelve acre plot was used to measure three different methods of pasture inoculation. The variables measured were brix content (%), Average Daily Gain (ADG), overall animal performance. The 12 acre pasture was divided into four test plots containing 3 acres each. Each section received a different method of treatment with one serving as a control. The treatments regimens were: Treatment 1) Nitrogen application, in the form of Ammonium Nitrate (NH4NO3) at a rate of 60 units per acre per application, applied on May 21st, June 18th, and July 23rd (N). Treatment 2) 1.0 ga/ac Soil Amendment applied at a split rate of 0.5 ga/ac on May 21 and 0.5 ga/ac on June 18 (SG). Treatment 3) Two gallons per acre of raw milk applied at the 2 ga/ac rate on May 21st, June 18th, and July 23^{rd,} (RM). Treatment 4) a control with no applications of any fertilization products applied (C). All applications were made using a boom sprayer.

Thirty-two cross bred steers were divided into four equal groups of eight steers each. Steers were randomly assigned to their respective treatment group. The steers weighed an average of 628 lb at the beginning of the first grazing period. The steers initially grazed a stand of 60% Marshal Ryegrass and 40% Red Clover (20 inches in height). This is the standard pasture combination in which MSU starts grazing stocker calves in the spring. BMR sorghum was planted at a seeding rate of 19 lbs/ac on June 24. The BMR Sorghum was no-till drilled in a cross drill pattern to provide a solid stand. The four groups of steers were moved to fresh grazing paddocks when approximately 50% of the available forage DM in each paddock had been consumed. Brix measurements were recorded weekly throughout the growing season using an Atago Master T Refractometer, following Brix testing recommendations developed by Allen Williams, Ph.D.

Cost per acre for treatment and application costs was $137.01 for Treatment 1 (N), $40.00 for Treatment 2 (SG), $45.00 for Treatment 3 (RM), and $0.00 for Treatment 4 (C).

Results: Growing conditions were relatively stable throughout the grazing period with adequate moisture for forage performance. However, temperature and humidity were challenging for the steers, particularly during the second grazing period in July and August.

Brix content for the summer grazing period were not significantly different ($p>0.05$) from each other for any of the four treatments with mean brix of 4.50%, 4.50%, 4.75%, and 4.00% for the N, SG, RM, and C, respectively (Table 1).

Mean ADG were significantly higher ($p<0.05$) for the steers grazing the SG and the RM treatments compared to the N and the C treatments. Mean ADG values for the SG and RM were 2.35 lbs/hd/d and 2.26 lbs/hd/d, respectively, while mean ADG for both the N and C were 2.08 lbs/hd/d. This would result in an additional gain per steer for the SG treatment of 40.5 lbs for a 150-Day warm season grazing period when compared to either the N or the C. The RM would produce an additional 27 lbs gain for a 150-Day grazing period when compared to the N or C (Table 1).

In calculating actual days grazed per number of head grazed per treatment over the summer grazing trial period, Animal Unit Months (AUM) were calculated. An AUM is defined for this trial as the number of 750 lb beef steers that one acre of forage can support for every 30 day period. Mean AUM for the SG and the RM were significantly higher ($p<0.05$) than the N or C treatments with AUM for the SG and RM at 3.67 hd/ac/mo compared to 1.67 hd/ac/mo for the N and 2.00 hd/ac/mo for the C (Table 1).

Per acre cost analysis for the treatment and application costs indicated an advantage of $101.45/ac for the SG treatment compared to the C, with an $67.63/ac advantage for the RM treatment compared to the C. However, the N treatment, due to the increased cost of NH4NO3 showed a $170.01 disadvantage compared to the control (Table 1).

Summary: There were no differences between treatments in Brix content in this particular study. However, there were differences between treatments for the ADG, AUM, and cost per acre for treatment. The SG and RM had the best overall performance with higher ADG's, increased AUM's, and better return on investment.

Table 1. Forage & Grazing Performance Data by Treatment.

		ADG			$$
Treatment	**Brix (%)**	**lbs/hd/d**	**AUM**	**Cost/Ac**	**Advan**
N	**4.50[a]**	**2.08[a]**	**1.67[a]**	**$137.01**	**-$170.01**
SG	**4.50[a]**	**2.35[b]**	**3.67[b]**	**$40.00**	**$101.45**
RM	**4.75[a]**	**2.26[b]**	**3.67[b]**	**$45.00**	**$67.63**
C	**4.00[a]**	**2.08[a]**	**2.00[a]**	**$0.00**	

OM Environmental Products with Soil Amendment

Lakota Ranch Progress Report-Tellus Consulting

Role of Tellus Consulting

The role of Tellus Consulting is: (1) to assist in the design of trials studying the effects of the application of products applied to cool-season grass-based agricultural systems at Lakota Ranch; and, (2) to collect and interpret soil and forage samples from said trials.

Studies: Planned, In-Progress, and/or Completed

- Soil Amendment Fall Gain Test:
    - To evaluate the performance of bulls over a 60-day period when forage testing on Soil Amendment amended pasture, pasture amended with synthetic fertilizers of similar cost to Soil Amendment, or pasture not amended with any fertilizer.
    - Status: Completed
    - Soil and Forage Data: Attached
    - Animal Gain Performance: Obtained by Jeremy Engh
- Soil Amendment Rye/Ryegrass/Turnip Trial:
    - To evaluate the effects of Soil Amendment on forage qualities of a rye/ryegrass/turnips mix over one growing season.
    - Status: Completed
    - Forage Data: Attached
- Soil Amendment Long-Term Cool-Season Forage Trial:
    - To evaluate the effects of Soil Amendment on soil nutrient supplies and forage quality at specific intervals over a three (3) year period; and, to develop effective and efficient Soil Amendment management practices on forage-based systems.
    - Status: Planned
    - Note: This is a dual purpose study to compare Soil Amendment to common soil fertility management practices and to help in developing potential management practices for Soil Amendment
    - (i.e. applying with poultry litter to aid in the mineralization nutrients held as organic matter within the litter).

Soil Amendment Fall Gain Test

Methods and Materials

The design of this test was not replicated due to the constrictions that would have been placed on the number of animals per treatment, the amount of area available for the test, and most importantly, management considerations. There were two fertilizer treatments in the study with a control: (1) Soil Amendment applied at a rate of 1 gal/ac; (2) commercial fertilizer applied at a rate we recommended based upon the soil analysis (note: we are generally soil fertility and agronomic consultants; therefore, we used our recommendations as the "standard" commercial fertilizer practice (actual recommendations are below and soil test information is attached); and (3) a control with no Soil Amendment or commercial fertilizers applied.

- 175 lbs/ac Muriate of Potash
- 10 lbs/ac 10% Borate
- 145 lbs/ac 21-0-0-24S Ammonium Sulfate
    - Fertilizer Analysis: 30-0-108-1B

Soil types and boundaries were taken into account when determining the plot boundaries. Plots were laid out to limit potential yield differences based on shifting soil types (Figure 1). This was very important due to no replications existing in the trial. Management considerations were also very important in the design of the plots. Equal amounts of shade and water access for the animals was maintained throughout the trial. The site was also chosen due to the proximity of the scales used to measure the weight gain of the animals.

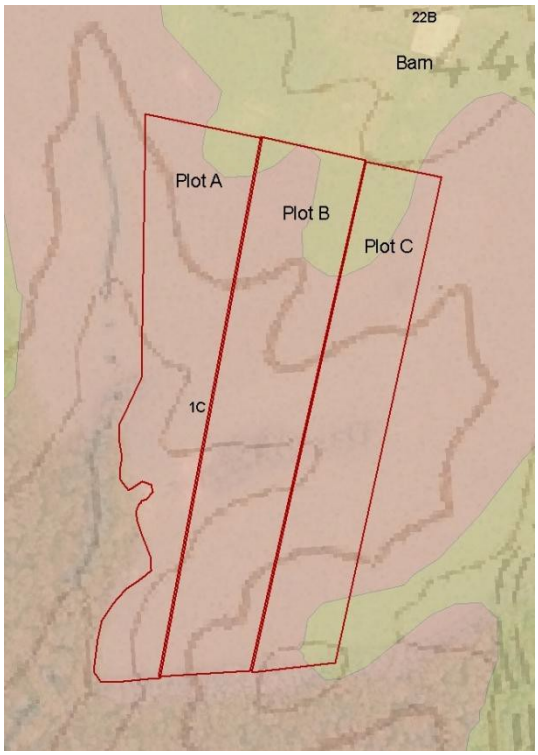

Figure 1. Plot layout for the Fall Gain Test at Lakota Ranch with soil map and topographic map overlay.

The animal component of the study lasted for 50 days where animal weights were measured every 7 days to determine average daily gain. The trial was initiated on October 17, 2011. The study was run in conjunction with the Lakota Bull Test, which is used to assess a bull's potential performance in grass-based grazing systems. Three groups of 12 bulls were used in the study. They were rotated onto each plot throughout the study to reduce potential error or inherent variance between the animal groups. Each group was rotated into a different plot every 7days, at which time each animal was weighed.

Forage yield was measured from three samples within each plot one time during the trial on November 10, 2011. A standard forage analysis was also performed

for each sample by Brookside Laboratories, Inc. Analytical results from the lab are summarized below and actual reports from the lab are attached.

Results

Forage Testing

The control plot yielded an average dry weight of 24.6±4.11 g/ft^2 or 2366±394 lbs/ac (Figure 2). The commercial fertilizer treated plot was slightly less at 21.8±5.4 g/ft^2 or 2090±522 lbs/ac. The Soil Amendment treated plot yielded the highest at 29.6±9.5 g/ft^2 or 2840±915.3 lbs/ac.

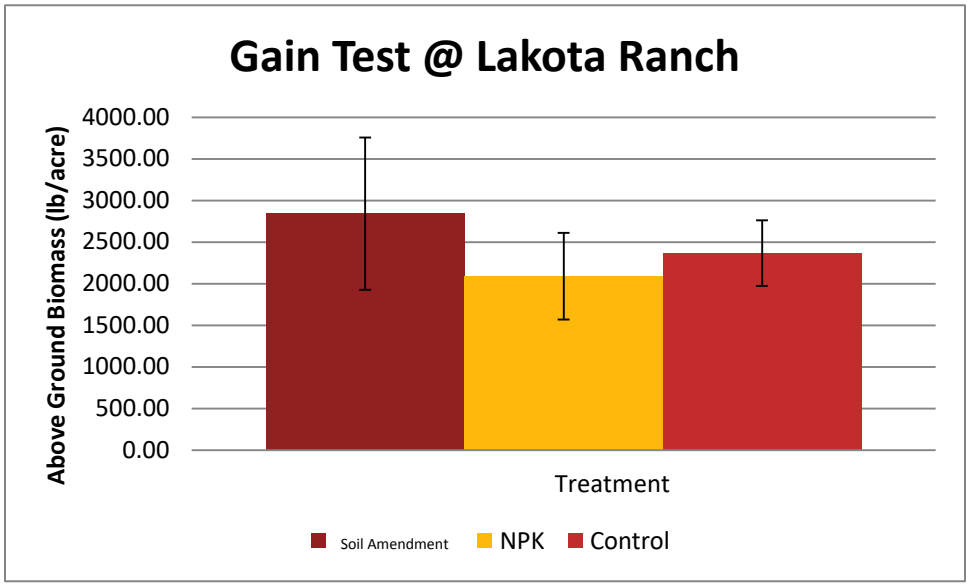

Figure 2. Forage Yield from Fall Gain Test

Nutritional differences in the forage were often slight, but favored Soil Amendment treated plots. Crude protein and digestible protein was higher in the Soil Amendment treated plots compared to the other treatments (Figure 3). Based upon visual observations there was a greater abundance of white clover in the Soil Amendment treated plot, which may account for the increased crude and digestible protein.

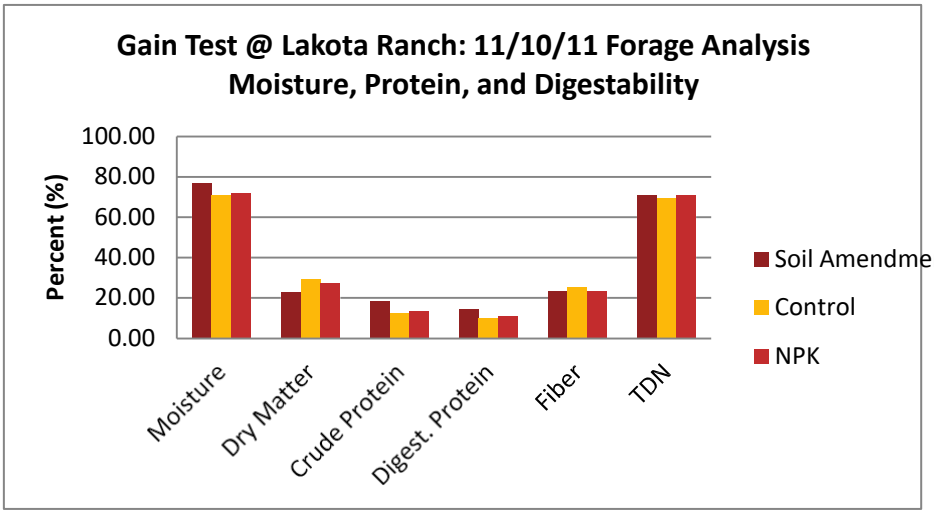

Figure 3. Protein and Digestibility Analysis of Forage from Fall Gain Test

Forage energy measurements were similar between the Soil Amendment and commercial fertilizer treated plots (Table 1). The control measured consistently produced the lowest energy. The Soil Amendment treated plot had the lowest Neutral Detergent Fiber (NDF) compared to the other plots, but had similar Acid Detergent Fiber (ADF) to the commercial fertilizer treated plot (Figure 4).

Table 1. Forage energy measurements from Fall Gain Test

Test	Treatment	Sample	NE Gain	NE Lactation	Digestable Energy
			Mcal/lb		
Gain Test	Soil Amendment	1	0.47	0.75	1.44
Gain Test	Soil Amendment	2	0.43	0.72	1.38
Gain Test	Soil Amendment	3	0.47	0.75	1.44
		Average	**0.46**	**0.74**	**1.42**
		Standard Deviation	**0.02**	**0.02**	**0.03**
Gain Test	Control	1	0.46	0.74	1.43
Gain Test	Control	2	0.4	0.69	1.34
Gain Test	Control	3	0.44	0.72	1.4
		Average	**0.43**	**0.72**	**1.39**
		Standard Deviation	**0.03**	**0.03**	**0.05**
Gain Test	NPK	1	0.49	0.77	1.48
Gain Test	NPK	2	0.47	0.75	1.45
Gain Test	NPK	3	0.4	0.69	1.34
		Average	**0.45**	**0.74**	**1.42**
		Standard Deviation	**0.05**	**0.04**	**0.07**

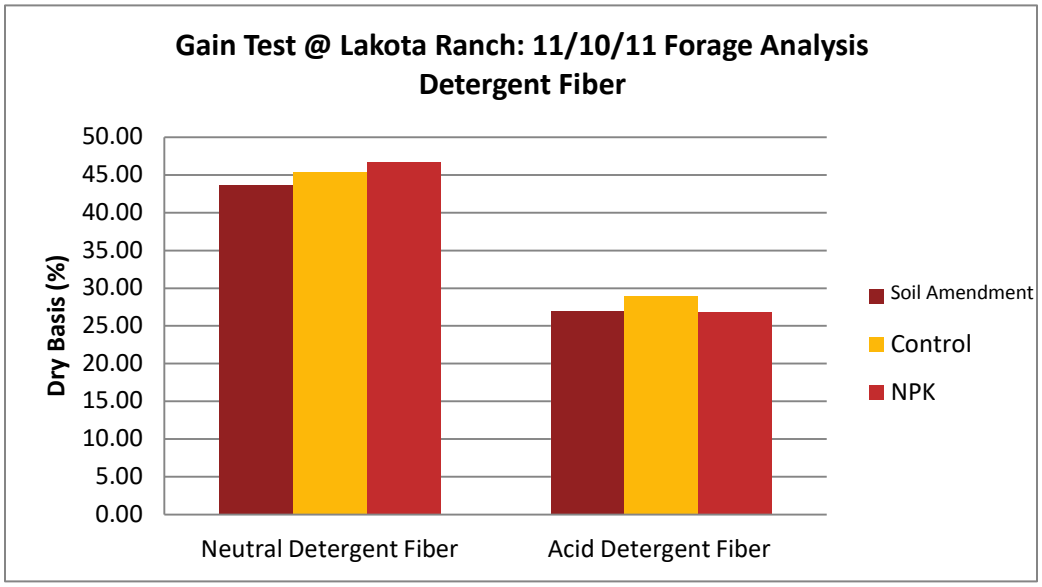

Figure 4. Forage fiber analysis from Fall Gain Test

Calcium, Potassium, Magnesium, and Sodium content was the highest in the Soil Amendment treated plot (Figure 5). The Soil Amendment treated plots also produced slightly higher Iron, Copper, and Zinc levels in the forage compared to the other treatments (Figure 6).

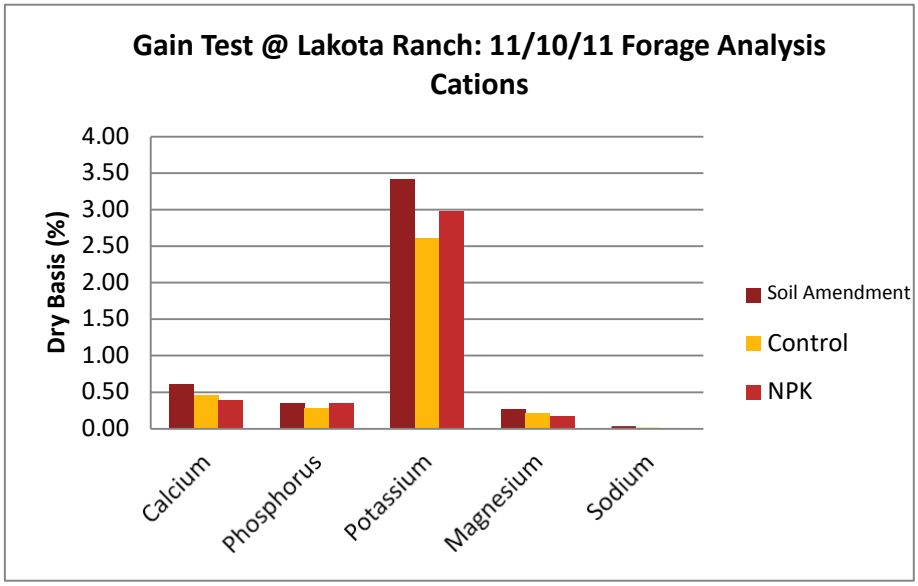

Figure 5. Forage nutrient content from Fall Gain Test

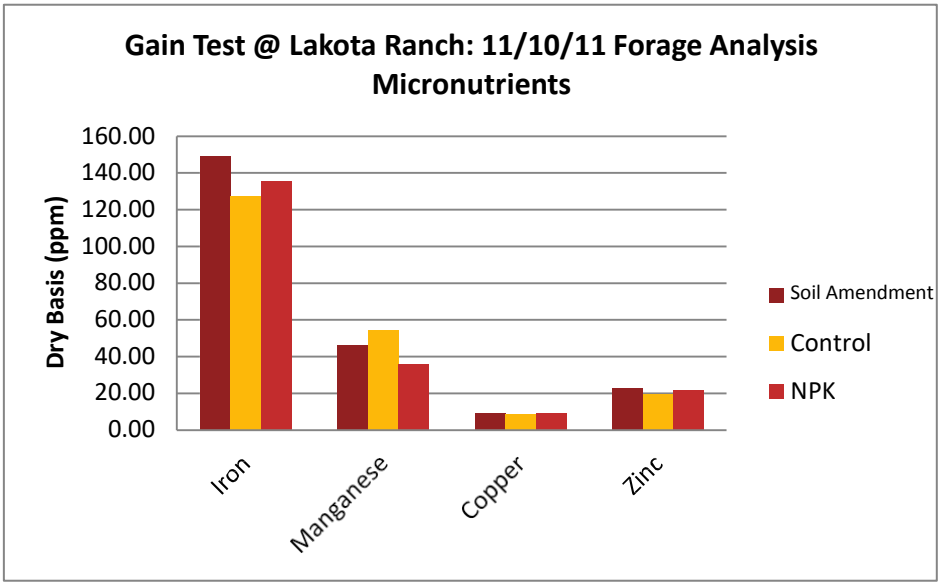

Figure 6. Forage micronutrient content from Fall Gain Test

Animal Performance

The average daily animal gain for groups grazing the Soil Amendment treated plot was 2.1 lbs/day/animal; commercial fertilizer treated plot was 1.9 lbs/day/animal; and, the control plot was 1.8 lbs/day/animal (Table 2). Average daily gain was similar between groups with only slight variation indicating little interaction or potential error from inherent differences in group performance.

Table 2. Animal mean daily gain from Fall Gain Test

	Treatment		
	Soil Amendment	30-0-108-1B	Control
Day	*Mean Daily Gain (lbs/ac/animal)*		
7	2.2	2.0	2.2
14	2.0	1.9	1.8
21	2.1	1.9	1.8
28	2.2	2.1	1.9
35	2.1	1.8	1.7
42	2.0	1.8	1.8
50	2.1	2.0	1.9
Mean	**2.1**	**1.9**	**1.8**
Std. Deviation	**0.1**	**0.1**	**0.2**

Conclusions

No definitive conclusions can be made about the treatments from this trial due to the lack of replications. We cannot be positive that the differences between treatments are a function of the treatments themselves and not inherent variation in productivity existing between each plot. This being said, we developed and designed the study to reduce known and potential sources of error, so that we could obtain good information in determining to pursue and assist in the design of future studies.

All of the results obtained from this study indicate that Soil Amendment may increase nutrient uptake, quality, and yield in cool-season forage compared to a standard application of commercial fertilizers at recommended rates for optimal plant growth. This may also explain the increase in average daily animal gain observed in the study.

The Soil Amendment product also costs less per acre than the application of commercial fertilizer. Substitution of Soil Amendment for commercial fertilizers may be an efficient short-term method of soil fertility management; however, long-term use of Soil Amendment in replace of sources adding nutrients to the soil could, in theory, create problems. Based on the information we have gathered, the introduction of humic acids and beneficial microbial populations increases the plant availability of nutrients held on exchange sites on soil colloids and organic matter, and the mineralization of nutrients in the form of organic matter. It seems at some point, in the absence of regular nutrient additions, the pool or supply of nutrients within the soil will be exhausted.

If Soil Amendment works as suggested there may be a benefit in the use of the product in conjunction with the application of manure sources (i.e. poultry litter, which is a common cool-season pasture amendment). It could result in the reduction in application rates and frequency of manure applications, since the nutrients could be more available and mineralized at a faster rate. Any method that reduces manure applications is in most cases both economically efficient and environmentally responsible.

Soil Amendment Rye/Ryegrass/Turnip Trial

Methods and Materials

This trial was a small, un-replicated trial comparing a rye/ryegrass/turnip pasture treated with Soil Amendment to a control where no amendment was applied. This trial was primarily designed to expend the remaining Soil Amendment product from the Fall Gain Test. The trial lasted for 4 weeks. A group of 40 heifers was used to evaluate average daily gain. The group was grazed initially for 1 week on the Soil Amendment treated pasture, weighed, and rotated to the control pasture where the process was repeated. During the duration of the trial, the animal group grazed the Soil Amendment treated pasture for 2 weeks at 2 separate instances and the control pasture for 2 weeks at 2 separate instances. Turnips within each pasture were sampled and a forage analysis was performed.

Results

Forage Testing

Forage analysis results between turnip samples were similar between the Soil Amendment treated pasture and the control pasture; however, protein, both crude and digestible, was higher in the Soil Amendment treated pasture. Phosphorus and Magnesium concentrations in the turnip tissue were also higher in the Soil Amendment treated pasture.

Animal Performance

The heifer group gained an average of 1.88±0.06 lbs/day/animal on the Soil Amendment treated pasture and 1.75±0.01 lbs/day/animal on the untreated pasture. Weather conditions during the test were monitored and no significant variation occurred that would have significantly affected animal gain.