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Raw Waste Milk as a Pasture Amendment

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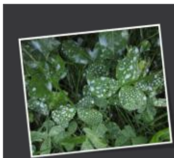

INTRODUCTION

Many graziers are turning toward biostimulants to boost forage production and quality. Spaying dilute raw milk onto pastures is a novel, untested practice that has recently gained widespread prominence as a potential means of increasing forage production and quality.

WHY SPRAY RAW MILK?

Some of the claims:

- Raw milk has been used as a crop amendment for centuries.
- Milk contains proteins and other compounds which are potent fungicides.
- Amino acids in milk proteins stimulate grass growth and vigor.
- The wide variety of bacteria naturally occurring in milk are beneficial to soil microbes.

Although there is anecdotal evidence based on farmer observation that applications of raw milk, even at low rates, appear to increase pasture growth, soil porosity, and grass brix content, there have been no peer reviewed, published studies that have reported on these claims. The intent of this project was to test the use of raw milk on pasture using a controlled set of on-farm field and greenhouse/laboratory studies.

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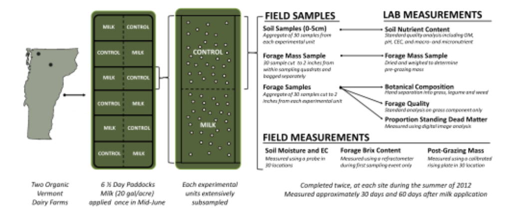
Field Experiment METHODS

The field experiment was replicated on two diary farms using a paired-comparison design with each pair of treatments (milk supplement verses a no milk control) replicated six times. Raw milk was spayed on the pasture once, in June 2012, at the rate of 20 gallons/ acre. Plots were sampled twice during 2012, approximately 30 and 60 days post milk application immediately prior to grazing. During each sampling event, forage and soil samples were collected from 30 randomly selected points within each experimental unit. Sample types and measurements are diagramed below.



Field Experiment RESULTS

All results were analyzed using a paired comparison t-test. For each grazing event, at each farm, there were six replicates.

Forage Production and Consumption

The milk treatment had no significant effect on forage production. During the second recorded grazing event at Applecheek Farm, cows consumed significantly more forage from the untreated plots.

Forage Quality

The milk treatment significantly increased degradable protein, soluble protein, crude fat and calcium concentrations in the forage during different grazing events at different farms. At certain points, forage within plots treated with milk had significantly lower concentration of soluble protein and lignin.

Soil Quality

Over the course of the experiment, the milk treatment significantly increased organic matter concentrations at both farms. No other soil quality parameter was significantly affected.

Other Parameters

The treatment had no effect on other measured variables.

Table 1. Summary of the paired t-test analyses comparing a wide variety of forge and soil parameters in plots with and without raw milk on pasture. Experiment was replicated on two farms (Applecheck Family Farm and Choiniere Family Farm) and measurements were made twice over the course of the season.

	APPLECHECK		CHOINIERE		BOTH
Parameter	*First Grazing*	*Second Grazing*	*First Grazing*	*Second Grazing*	*Both*
Pature Pregrazing Mass	N.S.	N.S.	N.S.	N.S.	N.S.
Pasture Post-Grazing Mass		N.S.	N.S.	N.S.	N.S.
Forage Consumption		↓*	N.S.	N.S.	N.S.
Acid Detergent Fiber (%)	N.S.	N.S.	N.S.	N.S.	N.S.
Neutral Detergent Fiber (%)	N.S.	N.S.	N.S.	N.S.	N.S.
Available Protein (%)	N.S.	N.S.	N.S.	N.S.	N.S.
Soluble Protein (% CP)	↑*	↓*	N.S.	N.S.	N.S.
Degradable Protein (% CP)	N.S.	N.S.	N.S.	N.S.	↑*
Lignin (%)	N.S.	N.S.	↓**	N.S.	N.S.
Water Soluble Carbs (%)	N.S.	N.S.	N.S.	N.S.	N.S.
Simple Sugars (%)	N.S.	N.S.	N.S.	N.S.	N.S.
BRIX	N.S.		N.S.		N.S.
Crude Fat	N.S.	N.S.	↑*	N.S.	N.S.
Phosphorus (%)	N.S.	N.S.	N.S.	N.S.	N.S.
Calcium (%)	↑**	N.S.	N.S.	N.S.	N.S.
Potassium (%)	N.S.	N.S.	N.S.	N.S.	N.S.
Soil Moisture (%)	N.S.		N.S.	N.S.	N.S.
Electrical Conductivity (mS/M)	N.S.		N.S.	N.S.	N.S.
Organic Matter	N.S.		N.S.	N.S.	↑*
pH	N.S.		N.S.	N.S.	N.S.
Available Phosphorus	N.S.		N.S.	N.S.	N.S.

N.S. is no significant difference due to treatment.
*, $P<0.05$; **, $P<0.01$ are significant differences between raw milk and control treatment.
↑, indicates that treatment resulted in a significant increase over the control
↓, indicates that treatment resulted in a significant decrease over the control

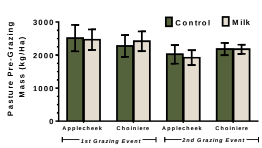


Figure 1A. Mean pasture pre-grazing mass (kg/Ha) (n=6). Error bars represent one standard deviation from the mean. Values determined using cut samples (30 per experimental unit) during the first grazing event and using a calibrate falling plate meter during the second grazing event.

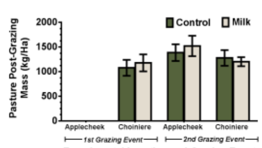


Figure 1B. Mean pasture post-grazing mass (kg/Ha) (n=6). Error bars represent one standard deviation from the mean. Values from each experimental unit estimated used 30 calibrated falling plat meter readings.

Laboratory Experiments SUMMARY

FORAGE GROWTH PARAMETERS

METHODS

Perennial ryegrass was grown from seed in 12 polyurethane cylinders. After 21 days, dilute milk was applied to the surface of half of the cylinders at the rate of 20 gal/acre. The growth rate and other characteristics of the forage above ground and below ground biomass (see results selection for list of variables) was monitored for 43 days over two cuttings.

RESULTS

During the first 20 days, grasses within the milk treatment tillered significantly ($P< 0.0186$) more rapidly than grasses which did not receive the treatment. Above ground biomass was significantly greater in the milk treatment during the first sampling event. Mean tiller weight did not differ, thus the increase in biomass is likely a function of the greater number of tillers per pot.

There was no significant difference between treatments for the following variables at any time in the experiment:

- Root Mass
- Root / Shoot Ratio
- Tiller Elongation Rate
- Percent standing dead matter
- Forage BRIX
- Mean Tiller Weight

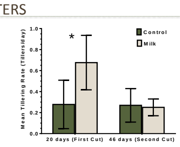


Figure 3. Mean tillering rate (tiller per day) of ryegrass between 0 to 20 days and 21 to 46 days post treatment application. Error bars represent one standard deviation from the mean. Symbols indicate significant difference for each interval at P< 0.05 (*).

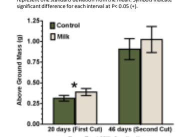


Figure 4. Mean above ground mass (g) of perennial ryegrass within pots 20 days and 46 days post milk application. Error bars represent one standard deviation from the mean. Grasses were cut to 6cm 20 days and allowed to regrown. During the second cut, grass were cut to ground surface. Symbols indicate significant difference for each interval at P< 0.05 (*).

SOIL RESPIRATION

METHODS:

Fresh, sieved pasture soils were either amended with leaf litter or left unamended. Soil surface was treated with diluted raw milk (20 gal/A) compared to an untreated control. Equal amounts of water were added to the soils to maintain constant moisture. After periods of 7, 14, 21, and 28 day subsequent to milk application, carbon dioxide flux rates were measured from each microcosm using a gas chromatograph.

RESULTS:

There was no significant difference between treatments during any of the sampling events.

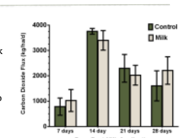


Figure 5. Mean carbon dioxide flux rate of unammended soils treated with raw milk. Error bars represent one standard deviation from the mean.

NITROGEN MINERALIZATION

METHODS:

Fresh pasture soils were packed into small pots. Small litter bags (3 cm^2) were buried 1 cm beneath the soil surface. Equal amounts of water were added to the soils every few days to maintain constant moisture.

Diluted raw milk (20 gal/A) was applied to the surface of half of the pots. After periods of 1, 7, 14, 21, and 28 days, pots were destructively sampled. Litter bags were cleaned, dried, and weighed. Soil mineral N concentrations (NH4-N and NO3-N) were determined in 1M KCl extracts.

RESULTS

Ammonium-N concentrations were significantly greater with the milk treatment 1 day post milk application. Ammonium concentration on other days, nitrate concentrations, and litter decomposition rates was not significant.

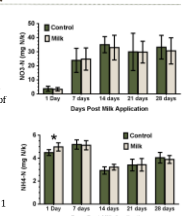


Figure 6. Mean soil nitrate an ammonium concentrations (n=7). Symbols indicate significant difference for each interval at P< 0.05 (*).

CONCLUSION

Even though an application of raw milk showed a positive affect on initial grass tiller production and yield in the greenhouse, we found no affect of milk on pasture growth or yield within the first 60 days of application in the field.

There are three possible explanations. First, the dry conditions present during the summer of 2012 may have inhibited any stimulatory effect milk might otherwise have had. Second, the soils at these sites were already high in organic matter, pH and mineral content. Perhaps a poor soil may have shown different results. Or third, there are generally too many environmental variables in the field for the slight benefits we found in the controlled environment of the greenhouse to be expressed and be biologically or economically significant.

Our results would indicate that it probably would not be economical to apply milk to pastures. However, additional field studies under varied environmental and edaphic conditions should be conducted to confirm these results.

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