JOURNAL OF THE NACAA

ISSN 2158-9429

VOLUME 9, ISSUE 1 - JUNE, 2016

Editor: Donald A. Llewellyn

COMPARING FERTILIZER ADDITIVES APPLIED TO UREA FOR STOCKPILING ORCHARDGRASS

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ABSTRACT

Fertilizing orchargrass with urea to extend the grazing season may be an option for producers if it is present in their fields. The purpose of the replicated study was to determine effects additives had on urea when applied during hot/dry summer months. Treatments consisted of no treatment (control), urea only at a rate of 46 lbs. of nitrogen (N) per acre; urea plus Agrotain®; and urea plus NutriSphere-N®. There was a significant difference in crude protein (CP) content at ($P<0.05$) between the NutriSphere-N® and Agrotain® treatments. There was no significant difference in drymatter, ADF, and TDN at ($P<0.05$).

INTRODUCTION

Many livestock owners spread a granular form of nitrogen (urea) during late summer and fall attempting to increase forage growth for “stockpiled” forage and decrease total feed costs. Urea is the most common form of Nitrogen used in the area due to availability of product and equipment available for making applications. Grass plants use nitrogen to maximize growth, produce proteins, and build-up sugars for growth. Livestock are then permitted to graze the “stockpile” at a later date when other forages no longer are growing or available. This practice extends the grazing season and reduces the need for higher priced stored feed. One of the problems with this practice however, is the possibility of losing broadcast nitrogen due to volatilization because of inadequate rainfall in a timely manner. The Tri-State Fertilizer Recommendations (1995), provides this recommendation, that urea-containing fertilizer should receive ½ inch or more of rainfall before hydrolysis occurs to reduce or eliminate volatilization losses. Urease inhibitor products such as Agrotain® and NutriSphere-N® are advertised to reduce such volatilization by lengthening the amount of time before such loss occurs. In a previous study Penrose, McCutcheon & Landefeld (2015) concluded, stockpiling cool season grasses, and in particular fescue can reduce the need for stored forages and in many cases it is higher quality than the hay producers make. In that study, there was a positive statistical difference ($P<0.05$) in the amount of crude protein above the control plots when adding Agrotain® to the urea before application.The purpose of this study was to determine the effects of yield and quality by adding fertilizer stabilizing (urease inhibitor) products to urea, at the labeled rate, before applying to orchardgrass.

METHODS

The study was a randomized complete block design with four (4) treatments, including a control and four (4) replications of each treatment. The site was located in Monroe County, Ohio (GPS coordinates 39° 49’ 25" N, 81° 09’ 09" W) and the soil type is Zanesville Silt Loam (USDA Web Soil Survey). Each plot was six feet by 20 feet. The site was a predominately orchardgrass hay field and the soil test results were pH, 6.2; P, 26 ppm; K, 68 ppm; Ca, 969 ppm; and Mg, 209 ppm. The field was mechanically harvested nine days prior to treatments and approximately 6 inches of natural regrowth had occurred. The control plots received no urea or urease inhibitor. For the other treatments, urea nitrogen (46-0-0) was broadcast on the surface as follows: 46 lbs. N/A; 46 lbs. N/A plus Agrotain® added at the labeled rate of one gallon per ton of fertilizer; and 46 lbs. N/A plus NutriSphere-N® added at the labeled rate of one half gallon per ton of fertilizer. The plots were fertilized August 3, 2015 and harvested on December 2, 2015 at a height of three inches above ground level utilizing 2’ x 2’ subsamples from each plot. Each sample was weighed to the nearest gram and dry matter was determined using laboratory moisture analysis. The samples were analyzed at a laboratory utilizing wet chemistry forage tests. Each of the 16 samples was quality tested for Crude Protein (CP), Acid Detergent Fiber (ADF), and Total Digestible Nutrients (TDN). Analysis for CP was done using the combustion method, ADF using Ankom Technology Method 5 (Ankom200 Fiber Analyzer, Ankom Technology, Fairport, N.Y.) and TDN was calculated using ADF values.

Yield and quality results were analyzed using the MIXED procedure in SAS 9.3 (SAS Inst. Inc., Cary, NC). The model included the treatment and the replication, with treatment as fixed and replication as random variables. The PDIFF function was used for mean separation.

RESULTS

There were no statistical (P > 0.05) differences in dry matter yields, ADF and TDN as shown in Table 1. There was a significant difference in CP content (P < 0.05) in the treatments. The treatment with Agrotain®, 14.6 percent CP, was greater than the treatments with NutriSphere-N®, 12.5 percent CP, the control, 13.2 percent CP, and the urea treatment 13.2 percent CP. There was no difference in the CP percentage for the NutriSphere-N®, urea, and control treatments

	Treatments					
Item	**Control**	**Urea**	**Urea + Agrotain**	**Urea + Nutrisphere**	**SEM**	**PR>F**
DM/A (lbs.)	1630	1899	2140	1911	261.3	0.61
CP (%)	13.2A	13.2A	14.6B	12.5A	0.54	<0.01
ADF (%)	39.6	40.0	40.4	42.5	1.28	0.33
TDN (%)	60.3	60.1	59.7	58.3	0.89	0.32

*Means with the same letter are not significantly different.

Table 1. Results of CP, ADF, TDN and DM yield of Orchardgrass

DISCUSSION

Urea nitrogen can be susceptible to volatilization when temperatures and humidity are high and no rainfall occurs to move broadcast N into the soil in a timely manner. Volatilization losses are highest when the soil is warm (above 60°F), experiencing high evaporation rates, and/or when soil pH is greater than seven. In most years, temperatures become high enough to cause concern in early May. After this time, urea N contained in surface applications is more volatile (Schwab, G., & Murdock, L., 2010). Rainfall after the treatments in this study was nearly non-existent (0.05 in.) for 6 days making the potential to lose N to volatilization very high. On day seven, a rain event (0.3 in.) occurred over the plots. Rainfall, during the first 30 days after treatments, totaled 1.10 inches. Average rainfall in Southeast Ohio the last five years has been approximately 38 inches per year and October is typically the driest month, averaging 2.6 inches. Daytime temperatures the first 10 days after N application ranged from 80 degrees to 86 degrees Fahrenheit with maximum relative humidity percentages in the upper 90's while averaging 70 to 80 percent each day.

During most years, producers would expect 1000 lbs. or more of additional DM to accumulate when applying 100 lbs. of urea to orchardgrass. However, in this 2015 study less than expected total growth accumulation was observed in all plots. This may be due to lack of adequate moisture for growth until mid-September. Rayburn (2000), said typical fall yield response per unit of nitrogen applied averages about 20 lbs. dry matter per pound of nitrogen (DM/lb. N) applied. When there is a high legume content in the stand or when other minerals or drought limit growth, only 5 to 10 lbs. DM/lb. N may be achieved. Normal, to above normal, rainfall amounts occurred after mid-September until harvest, but length of daylight hours were diminishing at that point in the growing season and forage growth typically slows down by then in our area. In addition, the late December harvest of the orchardgrass may have been after the grass had started to deteriorate from cold temperatures, reducing yield and quality.

While Agrotain® was used in this study, a newer formulation "Agrotain Advanced®" is now available at about twice the cost of Agrotain®. The new label rate is ½ the amount (2 quarts) per ton instead of 1 gal./ton, so costs per application are nearly identical.

Adding nitrogen can increase yield and quality of stockpiled forage when conditions permit. Nitrogen can be provided by legume plants, applying nitrogen from commercial fertilizer, or spreading manure. Studies by Herbet & Hashemi (2006), in Massachusetts and Wisconsin, showed tall fescue and orchardgrass stockpiling provided the highest yields of all grasses in the studies. Grasses need sufficient nitrogen to maximize their growth, produce high levels of protein, and accumulate sugars during late summer and fall. In this study orchardgrass ranged from 12.5 to 14.6 percent CP. According to the National Research Council, Nutrient Requirements of Beef Cattle (2000), sun-cured orchardgrass hay in late bloom, the mean composition would be 8.4 percent CP, 37.8 percent ADF and 54 percent TDN.

Additional forage growth, above control amounts, did not pay for the urea and urease inhibitors in this study. Adding nitrogen to the stockpiled forage at a rate of 46 lbs. N per acre cost $20.00 per acre when urea is $400/ton. Including Agrotain® at the labeled rate adds $2.75 per acre for a total of $22.75/A and including NutriSphere-N® at the labeled rate adds $3.39 per acre for a total of $23.39/A. These amounts do not including application costs that would be incurred.

For a comparison, using a purchased hay price of $0.04/lb. (±$70/ton as fed weight = $80/ton DM) to arrive at a value of forage growth in this study, the application of urea lost (-$9.24)/A; urea +Agrotain® was (-$2.31)/A and urea + NutriSphere-N® was (-$12.11)/A.

CONCLUSION

Stockpiling cool season grasses can reduce the need for stored forages and in many cases it is higher quality than much of the first cutting hay produced. The problems known to fescue, fungal endophyte which produces alkaloids that are toxic to animals and causes various animal health problems, are not encountered with orchardgrass. While orchardgrass may not be as good as fescue to hold its quality characteristics for late winter use or heavy grazing, it is a very palatable forage and produces sufficient tonnage for stockpiling when weather conditions permit. Studies consistently indicate stockpiling with N profitably increases yield and quality, however in this study the costs of adding fertility was higher than purchasing equivalent amounts of hay. More studies are needed to provide clear answers about using fertilizer additive products on orchardgrass in stockpiling situations. Future studies will include additional forms of N and harvesting at an earlier date since orchard grass is known to lose quality and quantity sooner than fescue.

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