Fertilizing Options for Stockpiling Forages

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Objective

Many livestock owners use the granular form of urea nitrogen during late summer and fall trying to increase forage growth for "stockpiled" forage. Livestock are then allowed 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. Urea is a common nitrogen fertilizer that is readily available but can volatize under warm, humid, dry conditions. Adding a urease inhibitor (Agrotain®) can reduce the chances of volatizing for a period of time. Ammonium sulfate is another nitrogen fertilizer that can be purchased although it is more expensive per unit of nitrogen and studies indicate it is less volatile than urea. This study was done to determine the effects of using urea, adding a urease inhibitor (nitrogen stabilizer) product to urea, at the labeled rate, before applying the urea to the forage, and applying ammonium sulfate. The objective was to determine any difference in dry matter accumulation between treatments and detect changes in quality characteristics of the forages.

Background

Crop Year: 2016
Location/Town: Woodsfield, OH
County: Monroe
Soil Type: Zanesville Silt Loam (ZnB)
Drainage: Natural
Nitrogen: 46 lbs actual N
Application Date: 8/2/16

Previous Crop: Permanent Mixed Grasses
Tillage: None
Soil Test: pH-6.2 P-26 ppm K-68 ppm
Rainfall within 12 days: 0.1 in.
Rainfall within 30 days: 3.20 in.
Harvest Date: 11/4/16

Crop Year: 2016
Location/Town: Belle Valley, OH
County: Noble
Soil Type: Lowell Silt Loam (LoD2)
Drainage: Natural
Nitrogen: 46 lbs actual N
Application Date: 8/2/16

Previous Crop: Predominant Fescue Grass
Tillage: None
Soil Test: pH-6.6 P-18 ppm K-130 ppm
Rainfall within 12 days: 0.00 in.
Rainfall within 30 days: 4.78 in.
Harvest Date: 11/4/16

Crop Year: 2016
Location/Town: Pennsville, OH
County: Morgan
Soil Type: Westgate Silt Loam (WfC2)
Drainage: Natural
Nitrogen: 46 lbs actual N
Application Date: 8/2/16

Previous Crop: Predominant Fescue Grass
Tillage: None
Soil Test: pH-7.0 P-4 ppm K-135 ppm
Rainfall within 12 days: 0.1 in.
Rainfall within 30 days: 5.85 in.
Harvest Date: 11/4/16

Methods

There were three locations (Monroe, Noble and Morgan Counties) with a randomized complete block design at each location with four (4) treatments, including a control, and four (4) replications of each treatment. Each plot was six feet by 20 feet. The fields were mechanically harvested to a height of four to six inches prior to treatment application. The control plots received no urea (46-0-0), urease inhibitor, or ammonium sulfate (21-0-0). For the other treatments, a total of 46 lbs/A of nitrogen was used in each treatment in the following manner: 100 lbs. urea/A; 100 lbs urea/A plus Agrotain® added at the labeled rate of one gallon* per ton of fertilizer; and 219 lbs ammonium sulfate. The plots were harvested on November 4, 2016 to a stubble height of three inches utilizing 2' x 2' subsample area from each plot. Each subsample was weighed fresh, and then taken to a laboratory for forage analysis. Each of the 48 samples were quality tested for crude protein (CP), acid detergent fiber (ADF) and total digestible nutrients (TDN). Statistics were calculated using Proc Mixed in SAS 9.3. The model included treatment, farm, and treatment by farm, with the random variable of rep within farm. Pdiff was used for mean separation, to compare each treatment against the control.
(*Note-A newer formulation "Agrotain Advanced®" is now available at about twice the cost of Agrotain, ® the product used in this study, but the new label rate is ½ the amount (2 quarts) per ton instead of 1 gal./ton so costs per application are nearly identical.)

Results

Tables 1, 2 and 3 list the results for each county and table 4 provides the averages across the three counties. There were no significant differences among treatments for CP, ADF, and TDN.

Table 1. Monroe Plots

Treatment	Lbs. DM/A	Lbs. DM/A above control	CP%	ADF%	TDN%
Control	**2698**	**-**	**12.28**	**41.31**	**61.60**
Urea	**3119**	**421**	**12.40**	**42.80**	**60.56**
Urea+Agrotain®	**3694**	**996***	**12.65**	**41.83**	**61.24**
Ammonium Sulfate	**3372**	**675**	**12.94**	**43.43**	**60.13**

LSD = 981 ($P < 0.05$) * denotes significant difference in yield compared to the control.

Table 2. Noble Plots

Treatment	Lbs. DM/A	Lbs. DM/A above control	CP%	ADF%	TDN%
Control	**2082**	**-**	**13.93**	**38.35**	**63.68**
Urea	**2608**	**526**	**14.19**	**41.65**	**61.36**
Urea+Agrotain®	**2711**	**629**	**14.55**	**38.45**	**63.60**
Ammonium Sulfate	**3114**	**1032***	**14.42**	**40.42**	**62.22**

LSD = 981 (P < 0.05) * denotes significant difference in yield compared to the control.

Table 3. Morgan Plots

Treatment	Lbs. DM/A	Lbs. DM/A above control	CP%	ADF%	TDN%
Control	**3101**	**-**	**13.35**	**41.25**	**61.64**
Urea	**3706**	**605**	**13.46**	**39.66**	**62.75**
Urea+Agrotain®	**3970**	**869**	**13.75**	**39.60**	**62.79**
Ammonium Sulfate	**4340**	**1239***	**13.45**	**38.59**	**63.49**

LSD = 981 (P < 0.05) * denotes significant difference in yield compared to the control.

Table 4. Three Site Average

Treatment	Lbs. DM/A	Lbs. DM/A above control	CP%	ADF%	TDN%
Control	**2627**	**-**	**13.19**	**40.29**	**62.31**
Urea	**3144**	**517**	**13.35**	**41.37**	**61.56**
Urea+Agrotain®	**3459**	**832***	**13.65**	**39.96**	**62.54**
Ammonium Sulfate	**3609**	**982***	**13.62**	**40.81**	**61.95**

LSD = 566 (P < 0.05) * denotes significant difference in yield compared to the control.

Summary

Rainfall after the treatments were initiated, in this study, was nearly non-existent (0.1 in. at two of the three sites, the other had none) for twelve days making the potential to lose N to volatilization very high. On day twelve, there was a rain event (0.7 in. Monroe Co., .74 in. Noble Co., 2.0 in. Morgan Co.). There were significant yield differences with the urea plus Agrotain® and ammonium sulfate, compared with the control (data from all three sites were used). In the combined site data and data from the individual sites, urea was not significantly different from the control.

Previous research conducted by Penrose (2014), and Landefeld (2015), showed a numerical increase in dry matter accumulation when Agrotain® was applied with urea compared with urea alone, although there was no significant difference in the treatments at the (P<0.05) for yield.

There was a significant difference in crude protein between urea (8.53%) and urea plus Agrotain® (8.31%) when compared with the control (6.77%) in the 2014 study. However, in the 2015 study, there was a significant difference between urea plus Agrotain® compared with the control and urea only.

During most growing years, producers would expect over 1000 lbs of additional growth from 46 lbs N/acre. Additional forage growth, above control amounts, did pay for the urea and urease inhibitors in this study, but not for the ammonium sulfate. Adding nitrogen to the stockpiled forage at a rate of 100 pounds of urea per acre cost $19 per acre when urea is $385/ton. Including Agrotain® at the labeled rate adds $4 per acre for a total of $23/A. When ammonium sulfate at 46 lbs N/acre per acre is applied, the cost is $88/A for the fertilizer. These amounts do not include application costs that would be incurred.

Using a hay price of $0.04/lb ($70/ton as fed weight, = $80/ton DM) as a comparison to arrive at a value for the forage growth in this study, the application of urea increased marginal return (forage value minus treatment application cost) by $1.68/A; urea +Agrotain® increased marginal return by $10.28/A; and ammonium sulfate resulted in a loss of $48.72/A considering fertilizer treatment costs alone. One needs to consider also the application costs, labor to feed stored feed, the animal utilization of the stockpiled forages, and the stored feed. In many cases, stockpiling is a viable option to reduce costs and save time.

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