Fertilizer Options for Stockpiling Cool Season Grass

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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. This was an identical study to one that was conducted in 2016 to replicate over time and was designed 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 study was to determine any difference in dry matter accumulation between treatments and detect changes in quality characteristics of the forages.

Background

Crop Year: 2017
Location/Town: Woodsfield, OH
County: Monroe
Soil Type: Zanesville Silt Loam (ZnB)
Drainage: Natural
Nitrogen: 46 actual N
Application Date: 7/31/17

Previous Crop: Permanent Mixed Grasses
Tillage: None
Soil Test: pH-6.2 P-26 ppm K-68 ppm
Rainfall within 4 days: 0.70 in.
Rainfall within 30 days: 3.18 in.
Harvest Date: 11/13/17

Crop Year: 2017
Location/Town: Belle Valley, OH
County: Noble
Soil Type: Lowell Silt Loam (LoD2)
Drainage: Natural
Nitrogen: 46 actual N
Application Date: 7/31/17

Previous Crop: Predominant Fescue Grass
Tillage: None
Soil Test: pH-6.6 P-18 ppm K-130 ppm
Rainfall within 4 days: 0.75 in.
Rainfall within 30 days: 3.32 in.
Harvest Date: 11/13/17

Crop Year: 2017
Location/Town: Pennsville, OH
County: Morgan
Soil Type: Westgate Silt Loam (WfC2)
Drainage: Natural
Nitrogen: 46 actual N
Application Date: 7/31/17

Previous Crop: Predominant Fescue Grass
Tillage: None
Soil Test: pH-7.0 P-4 ppm K-135 ppm
Rainfall within 12 days: 1.3 in.
Rainfall within 30 days: 3.20 in.
Harvest Date: 11/13/17

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 prior to treatments to a height of three inches. 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 pounds/acre of nitrogen was used in each treatment in the following manner: 100 pounds urea/acre; 100 pounds urea/acre plus Agrotain® added at the labeled rate of one gallon* per ton of fertilizer; and 219 pounds/acre ammonium sulfate which was applied on July 31, 2017. The plots were harvested on November 13, 2017 to a height of three inches above ground level utilizing 2' x 2' subsamples from each plot. Each subsample was weighed fresh, and then taken to a laboratory for forage analysis. Each of the 48 samples was 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. Model included treatment, farm, and treatment by farm, with the random variable of rep within farm.
(*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 lists the results for each county and table 4 provides the averages for the three counties. Dry matter (DM) yields averaged 2645 pounds/acre for the plots where no nitrogen (N) was applied, 3322 pounds/acre for the plots with 46 pounds of N in the form of urea applied, 3494 pounds/ acre for the plots with 46 pounds of N in the form of urea applied, with Agrotain® added, and 3278 pounds for the plots with 46 pounds of N in the form of ammonium sulfate applied. There was a significant difference between the control and the treatments ($P<0.05$) for yield, but not between the treatments. There was also a significant difference in CP between the control and the treatments, but not between the treatments. There were no significant differences with ADF and TDN.

Table 1. Monroe Plots

Treatment	Pounds DM/acre	Pounds DM/acre above control	CP%	ADF%	TDN%
Control	**1781**	**-**	**12.06**	**44.10**	**57.16**
Urea	**3244**	**1463***	**12.61**	**46.36**	**56.09**
Urea+Agrotain®	**2757**	**976***	**12.91**	**44.38**	**56.97**
Ammonium Sulfate	**2879**	**1098***	**12.26**	**44.98**	**56.55**

LSD = 777 ($P < 0.05$) * denotes significant difference in yield compared to the control.

Table 2. Noble Plots

Treatment	Pounds DM/acre	Pounds DM/acre above control	CP%	ADF%	TDN%
Control	**2068**	**-**	**13.15**	**39.77**	**59.22**
Urea	**2567**	**499**	**12.74**	**42.24**	**58.46**
Urea+Agrotain®	**3236**	**1168***	**12.79**	**40.52**	**57.91**
Ammonium Sulfate	**2340**	**272**	**13.34**	**44.20**	**57.09**

LSD = 777 ($P < 0.05$) * denotes significant difference in yield compared to the control.

Table 3. Morgan Plots

Treatment	Pounds DM/acre	Pounds DM/acre above control	CP%	ADF%	TDN%
Control	**4084**	**-**	**10.22**	**39.60**	**60.29**
Urea	**4156**	**72**	**10.80**	**40.40**	**59.74**
Urea+Agrotain®	**4490**	**406**	**10.34**	**38.85**	**60.82**
Ammonium Sulfate	**4613**	**529**	**10.76**	**39.18**	**60.59**

Table 4. Three Site Average

Treatment	Pounds DM/acre	Pounds DM/acre above control	CP%	ADF%	TDN%
Control	**2645**	**-**	**11.81**	**41.16**	**58.89**
Urea	**3322**	**677***	**12.05**	**43.00**	**58.09**
Urea+Agrotain®	**3494**	**849***	**12.01**	**41.25**	**58.57**
Ammonium Sulfate	**3278**	**633***	**12.12**	**42.79**	**58.08**

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

Summary

Research has demonstrated that urea nitrogen can be susceptible to volatilization when temperatures and humidity are high and no rainfall occurs to move the broadcast nitrogen (N) into the soil in a timely manner. However, rainfall after the treatments were initiated occurred within 96 hours of the start of the study (0.7 in. Monroe Co., 0.75 in. Noble Co., 1.3 in. Morgan

Co.) reducing the potential to lose N to volatilization. For the month of August, rainfall at the three sites ranged from 3.18 in. to 3.2 in.

There were no statistical differences in CP, ADF, and TDN ($P < 0.05$). There were significant differences in yield between the control and all of the treatments for the three site average, but not between the treatments. The three site average for the control was 2645 pounds DM/acre; urea, 3322 pounds. DM/acre; urea+Agrotain®, 3494 lbs. DM/acre; and ammonium sulfate, 3278 pounds DM/acre.

In the identical 2016 study, dry matter (DM) yields averaged 2627 pounds/acre for the plots where no N was applied, 3144 pounds/acre for the plots with 46 pounds of N in the form of urea applied, 3459 pounds/acre for the plots with 46 pounds of N in the form of urea applied, with Agrotain® added, and 3609 pounds/acre for the plots with 46 pounds of N in the form of ammonium sulfate applied. There was a significant difference between the control and the treatments ($P<0.05$) for yield, but not between the treatments. There was also a significant difference in CP between the control and the treatments, but not between the treatments. There were no significant differences with ADF and TDN.

Previous research conducted by Penrose (2014), and Landefeld (2015), showed a significant increase in dry matter accumulation occurred using treatments over the control (urea alone and urea plus Agrotain®) even though 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 to the control (6.77%) in the 2014 study. However, in the 2015 study, there was a significant difference between urea plus Agrotain® compared to the control and urea only.

One needs to calculate the application costs, consider the costs and time to feed stored feed, and the 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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