Nitrogen Options to Increase Yields for Stockpiling Cool Season Grass in Eastern Ohio, USA

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Abstract

Stockpiling cool season grass for grazing in the fall and winter is an option to extend the grazing season. The purpose of this study was to determine the effects of yield and quality by adding urea, urea with Agrotain®, and ammonium sulfate to cool season grasses, primarily fescue and orchardgrass. This was the third year of the three location study in Southeast Ohio. Each location had a randomized complete block design with four treatments (control, 112 kg urea ha^{-1}, 112 kg urea ha^{-1} plus Agrotain®, and 245.5 kg ammonium sulfate ha^{-1}) and four replications of each treatment. The application date was August 6, 2018 and the plots were harvested on November 4, 2018. There were no statistical differences in crude protein, acid detergent fiber, and total digestible nutrients (CP, ADF, and TDN) ($P < 0.05$). There were significant differences in yield between the control and all the treatments, but not within the treatments. The three-site average for the control was 2682 kg/ha^{-1}; urea, 3431 kg/ha^{-1}; urea+Agrotain®, 3855 kg/ha^{-1}; and ammonium sulfate, 3468 kg/ha^{-1}. Rainfall in the first 30 days from trial initiation in 2018 ranged from 8.15 to 9.47 cm, and the first significant rainfall (0.28-0.64 cm) was within 30 hours of initiation. This was the third and final year of this study and year three results continue to indicate that adding nitrogen increases yields.

Introduction

Many livestock owners use the granular form of urea nitrogen (N) 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 are available. This practice extends the grazing season and reduces the need for higher priced stored feed. This was an identical study to ones that were conducted in 2016 and 2017 to replicate over time. The study 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 purpose of the study was to determine any difference in dry matter accumulation between treatments and detect changes in quality characteristics of the forages.

Methods and Study Site

There were three locations in eastern Ohio. The Monroe County location is 39º49'24"N, 81º09'12"W. Soil type is a Zanesville Silt Loam with a predominant orchardgrass (*Dactylis glomerata* L.) cover. Soil pH was 6.2, 26 ppm P, and 69 ppm K.

The Noble County location is 39º47'15"N; 81º31'16"W. The soil type is a Lowell Silt Loam with a predominant tall fescue (*Festuca arundinacea*) grass cover. Soil pH was 6.6, 18 ppm P, and 130 ppm K.

The Morgan County location is 39º35'21"N, 81º49'53"W. Soil type is a Westgate Silt Loam with a predominant tall fescue (*Festuca arundinacea*) grass cover. Soil pH was 7.0, 4 ppm P, 135 ppm K.

The study had 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 1.83m by 6.10 m. The fields were mechanically harvested prior to treatments to a height of 7.6 cm.

The control plots received no urea (46-0-0), urease inhibitor, or ammonium sulfate (21-0-0). For the other treatments, a total of 51.6 kg nitrogen ha^{-1} was used in each treatment in the following manner: 112 kg urea ha^{-1}; 112 kg urea plus Agrotain® ha^{-1} added at the labeled rate of 0.24 ml/kg fertilizer; and 245.5 kg ammonium sulfate ha^{-1} which was applied on August 6, 2018. The plots were harvested on November 4, 2018 to a height of 7.6 cm above ground level utilizing 0.61 m x 0.61 m 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 CP, ADF and TDN. Statistics were calculated using Proc Mixed in SAS 9.3. Model included treatment, site, and treatment by site, with the random variable of replicate within site.

Results

Table 1 lists the three location average for yield and quality. There was a significant difference between the control and the treatments ($P<0.05$) for yield, but not between the treatments. There were no significant differences with CP, ADF and TDN.

Table 1. 2018 Three Site Average

Treatment	kg DM/ha	Kg DM/ha above control	CP%	ADF%	TDN%
Control	2682	-	9.4	30.0	67.0
Urea	3431	749*	9.8	32.0	65.3
Urea+Agrotain®	3855	1173*	10.4	28.5	68.0
Ammonium Sulfate	3468	787*	10.1	31.7	65.8

LSD = 569 ($P < 0.05$) * denotes significant difference in yield compared to the control.

Discussion

Research by McInnes *et al.* (1986) has demonstrated that urea N can be susceptible to volatilization under dry conditions when no rainfall occurs to move the broadcast 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 (1.78 cm Monroe

Co., 1.91 cm Noble Co., 3.30 cm Morgan Co.) reducing the potential to lose N to volatilization. For the month of August, rainfall at the three sites ranged from 8.08 cm to 8.13 cm.

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.

Previous research conducted by Penrose (2015, 2018), and Landefeld (2016), showed a numerical 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. In the 2016 & 2017 portion of this trial, there was a significant difference between the control and the treatments for yield as in the 2018 portion of this trial.

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. In this study, the addition of nitrogen significantly increased yields.

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