

Alternative Nitrogen Fertilizers to Ammonium Nitrate for Tall Fescue Pastures

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Introduction

Tall fescue [*Lolium arundinaceum* (Schreb.) Darbysh.] is the dominant grass species in pastures of the humid-temperate region, USA [3]. Efficient N management for grass pastures is one of the most important factors for successful forage-livestock production systems [1]. Ammonium nitrate and urea have been popular sources of N for grass forage production in the region. However, ammonium nitrate is a security issue for the fertilizer industry because it can be used as an explosive [2]. Surface application of urea, on the other hand, can be problematic due to N volatilization [4]. These issues are driving producers to look at alternative forms of N fertilizer for pastures.

Objective

To identify the best alternative to ammonium nitrate for tall fescue pastures fertilized in March (spring) or August (late-summer).

Materials and Methods

Established tall fescue pasture was fertilized with six different N sources in mid-March and mid-August in separate experiments at two locations in Missouri during 2005-2007. Ammonium nitrate, urea, ammonium sulfate, coated urea products, and mixtures of ammonium sulfate/urea and ammonium sulfate/polymer coated urea were used as N sources. The N fertilizer application rate was 84 kg N ha⁻¹ yr⁻¹. For the spring N-fertilized plots, forage was harvested in late May, late July, and mid-October. For the late-summer application, plots were harvested in early December. The experimental design was randomized complete block with five replicates.

Results

Ammonium sulfate was in the top producing group at almost all harvests and locations (Table 1). Ammonium nitrate, urea, and ammonium sulfate proved to be nearly equal N fertilizer sources for tall fescue in spring. For late-summer N fertilized plots, most of the products yielded similarly. Urea, ammonium nitrate and ammonium sulfate had comparable yields in most site-years. However, in the dry autumn of 2005, tall fescue fertilized with urea yielded 35% less than that fertilized with ammonium nitrate or ammonium sulfate.

Conclusion

Ammonium sulfate was the best alternative to ammonium nitrate for tall fescue pastures. Agrotain treated urea was only better than uncoated urea in one of nine applications, though the difference in that one case was substantial. Coating urea with starch or mixing with ESN was not effective.

References

1. Raczkowski et al. 2016. J. Plant Nutri. 39:581-587.
2. USDA Economic Research Service, 2013.
3. USDA, National Agricultural Statistics Service, 2015.
4. Vaio et al. 2008. Soil Sci. Soc. Am. J. 72:1665-1671.

Table 1. Total annual forage DM yield (kg ha⁻¹).

Treatments (N fertilizers)	Mid-March N-fertilized					Mid-August N fertilized			
	Southwest Research Center			Bradford Research Center		Southwest Research Center		Bradford Research Center	
	2005	2006	2007	2006	2007	2005	2006	2006	2007
	kg ha ⁻¹								
Ammonium nitrate	9050	4449	4085	5153	5405	2164	2148	3024	2781
Urea	8713	4122	3516	4521	5282	1394	2465	3209	2167
Ammonium sulfate	9892	4465	4685	4936	5505	1768	2514	3121	2604
Agrotain treated urea	9294	4338	4241	4688	5248	1706	2106	3020	2561
ESN [†]	7989	2368	3775	3067	4114	1398	1735	2371	2045
Starch coated urea	9117	3817	3808	4698	5112	1609	2451	3067	2427
Unfertilized control	4739	1851	1753	1891	2426	551	934	1928	1534
	Orthogonal contrasts								
Urea vs. ammonium nitrate	ns [§]	ns	**	ns	ns	**	ns	ns	**
Urea vs. ammonium sulfate	*	ns	***	ns	ns	ns	ns	ns	*
Ammonium sulfate vs. ammonium nitrate	ns	ns	**	ns	ns	ns	ns	ns	ns
Urea vs. Agrotain treated urea	ns	ns	***	ns	ns	ns	ns	ns	ns
Urea vs. starch coated urea	ns	ns	ns	ns	ns	ns	ns	ns	ns
Unfertilized control vs. all others	***	***	***	***	***	***	***	***	***

[†]ESN= Environmentally smart nitrogen - polymer coated urea.

[§]ns = not significant at the p = 0.05 level of significance; *Significant at the p = 0.05 level of significance.

Significant at the p = 0.01 level of significance; *Significant at the p = 0.001 level of significance.