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Nitrogen Fertilizer Source Influence on Yield of Bermudagrass

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Summary

The influence of different nitrogen fertilizers on yield of bermudagrass was determined throughout the 1987 summer growing season. A total of 27 trials were conducted during the season at varied times to obtain results under the differing environmental conditions. Part of the trials were conducted on a calcareous clay soil and part on an acid fine sandy loam soil. Nitrogen sources were ammonium nitrate, ammonium sulfate, urea with and without $CaCl_2$ added, and urea ammonium nitrate (UAN) with and without ammonium thiosulfate. The urea additives were used as nitrogen loss inhibitors, but showed no benefit, probably the result of negligible nitrogen loss in their absence.

In all the trials, fertilizers were top-dressed on bermudagrass and allowed to remain on the surface for varied periods of time before being moved into the soil root zone by rainfall.

The different bermudagrass cultivars were not intended for a cultivar comparison but were only incidental as a source of established grass area on which to conduct the fertilizer trials. Generally, there were little significant differences in yield between nitrogen sources, even in situations where the fertilizer had remained on the soil surface for several weeks without rainfall. Urea fertilizer usually performed as well as and occasionally better than the other nitrogen sources. Based on these numerous trials and under widely differing environmental conditions, urea compares well with other nitrogen fertilizers as a source of nitrogen for surface applications on bermudagrass.

Introduction

In recent years, Urea has rapidly become one of the leading sources of nitrogen fertilizer. Recent developments in urea manufacturing have improved the economics of its production over that of previously predominate nitrogen sources. However, due to some reports of poor response from surface applied urea, forage producers have been hesitant about its use in topdressing forage crops. Laboratory studies have suggested that certain additives such as $CaCl_2$ and ammonium thiosulfate may inhibit urea hydrolysis and subsequently prevent volatilization loss of nitrogen from surface applications. These additives were tested in the present study under actual field conditions. Also, topdressed nitrogen fertilizers were allowed to remain on the surface for varied periods until rainfall occurrence to determine potential for nitrogen loss.

This investigation should provide information to producers which will enable them to assess the magnitude of risk for nitrogen loss and aid in the decision of which nitrogen source might work best for their system of bermudagrass production.

Procedure

Fertilizer treatments consisted of 100 lbs N/A from each of the following N sources: ammonium nitrate, ammonium sulfate, and urea surface broadcast as dry solid form while urea + $CaCl_2$ and urea ammonium nitrate (UAN) plus ammonium thiosulfate additive at 2, 5, and 19 percent were dribble banded on the soil surface. The bands were spaced 14 inches apart.

Each treatment was replicated four times in a randomized block design. Phosphorus and potassium fertilizers were applied in the spring as required according to soil test levels. Field plots were established at two locations with contrasting soil types. The Brazos River bottom clay soil was a Ships clay soil series with a pH of 7.8, while the sandy soil was a Lufkin fine sandy loam soil series with a pH of 4.9. A total of 27 trials were staggered throughout the 1986 growing season to encompass the varying environmental conditions which might influence NH_3 volatilization losses from urea as compared with other nitrogen fertilizers. Plot size was 5 × 20 ft of which a 3- × 17-ft swath was harvested from the center of the plots for yield measurement. A small sample was collected from each plot for moisture and chemical analyses. Data were analyzed statistically by SAS for analysis of variance and Duncan's Multiple Range Test for mean comparisons.

Results and Discussion

Bermudagrasses yield on the Brazos River bottom clay soil as influenced by N fertilizer source is given in Table 1. The use of several bermudagrass varieties was incidental only to acquire additional plot space to accommodate a greater number of trials. The objective was to evaluate N sources without regard to the variety. The main purpose was to compare N source performance within a given trial which had environmental conditions differing from any other trial date. The days until rain denote the time period which the fertilizer laid on the surface until moved into the soil by the first significant rainfall (>0.2 inch) or by irrigation. Using NH_4NO_3 as a standard for comparison, urea generally performed as well even in trials where

TABLE 1. BERMUDAGRASS YIELD AS INFLUENCED BY N FERTILIZATION SOURCE ON BRAZOS RIVER BOTTOM CLAY SOIL 1987

Date Fertilized		Apr. 8	Apr. 14	July 10	July 13	Mar. 24	Apr. 3	June 26	July 2	Aug. 14	Aug. 17
Days Until Rain*		27	21	11	8	12	2	4	7	15	12
N-Source	N rate (lbs/Acre	S-16 Bermudagrass				Coastal Bermudagrass					
		yield (cwt/Acre)									
Control	0	31b[†]	38b	31b	34d	39c	38b	29c	29c	18b	17c
NH_4NO_3	100	76a	81a	55a	58a	84ab	84ab	64ab	63a	47a	48ab
Urea	100	75a	80a	50a	49abc	89a	80a	67ab	61ab	50a	51a
Urea + Ca	100	74a	83a	53a	45c	76b	85a	65ab	55b	54a	43ab
UAN	100	70a	77a	45a	46bc	79ab	81a	68a	57ab	45a	42b
UAN + 2% ATS	100	68a	81a	46a	59a	78ab	86a	64ab	56b	52a	40b
UAN + 5% ATS	100	69a	80a	49a	54abc	80ab	78a	57b	56b	47a	45ab
UAN + 19% ATS	100	73a	75a	49a	56ab	76ab	79a	62ab	58ab	45a	46ab

Date Fertilized		Apr. 20	June 23	Aug. 11	Apr. 27	May 1	May 8	July 20	July 23	July 28
Days Until Rain*		15	7	18	8	4	3	1	1	32
N-Source	N rate (lbs/Acre)	S-54 Bermudagrass			Callie Bermudagrass					
		yield (cwt/Acre)								
Control	0	21b[†]	20b	15b	35c	39c	48b	28b	15c	18b
NH_4NO_3	100	54a	47a	40a	80a	82a	78a	38a	41a	38a
Urea	100	50a	45a	42a	78ab	79ab	81a	38a	35b	38a
Urea + Ca	100	47a	44a	36a	81a	73b	72a	38a	32b	35a
UAN	100	51a	46a	39a	77ab	78ab	72a	43a	32b	35a
UAN + 2% ATS	100	50a	42a	39a	72ab	74ab	73a	39a	35b	36a
UAN + 5% ATS	100	49a	44a	38a	66b	75ab	71a	38a	33b	36a
UAN + 19% ATS	100	46a	43a	36a	69ab	78ab	73a	43a	32b	35a
$(NH_4)_2SO_4$	100	48a	42a	41a	69ab	74ab	74a	41a	33b	36a

*Days that ammonia volatilization loss might occur between fertilizer application and first significant rainfall occurrence.

[†]Means within a column followed by the same letter are not significantly different ($P<0.05$).

TABLE 2. YIELD OF BERMUDAGRASS AS INFLUENCED BY NITROGEN FERTILIZER SOURCE ON SANDY SOIL 1987

Date Fertilized		Apr. 7	Apr. 10	Apr. 13	Apr. 17	June 18	June 22	June 25	June 29
Days Until Rain*		6	3	22	18	12	8	5	1
N-Source	N rate (lbs/Acre)	Coastal Bermudagrass							
		yield (cwt/Acre)							
Control	0	25d†	21b	27d	19d	30d	30b	29d	25c
NH_4NO_3	100	58ab	58a	58abc	65a	62a	62a	67a	64a
Urea	100	48c	54a	56bc	53c	51c	60a	58c	64a
Urea + Ca	100	50bc	55a	52c	58bc	52bc	55a	61bc	55b
UAN	100	57abc	57a	65a	58bc	57ab	59a	64ab	64a
UAN + 2% ATS	100	55abc	63a	62ab	68a	60a	60a	63ab	64a
UAN + 5% ATS	100	59a	61a	61ab	62ab	62a	59a	65ab	65a
UAN + 19% ATS	100	52abc	63a	61ab	68a	54bc	61a	65ab	66a

*Days that ammonia volatilization loss might occur between fertilizer application and first significant rainfall occurrence.

†Means within a column followed by the same letter are not significantly different ($P<0.05$).

urea remained on the surface subject to potential volatilization for several weeks. When urea was applied alone without an inhibitor, there was no significant loss of N apparent; therefore, it was not possible to thoroughly test the effectiveness of Ca or ATS amendments as N loss inhibitors.

Coastal bermudagrass yields as influenced by N fertilizer source on a sandy soil is shown in Table 2. In those limited cases where yield from urea treatment was significantly lower than from NH_4NO_3, the urea + Ca additive did not significantly correct the situation leaving some question as to its efficacy. The UAN fertilizers performed quite comparably with yields from NH_4NO_3, indicating that potential nitrogen loss was not a serious problem.

Considering both soil types and overall 27 trials, urea produced yields similar to NH_4NO_3 in most cases. None of the inhibitor amended treatments were superior to urea alone. Apparently, the daily rapid drying of the surface sod and soil by summer environmental conditions following a light rain shower or nighttime dew reduces the urease enzyme activity sufficiently to prevent hydrolysis and serious volatilization N loss. This is in contrast to high N loss in laboratory tests where the surface is kept moist. Under actual field conditions, urea N generally was not lost more than from other N sources as evidenced by the yield data.