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A Five-year Summary of Nitrogen Source Studies on Bermudagrass Production

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Summary

A summarization of 5 years of intensive field testing in more than 100 trials, compares performance of nitrogen (N)sources for bermudagrass production. These investigations were conducted at two different locations with widely contrasting soil types (a calcareous clay soil and an acid sandy soil). On the acid sandy soil, all the N sources performed rather equally well with no statistically significant differences in bermudagrass yields. However, on the calcareous soil, ammonium sulfate fertilizer showed a consistent trend for somewhat inferior yields of bermudagrass in each of the 5 years. Urea produced bermudagrass yields as good as or better than other N sources tested, indicating no serious risk of N loss from topdressing urea on bermudagrass.

Introduction

Urea fertilizer has rapidly become one of the lowest price sources of N fertilizer in recent years as a result of beneficial manufacturing costs. Nevertheless, there is a reluctance on the part of agricultural producers to topdress with urea fertilizer. This reluctance is due to some past reports of N loss from urea applied on the soil surface. High N losses have been reported in numerous laboratory tests. However, laboratory conditions are not usually typical of natural field situations. A small amount of plant residue on the soil surface generally supplies a ready source of urease enzyme. This enzyme is activated by moisture and can hydrolyze the urea to a volatile form which can result in N loss. Laboratory tests generally are conducted in a closed chamber to measure gaseous volatile N loss. These conditions tend to maintain the fertilizer, plant residue, and soil surface all in a moisture situation which is optimal for N loss to occur. On the other hand, under natural field situations, drying cycles usually are prevalent after night dew or light showers. Drying effects of sunshine and wind movement on the plant residue and soil surface result in dry conditions not conducive to urease enzyme hydrolysis. The purpose of these studies was to investigate the potential for urea N loss compared to other N sources under natural field conditions.

Procedure

Field trials were conducted on established bermudagrass stands at two different locations with contrasting soil types. A Ships clay soil series was a calcareous pH 7.8 soil located on the Texas A&M University farm in the Brazos River Bottom. The Lufkin fine sandy loam soil series was an acid soil with pH of 4.9. It was located on a producer's farm several miles distance from the other site. The same individual plots (6 ft X 20 ft) were maintained over the 5-year period. Phosphorus and potassium fertilizers were applied in the spring as required according to soil test levels. Nitrogen fertilizers were applied at a rate of 100 lbs/A/cutting with four replications of each treatment. The N fertilizer sources compared were: ammonium nitrate (NH_4NO_3-34% N), ammonium sulfate $(NH_4)_2SO_4$ - 21% N), urea ammonium nitrate (UAN-28% N), urea (46% N), and urea + Ca. A no nitrogen control treatment was also included. The dry N fertilizers were broadcast by hand. The UAN is a liquid fertilizer which was dribble banded on the grass surface from small plastic bottles by hand at about 14-inch spacings. The urea + Ca treatment was urea ammended with $CaCl_2$ at a N:Ca ratio of 0.25 on a chemical equivalent basis. A soluble source of Ca had been suggested as an inhibitor to urea hydrolysis N loss. The urea and $CaCl_2$ were dissolved together and applied in dribble bands by the method given above.

Numerous trials were conducted at varied times throughout the growing season to capture intervals of varied duration between fertilization and the occurrence of significant rainfall (>0.2 inch). This was to determine how long N fertilizers, especially urea, could remain on the soil surface without risk of N loss. Also, it was an attempt to ascertain whether or not different climatic environment with early, mid, or late season affected urea hydrolysis and N loss. On the Ships clay soil site, supplemental irrigation was available to terminate the interval duration of potential urea hydrolysis when rainfall did not occur at the desired period. However, irrigation was not available at the Lufkin sandy soil site. Bermudagrass yields were measured at maturity by harvesting a 3-ft X 17-ft strip from the 6-ft X 20-ft plots. A small sample was collected from each plot for moisture determination and yield values reported on an over-dry basis.

Results and Discussion

Yield of bermudagrass grown on Ships clay soil as influenced by different N sources over a 5-year period is shown in Table 1. Several tests were conducted each year at varied times throughout the growing season to obtain results representative of the whole season. The yield data were averaged over all of the tests for a given year and reported as dry matter in pounds per acre per cut. These average yields per cut were then averaged over the 5-year period. The first part of Table 1 selected only the yields for Coastal bermudagrass, whereas the second part (all bermudagrasses) includes several other experimental bermudagrass cultivars as well as coastal. Lower yields from some of the experimental cultivars, due to thinner stands, pulled down the over-all average yields. However, the data still gave valid comparisons between N fertilizer sources since relative performance was being evaluated rather than maximum yield.

The 5-year average yield values for Coastal bermudagrass dry matter production in pounds per acre per cut are illustrated in Figure 1. Urea fertilizer performed as well as or better than ammonium nitrate, which was used as the standard by which to compare. Since urea apparently did not suffer any significant loss of N, one would not expect a response to $CaCl_2$ ammendment in preventing N loss. There was a trend evident each year indicating ammonium sulfate as inferior on the calcareous Ships clay soil, although not quite enough to be statistically significant. However, when yields from all of the bermudagrass cutlivars were averaged together over the 5-year period on the Ships clay soil, the average yields were pulled down somewhat as previously mentioned and illustrated in Figure 2. Also, the tendency for inferiority of ammonium sulfate performance increased to a statistically significant effect while urea persistently performed as well as or better than ammonium nitrate. This was in 71 different trials with each treatment replicated four times and over a wide range of environmental conditions spanning the 5-year period.

Coastal bermudagrass production on an acid Lufkin fine sandy loam soil as influenced by N fertilizer sources over a 5-year period is shown in Table 2. A total of 26 trials were conducted on this soil over the 5-year period. Since no supplemental irrigation was available at this site, an extremely dry year, such as occurred in 1984, severely reduced yields. The ammonium sulfate performed as well as the other N fertilizers on this acid soil in contrast to the calcareous soil situation. The performance of N fer-

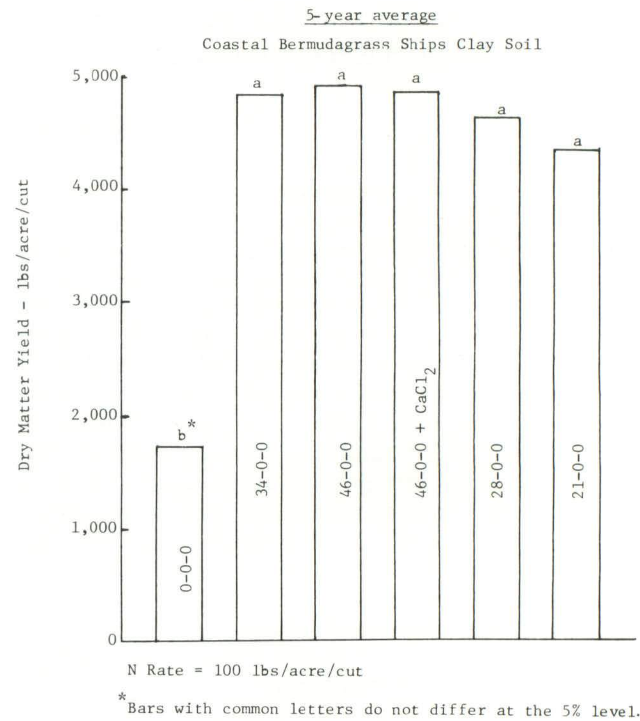

Figure 1. (right) Coastal bermudagrass yield on Ships clay soil as influenced by nitrogen fertilizer source.

TABLE 1. YIELD OF BERMUDAGRASS GROWN ON SHIPS CLAY SOIL AS INFLUENCED BY N FERTILIZER* SOURCE

Coastal Bermudagrass Year	No. of Tests	Control	Nitrate	Urea	Urea + Ca	UAN	Sulfate
		Average dry matter yield (lbs/A/cut)					
1982	6	2,246	5,752	5,749	6,070	5,914	5,379
1983	5	1,404	4,629	4,710	4,674	4,489	3,950
1984	6	1,537	3,578	4,229	4,156	3,307	3,516
1985	6	1,284	4,926	4,909	4,600	4,629	4,433
1986	6	2,066	5,141	4,915	4,699	4,801	—
Average		1,707b**	4,805a	4,902a	4,839a	4,628a	4,319a

All Bermudagrasses Year	No. of Tests	Control	Nitrate	Urea	Urea + Ca	UAN	Sulfate
		Average dry matter yield (lbs/A/cut)					
1982	13	1,819	4,407	4,376	4,592	4,485	4,046
1983	9	1,397	3,999	3,977	3,963	3,897	3,450
1984	6	1,537	3,578	4,229	4,156	3,307	3,516
1985	22	1,362	3,977	3,899	3,906	3,843	3,564
1986	21	2,084	4,585	4,456	4,325	4,272	3,657
Average		1,640c**	4,109a	4,186a	4,188a	3,961ab	3,647b

* N rate = 100 lbs/A.
**Values within a row with a common letter are not significantly different (P<.05).

TABLE 2. DRY MATTER YIELD OF COASTAL BERMUDAGRASS GROWN ON A LUFKIN FINE SANDY LOAM SOIL AS INFLUENCED BY N FERTILIZER* SOURCE

Coastal Bermudagrass Year	No. of Tests	Control	Nitrate	Urea	Urea + Ca	UAN	Sulfate
		Average dry matter yield (lbs/A/cut)					
1982	2	1,931	4,438	4,660	4,732	4,330	5,044
1983	6	1,568	4,326	4,200	4,736	4,377	3,836
1984	2	691	2,731	2,432	3,130	2,551	2,892
1985	8	1,132	4,233	4,066	4,238	4,074	4,089
1986	8	2,979	4,530	4,576	4,344	4,238	—
Average		1,660b**	4,052a	3,987a	4,236a	3,914a	3,965a

* N rate = 100 lbs/A.
**Values within a row with a common letter are not significantly different (P<.05).

tilizer sources averaged over 5 years is illustrated in Figure 3. Since there was no significant difference between the N fertilizer sources, apparently there is no added risk in top-dressing urea versus the other N fertilizers. Even though fertilizers remained on the soil surface for as long as several weeks in some cases before being moved into the soil profile by rainfall, urea performed as well as other N sources. This indicates that under these natural field conditions neither urea hydrolysis nor N loss was of serious concern as some had predicted.

TABLE 3. GRAZING TIME DISTRIBUTION

SR	Percent of total time spent grazing			
	0-6HR	6-12HR	12-18HR	18-24HR
Day 1	15	24	34	26
Day 4	13	26	31	30
Day 7	14	24	30	31
Means	14	25	32	29

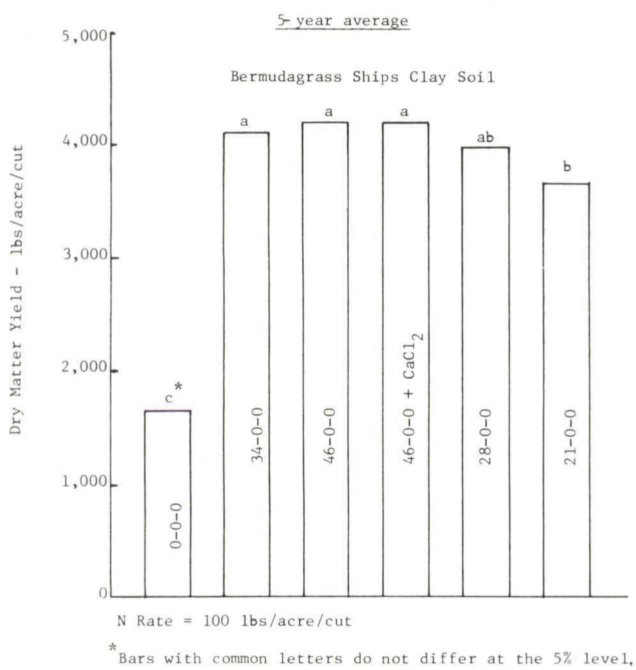

Figure 2. Average yield of bermudagrasses on Ships clay soil as influenced by nitrogen fertilizer source.

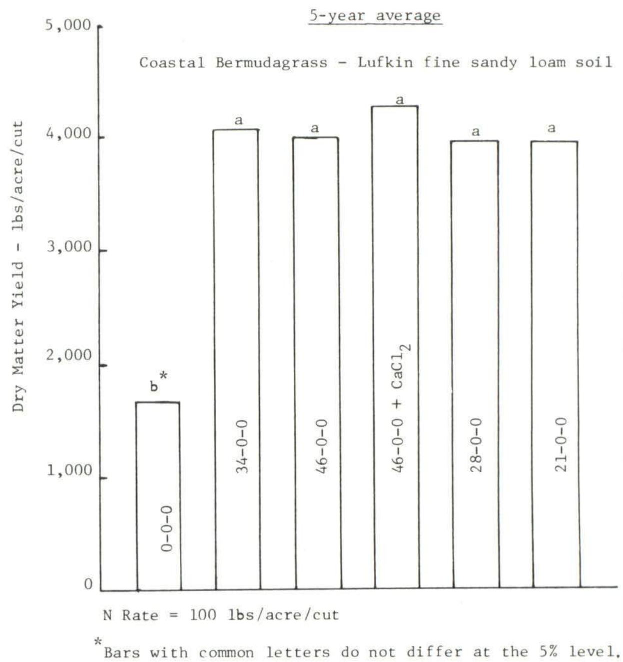

Figure 3. Yield of coastal bermudagrass on Lufkin fine sandy loam soil as influenced by nitrogen fertilizer source.