Seasonal Turfgrass Quality of Bermudagrass and Zoysiagrass, as Affected by Various Soluble and Slow-Release Nitrogen Sources

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RESEARCH PROBLEM

Bermudagrass and zoysiagrass are the major turfgrass species in Arkansas, where they are used on golf courses, sports fields, home lawns, and in sod production. Although both of these species utilize the C4 photosynthetic pathway and have similar growth habits, they respond quite differently to applications of nitrogen (N) fertilizer. While a number of studies have investigated the N fertilizer needs of bermudagrass turf, the number of studies that have addressed zoysiagrass fertilization are very limited. Because of the widespread use of zoysiagrass and bermudagrass turf in Arkansas, a more thorough understanding of their N fertility needs is of value.

BACKGROUND INFORMATION

The maintenance of a high-quality turfgrass site requires frequent applications of N to promote growth and maintain good color and density. Depending on the type of site under maintenance, a turfgrass manager may use either soluble forms of N such as urea, NH_4NO_3, or NH_4SO_4 or slow-release forms of N such as methylene urea or sulfur-coated urea. Although soluble forms of N are generally less expensive than slow-release products, they will usually cause short-term bursts of turf quality, followed by equally quick drops in quality. Therefore, they must be applied frequently to maintain quality over an entire growing season. Slow-release products will typically produce a more uniform turfgrass quality over a longer period of time, but the quality is often slow to appear after application and is dependent on the release characteristics of the material. No studies have been conducted in Arkansas to compare the N needs of zoysiagrass and bermudagrass turf. In addition, limited research has been conducted on the use of various ratios of soluble and slow-release N sources and their effects on seasonal turfgrass quality. This study, which was initiated in 2000 and repeated in 2001 and 2002, was designed to investigate the effects of various N sources and rates on the seasonal turfgrass quality of bermudagrass and zoysiagrass.

RESEARCH DESCRIPTION

The overall design of this research involved two grass species (*Cynodon dactylon* cv. Tifway and *Zoysia japonica* cv. Meyer); two test locations (University of Arkansas Research and Extension Center, Fayetteville, AR; Lonoke County Extension Office, Lonoke, AR); three fertilizer raw materials; and three fertilizer rates. The fertilizer raw materials included ammonium sulfate (AS), polymer-coated urea (PCU), and polymer-coated sulfur coated urea (SCU). The three fertilizer materials were either applied alone or in combination to yield the following fertilizer source treatments: 1) 100% AS; 2) 100% PCU; 3) 100% SCU; 4) 33% AS / 67% PCU; 5) 33% AS / 67% SCU; 6) 67% AS / 33% PCU; and 7) 67% AS / 33% SCU. The fertilizer rates included applications of 1.0, 1.5, and 2.0 lb N/ 1000 ft^2 (~44, 66, and 88 lb N/acre) and the N treatments were applied on both 1 May and 1 August. Plot size was 3 ft × 6 ft (0.9 m × 1.8 m). The experimental design was a randomized complete block design with a factorial treatment structure of fertilizer rates and sources, with location and species considered fixed effects. Each treatment was replicated four times. Turf was irrigated as needed to prevent stress and plots were evaluated weekly for turfgrass quality. Turf quality was visually assessed on a scale of 0 to 9, with 9 being the highest possible quality. Quality rating values were averaged across 12 evaluation times for statistical analysis.

RESULTS

As expected, turf quality varied during the growing season but was not significantly affected by location (data not shown). Therefore, for brevity, the data were averaged across locations for this report. Turf quality was affected by both N rate and N source and there was a significant N source × N rate interaction. In general, bermudagrass had a greater response to the higher N rates with significant increases in turf quality at 1.5 and 2.0 lb N/1000 ft^2 compared to the 1.0 lb N/1000 ft^2 (Tables 1 and 2). Zoysiagrass demonstrated a stepwise increase in quality in response to both a 1.0 and 1.5 lb N/1000 ft^2 but did not show a further increase in quality at 2.0 lb N/1000 ft^2 (Tables 1 and 2). Collectively, these data suggest that the quality of 'Meyer' zoysiagrass can be maintained using lower N rates than 'Tifway' bermudagrass.

Nitrogen source had a significant effect on seasonal turf quality for both species and at all rates (Table 1 and 2). One trend that was consistent across both species was that N treatments containing SCU tended to produce the best overall quality compared to blends containing PCU. This likely reflects a more uniform release of N in SCU compared to PCU. A variance in turf quality across all evaluation dates was computed from the means of each evaluation date to demonstrate how fertilizer source and rate affected the consistency of turf quality across the growing season (Tables 1 and 2). This is an important parameter, since consistency and uniformity are often more important than short-term increases in turf quality. When evaluating the data, it is clear across both species and most fertilizer rates that single-source fertilizers produced less consistency in turf quality than combinations of soluble and slow-release materials. The combination of slow-release and soluble materials leads to an early response to added N from the soluble component of the blend and longer-term responses from the slow-release material. Model generation to compute longevity of the various fertilizer sources has not been conducted at the time of this writing.

PRACTICAL APPLICATIONS

From the current studies and other studies being conducted by the turfgrass program, it is apparent that the current recommendation for zoysiagrass is likely too high, based on the fact that adequate quality was maintained throughout the season with only 2.0 to 3.0 lb total N/1000 ft^2 (~65 to130 lb N/acre). On the other hand, bermudagrass needs much higher N to maintain adequate, year-around quality. A good turfgrass fertilizer combination would contain a blend of soluble materials such as ammonium sulfate and a slow-release product such as sulfur-coated urea, with approximately 1/3 of the blend being the soluble N source. This type of fertilizer ratio produced exceptional turfgrass quality.

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Table 1. Average seasonal turf quality[z] and variance (∂) of the means in seasonal turf quality of 'Meyer' zoysiagrass across two locations in Arkansas as affected by fertility rate and fertility source. Fertilizers treatments were applied on both 1 May and 15 Aug.

	Fertilizer rate (lb N/1000 ft²)					
	1.0		1.5		2.0	
Fertilizer source	Avg.	∂	Avg.	∂	Avg.	∂
100% AS	6.2	0.3	6.4	0.5	6.6	0.3
100% PCU	6.1	0.3	6.1	0.5	6.4	0.7
100%SCU	6.4	0.2	6.6	0.3	6.6	0.7
33 AS / 67 PCU	6.3	0.2	6.3	0.2	6.6	0.2
33 AS / 67 SCU	6.4	0.1	6.8	0.3	6.9	0.2
67 AS / 33 PCU	6.3	0.2	6.6	0.2	6.7	0.3
67 AS / 33 SCU	6.4	0.2	6.4	0.1	6.7	0.3
Control	5.4	0.2	5.4	0.2	5.4	0.2
LSD (0.05) = 0.2						

[z] Turf quality was visually assessed on a scale of 0-9, with 9 being the highest possible quality. Numbers represent the average of 12 evaluation periods throughout the season.

Table 2. Average seasonal turf quality[z] and variance ( ) of the means in seasonal turf quality of 'Tifway' bermudagrass across two locations in Arkansas as affected by fertility rate and fertility source. Fertilizers treatments were applied on both 1 May and 15 Aug.

	Fertilizer rate (lb N/1000 ft²)					
	1.0		1.5		2.0	
Fertilizer source	Avg.	∂	Avg.	∂	Avg.	∂
100% AS	6.6	0.4	6.9	0.5	6.9	0.7
100% PCU	6.2	0.5	6.1	0.5	6.4	0.3
100%SCU	6.1	0.2	6.5	0.4	6.6	0.2
33 AS / 67 PCU	6.0	0.8	6.4	0.3	6.4	0.4
33 AS / 67 SCU	6.5	0.3	6.7	0.3	7.0	0.4
67 AS / 33 PCU	6.3	0.4	6.6	0.2	6.7	0.3
67 AS / 33 SCU	6.4	0.2	6.7	0.3	7.0	0.3
Control	5.3	0.4	5.3	0.4	5.3	0.4
LSD (0.05) = 0.3						

[z] Turf quality was visually assessed on a scale of 0-9, with 9 being the highest possible quality. Numbers represent the average of 12 evaluation periods throughout the season.