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SOIL NITRATE LEVELS IN BERMUDAGRASS PASTURES UNDER LONG-TERM STOCKING RATES AND FERTILITY REGIMENS

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Background. Grazing of 'Coastal' and common bermudagrass research pastures at TAMU-Overton began in 1969. Related Field Day reports on pH, P, and K detail treatment of pastures during the past 28 years. Nitrogen applications from 1985-1989 were split at 6 to 8-week intervals from Dec. to Sept. From 1990-1996, N was split-applied from Dec. through May only during the ryegrass growing season with no N during the exclusive bermudagrass growing season (Table 1). Soil nitrate-N was determined by conventional soil analysis methodology. The objective of this experiment was to quantify soil nitrate-N levels after 28 years of continuous N fertilizer application, which included 12 years (1985-1996) of no-N fertilization to bermudagrass pastures.

Table 1. Fertilization of bermudagrass pastures during 28-year period, 1969 through 1996.

Date	Annual Fertilization Rate (N-P ₂ O ₅ -K ₂ O)	
	Ryegrass + N	Clover + K
1969 through 1984 ¹	200-100-100	200-100-100
1985-1989 ²	408-0-0	0-0-114
1990-1994 ³	238-0-0	0-0-121
1995-1996 ^{3,4}	289-0-0	0-0-108

¹Pastures not divided into fertility treatments from 1969 through 1984; therefore, all pastures were fertilized identically and were overseeded with both ryegrass and clover.

²Initiation of N vs no-N treatments (1985). N applied at 6 to 8-week intervals from Dec. to Sept.

³N fertilization only during ryegrass growing period, Dec. to May, with none on bermudagrass.

⁴Used rye + ryegrass during 1995 and 1996 with N fertilization from Nov. to May.

Research Findings. Soil nitrate-N levels, across all three stocking rates, at the initiation of the fertility regimens (1985) were low in the 0-6" depth, but with higher levels for common bermudagrass than for Coastal (Table 2). At both 0-6" and 6-18" depths, nitrate-N levels were predictably higher in N-fertilized pastures. Soil tests in 1989, following 5 years of 408 lbs N/ac per year showed higher levels of soil nitrate-N. Similar trends were noted for 1985 (Table 2). Lower soil nitrate-N in Coastal bermudagrass pastures was likely due to differences in forage uptake of N and forage production since Coastal is likely to produce nearly twice as much total dry matter as common bermudagrass.

Soil nitrate-N analysis in 1996 after 6 years of applying fertilizer N only during the ryegrass growing period showed reduced levels compared to 1985 and 1989. Data (Table 3) show differences between fertility levels at each soil depth (0-60"). Differences in soil nitrate-N between

bermudagrasses primarily occurred in the 0 to 18" depths. There was essentially no effect of stocking rate on soil nitrate-N except in the 0-6" soil depth. Even in this top soil layer, stocking rate did not have a major role in influencing soil nitrate-N levels when soil was sampled about 3 months following the last N fertilization. Nitrate-N rapidly declined with soil depth and stabilized at 3 to 4 ppm from 18 to 60" soil depth.

Application. Sandy soils and improved bermudagrass pastures in East Texas have sufficient forage production to prevent significant accumulations of soil nitrate-N under fertilization rates used in this study. Without N-fertilization, contributions from clovers via excreta-based nutrient cycling have been adequate to maintain stands of bermudagrass, and offers fertilization management alternatives for producers.

Table 2. Soil nitrate-nitrogen at two soil depths in bermudagrass fertilized with N (RYG + N) or K (CLV + K) at initiation of fertility x stocking rate regimens.

Item	Nitrate-N (ppm) at Soil Depths			
	0-6"		6"-18"	
	RYG + N	CLV + K	RYG + N	CLV + K
1985 ¹				
Coastal	14.8 b	2.8 b	4.4 a	2.3 a
Common	22.7 a	5.5 a	3.6 a	1.7 a
1989 ²				
Coastal	24.8 b	4.9 b	22.0 a	2.3 a
Common	33.2 a	10.9 a	25.1 a	5.0 a

¹Numbers with different letters: Bermudagrasses differ (P<.05); at 0-6", N vs K (P<.0001); at 6-18", N vs K (P<.04).

²Numbers with different letters: Bermudagrasses differ (P<.004); at both depths, R vs K (P<.0001).

Table 3. Soil nitrate-nitrogen at various soil depths in bermudagrass pastures after 28 years of N application which included 12 years of fertility x stocking rate treatments.

1996	Nitrate-N (ppm) at Soil Depths				
	0-6"	6-18"	18-36"	36-48"	48-60"
<u>Bermudagrass</u>					
Coastal	16.4 a ¹	10.7 a	4.7 a	4.0 a	3.8 a
Common	3.5 b	3.0 b	2.7 a	1.5 b	2.8 a
<u>Fertility</u>					
Clover + K	6.0 b	3.5 b	1.0 b	0.9 b	1.2 b
Ryegrass + N	13.9 a	10.1 a	6.3 a	4.6 a	5.4 a
<u>Stocking Rate</u>					
High	9.1 ab	6.9 a	2.3 a	2.0 a	3.1 a
Medium	6.3 b	8.0 a	4.1 a	3.3 a	3.2 a
Low	14.5 a	5.6 a	4.7 a	2.9 a	3.6 a

¹Numbers within a soil depth and major treatment category followed by a different letter, differ (P<.01).