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CHANGES IN SOIL NITRATE-NITROGEN OF COMMON AND COASTAL BERMUDAGRASS PASTURES SUBJECTED TO LONG-TERM STOCKING RATES AND FERTILITY REGIMENS

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Background. A detailed description of stocking rates and fertility regimens from 1969 through 2005 are presented in a companion 2006 Field Day Report by Rouquette et al. The objective of this experiment was to examine long-term changes in soil nitrate-nitrogen (NO_3-N) concentrations over 35 years of continuous stocking and 19 years of differential fertility regimens.

Research Findings. Soil NO_3-N concentrations significantly increased from 1985 to 1989 in bermudagrass pastures overseeded with ryegrass and fertilized with about 408 lbs N/ac annually (Figure 1). Excess N (not used for plant uptake) was contributing to NO_3 accumulation in the 0-6" soil depth. However, compared to the annual N load, increases in soil NO_3-N were negligible after four years of relatively high N application rates. During this 5-year period, bermudagrass pastures overseeded with ryegrass received approximately 2,000 lbs N/ac, while soil NO_3-N status increased less than 10 ppm (~ 20 lbs N/ac). This suggested that plant uptake was recovering a significant fraction of the applied and recycled N. Coastal can potentially produce twice as much total dry matter as commom bermudagrass; thus soil N was likely more efficiently used for plant uptake by Coastal bermudagrass.

From 1989 to 2004, annual N fertilization rates were reduced to ~ 200 lbs N/ac, and there was a dramatic decrease in soil NO_3-N concentrations, especially in commom bermudagrass pastures. Pastures overseeded with clover and not fertilized with N had much lower soil NO_3-N levels than N-fertilized ryegrass pastures. Although no N has been applied to the clover pastures since 1984, soil NO_3-N concentrations were relatively constant over 35-years of continuous stocking. Fixation of atmospheric N_2 by clovers and subsequent recycling via animal excreta maintained adequate levels of available N for satisfactory forage production.

Differences in soil NO_3-N concentrations among the treatments were primarily due to the fertility regimen (N-fertilized, ryegrass vs no N, clover). Stocking rates varying from 1 to 2-3 cow-calf pair/ac showed no effect on soil NO_3-N concentrations. From 1994 to 2004, soil NO_3-N concentrations were greater for Coastal bermudagrass (average = 8.5 ppm) compared to common bermudagrass (average= 2.8 ppm).

Application. Soil NO_3-N concentrations on Coastal Plain, sandy soils, are strongly related to the fertilizer management. Large N application rates (greater than plant uptake) may result in NO_3 accumulation in soils and rapidly increase soil acidity. Environmental risks associated with N losses may occur. Excessive soil drainage associated with the warm and humid climate of eastern Texas may favor N losses via leaching and denitrification in heavily N fertilized sandy soils.

Bermudagrass pastures overseeded with clover, with no N-fertilization for the past 20-years, sustained moderate production of bermudagrass. Despite the inherent seasonal and spatial variability associated with NO_3 in soils, relatively constant NO_3 concentrations with time is an indication that N has been efficiently recycled via animal excreta in bermudagrass pastures overseeded with clover. Clover is an environmental and economic alternative to N fertilization, and can be integrated into fertility strategies for forage production.

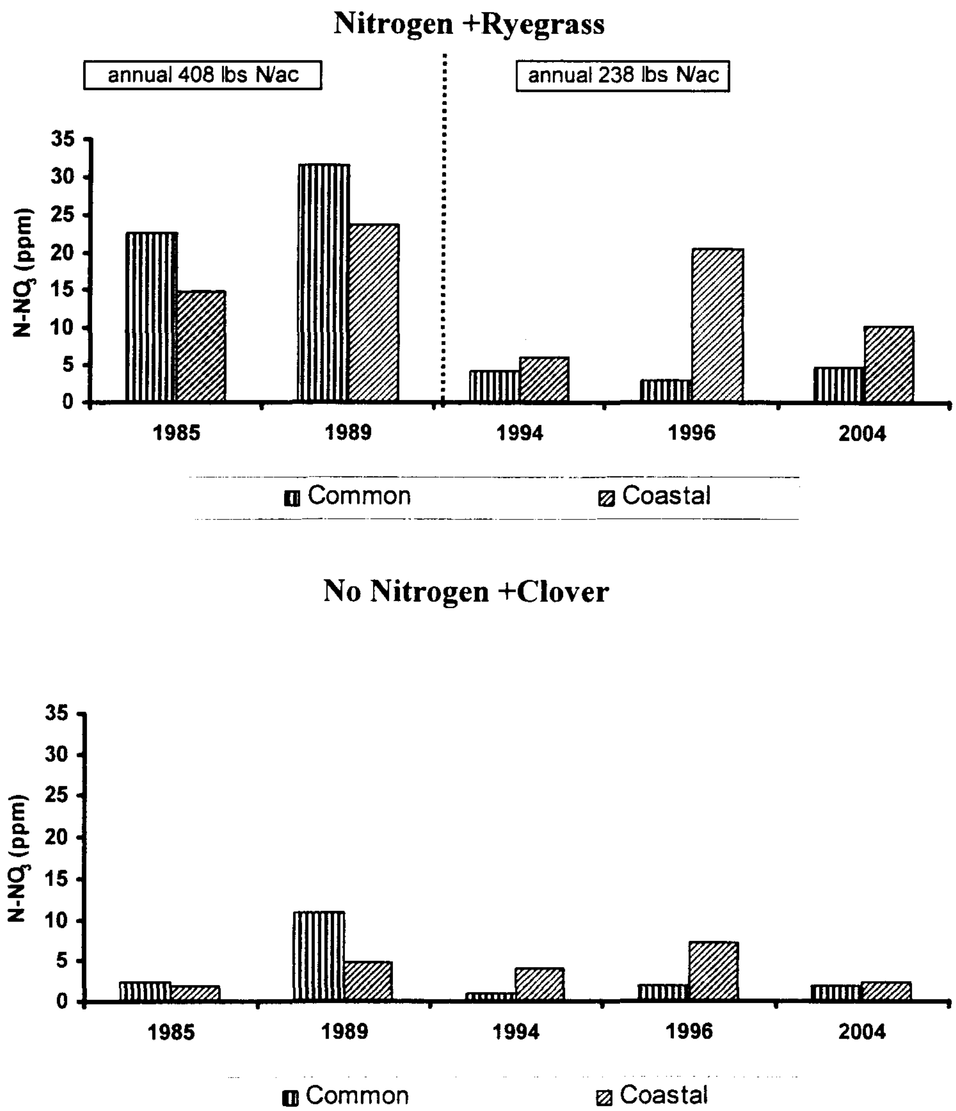

Figure 1. Changes in soil NO_3-N concentrations in the 0-6" soil depth of bermudagrass pastures with different fertility regimens.