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Forage Yield of Coastal Bermudagrass and Bermudagrass - Winter Forage Systems Receiving Liquid or Solid Dairy Waste

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Summary

Dairy waste disposal on 'Coastal' bermudagrass [*Cynodon dactylon* (L.) Pers.] alone or overseeded with winter forages were evaluated for yield and soil nutrient loading. The Coastal-only system produced the most dry matter yield (averaged 14,500 lb/A) because overseeded winter forages reduced early Coastal production. Nutrient availability from dairy waste was limited in the first year, and yield response to manure rate was not significant. Overseeding winter forages on Coastal bermudagrass may be a suitable best management practice for year-around dairy waste disposal on Central Texas dairies.

Introduction

Dairy producers are required by the Texas Water Commission (TWC) to retain and dispose solid and liquid waste properly on agriculturally productive land at rates that do not impair growth of crops or result in contaminated runoff or leaching (TWC, 1987). Contaminated runoff or groundwater may occur on disposal sites from excessive dairy waste application (Bacon et al., 1990; Long, 1979). Coastal bermudagass is extensively used as a primary waste receiver on Central Texas dairies. We compared the use of Coastal bermudagrass alone versus Coastal overseeded with winter forages as systems for using nutrients from dairy waste.

Keywords: dairy waste / forage systems / manure.

Procedure

Two dairy sites were chosen within the Trinity Group Aquifer and the Upper North Bosque River watershed in Erath County, Texas. Dairy 1, on a shallow Windthorst series, fine sandy loam (fine, mixed, thermic Udic Palustalfs) soil, received solid manure scraped from a dairy drylot. Dairy 2, on a Blanket series, clay loam (fine, mixed, thermic Pachic Arguistolls) soil, received dairy lagoon effluent.

Coastal bermudagrass, Coastal bermudagrass overseeded with wheat [*Triticum aestivum* (L.)] at 90 lb/A, and Coastal bermudagrass overseeded with tall fescue [*Festuca arundinacea* Schreb.] at 20 lb/A in November 1990 were the forage systems used. Dairy waste was applied at nominal rates of 0, 100, 200, and 400 lb N equivalent/A/year. Actual nutrients applied (lb/A/year) were 112 nitrogen (N), 19 phosphorus (P), and 133 potassium (K); 224 N, 37 P, and 267 K; and 448 N, 75 P,

and 533 K, respectively, in a single application on Dairy 1. Dairy 2 received a single application of 41 N, 6 P, and 45 K; 82 N, 11 P, and 89 K; and 163 N, 21 P, and 178 K.

Effluent was applied by modified drip irrigation, and solid drylot manure was applied with a shovel and rake. Solid waste application was deferred until after the first harvest to assist in removal of high residual soil N. One effluent treatment was applied (August 7, 1991) because of difficulty in developing an irrigation system to accommodate small plots.

Dairy waste samples were collected at each application and analyzed for total N, P, K, calcium (Ca), magnesium (Mg), zinc (Zn), iron (Fe), manganese (Mn), copper (Cu), and sodium (Na) by the Texas Agricultural Extension Service Plant and Soil Testing Laboratory at College Station for determination of actual nutrients applied.

Plot design was a randomized complete block with a strip-split plot arrangement of treatments. Four waste treatments were randomly arranged across three forage systems replicated three times. Glyphosate herbicide was used to treat weedy cool-season grass growth in the Coastal-only plots.

Coastal was harvested monthly during the growing season. Wheat and fescue were harvested once in April. Forage was clipped from the center 12 ft of each plot with a sickle mower, and yield was determined on a forced air-dry (131°F for 48 hours) basis. Forage was analyzed for N, P, K, Ca, and Mg at the Texas A&M University Research and Extension Center in Stephenville.

Soils were sampled before dairy waste application and after the final Coastal harvest in the fall. Three cores were extracted from the Coastal and Coastal-wheat plots receiving the four treatment rates at depths of 0 to 6, 6 to 12, 12 to 24, 24 to 36, and 36 to 48 in. and composited by depth. Samples were analyzed for NO_3-N, pH, salinity, and extractable P, K, Ca, Mg, Zn, Mn, Na, Cu, and sulfur (S).

Results and Discussion

The Coastal-only system at both locations had the greatest dry matter yields (Fig. 1). Competition from Coastal sod at planting time and heavy rescuegrass (*Bromus catharticus* Vahl.) invasion resulted in poor wheat and fescue stands. Coastal yields were reduced ($P < 0.05$) in these systems because of delayed spring growth caused by cool-season forage growth. Yield response to N rate from manure or effluent application was nonsignificant. Movement and mineralization of nutrients from the surface-applied manure to the root zone was slow and non-uniform in the first year, as also noted by Lund et al. (1975). White and Safley (1984) found

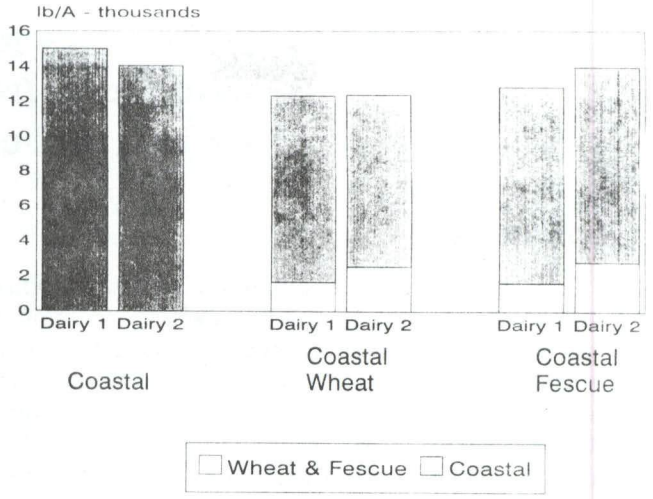

Figure 1. Total dry matter yield of three forage systems receiving dairy waste in 1991 season. Data are averages of three replicates and four rates of dairy waste. $LSD_{0.05}$ = 594 for Dairy 1, and $LSD_{0.05}$ = 287 for Dairy 2.

that mineralization of organic N from dairy manure varies from 20 to 90% the first year, and an average of 50% N loss can occur from surface application. This data may explain the irregular, observed response of yield to manure rates.

Forage nutrient data are not currently available, but results will be used to determine nutrient uptake from each forage system. Soil analysis showed soil K accumulation by N rate ($P < 0.05$) in the 0- to 6-in. depth at Dairy 1. No other soil nutrients accumulated.

Dairy manure and effluent application for the first year did not adversely affect the forage systems. Overseeding winter forages may reduce early season Coastal production but allow year-around dairy waste disposal. This study will be repeated in 1992 at the same dairy sites in Erath County.

Literature Cited

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