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Impact of P Fertilizer, Lime, and Gypsum Application on Stargass Yield and Quality and Water Quality

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Phosphorus (P) is the primary cause of algae blooms and depletion of oxygen in fresh water lakes in south-central Florida. Research showed that P fertilizer application to bahiagrass pasture could be eliminated without any adverse effect on forage yield and quality. At the same time, P levels in surface water runoff were reduced by 33 to 60% as P fertilizer rate was decreased from 100 to 25 lb P_2O_5/A. Those studies led UF/IFAS to adopt a zero P recommendation in 1998 for bahiagrass pastures grazed in Florida south of Orlando.

The recommended P rate for other improved pasture grasses such as stargrass still range from zero to 40 lb P_2O_5/A for high and low P soils, respectively. Studies by Rechcigl and Bottcher, demonstrated that fertilization of improved pastures even at the optimum P recommended rates caused a significant increase in P levels of surface water runoff. Hence, it became necessary to evaluate the capacity of soil amendments for tying up fertilizer-derived P on other improved grasses.

Field studies were conducted from 1999 to 2002 at Williamson Cattle Company in Okeechobee to: 1) re-evaluate the existing UF/IFAS recommended P fertilizer rates for stargrass and 2) study the effectiveness of limestone and gypsum for improving the retention capacity of soils for applied P on stargrass pastures. Treatments were 0, 25, 50, 100 lb P_2O_5/A from triple super phosphate applied to 50 ft x 100 ft stargrass pasture plots every year. Treatments were replicated four times. The amendments were calcium carbonate ($CaCO_3$) and mined gypsum ($CaSO_4.2H_2O$) applied based on 100% $CaCO_3$ at 0, 1 and 2 T/A annually to plots that received 100 lb P_2O_5/A. All plots including the

untreated plots (control) received one uniform application of 80 lb K_2O/A from KCl and two equal applications of 80 lb N/A as ammonium nitrate, yearly. Forage was harvested every 30-35 days in 1999-2001 for dry matter yield, crude protein (CP) content, organic matter digestibility (IVOMD) and tissue mineral content. Soil was sampled at 6 inch intervals down to the hardpan every 6 months and analyzed for total P. Rainfall, surface runoff volume, and depth of water table were measured throughout each year. Water samples from surface runoff and from shallow PVC wells installed to 2 ft and 4 ft depths inside plots were collected for water quality analysis.

Phosphorus fertilizer or soil amendments did not increase stargrass forage yield, crude protein or digestibility throughout the 3 years. Although applied P improved forage tissue P level, most cattle producers routinely feed a mineral mix to provide adequate P. Increased P application caused a significant buildup of P in the top, middle, and hardpan soil horizons, increased soluble P concentrations in shallow and deep wells by 400% and 1500%, respectively, increased P in surface runoff by 50%, and raised the potential for non-point source of P pollution. Gypsum was effective in eliminating P leachate from applied P into deep wells but was not beneficial for reducing P in surface runoff. Although promising in reducing total P in surface runoff, the long-term benefit of Ca-lime was not clear due to equilibrium effect.

This study supports multi-county fertilizer trials to provide strong evidence that current IFAS P-fertilizer recommendations for grazed improved grasses of up to 40 lb P_2O_5 in south Florida could be reduced at tremendous savings to ranchers and protect the environment from P pollution. Soil amendments per se do not provide that kind of long-term protection..