Florida Cattle Enhancement Grant Final Report

Title: Defining the Importance of Soil pH, Potassium, and Phosphorus in Reversing Bahiagrass Pasture Decline on Florida Cattle Ranches

Sponsoring Agency: Florida Department of Agriculture and Consumer Services

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Project Overview:

The beef cattle industry in Florida depends upon perennial warm-season grasses as a source of feed for livestock. Perennial grass pasture decline has been identified recently as a problem. In response to producer concerns about the decline of perennial grass pastures, the UF/IFAS Pasture Grass Task Force was established in August 2013 to identify all pertinent information that would aid in isolating the causes of the problem including management practices, soil tests, tissue nutrient concentrations, and disease assessments.

Ranchers observing symptoms of pasture decline contacted task force members who assessed their pastures in 2014 and 2015. Soil and plant tissue samples were taken and management information was collected. Descriptive data showed that 92% of the problem pastures were planted to either Pensacola or Argentine bahiagrass, all pastures were at least 10 years old and 77% were greater than 15 years old, most (69%) were stocked at between 2 and 5 acres per cow-calf pair, and 69% were managed using continuous grazing. These management practices are well suited to bahiagrass, so none of this information raised any particular concerns as being the cause of the problems observed.

However, characterization of soil samples showed that 62% of problem sites reported soil pH below the target (5.5) for bahiagrass. Further, 62% of problem pastures had soil potassium (K) levels that were classified as low, and 31% had low soil phosphorus (P). Seventy-seven percent of the pastures had low soil levels of either P or K, with 15% reporting low soil levels of both P and K. Fifty percent of producers with problem pastures had not applied lime in the last three years and 40% had not applied P or K in the last three years. There was no evidence that any specific plant disease or insect was the primary cause of the responses observed.

Based on these results, the task force concluded that inadequate soil pH and P and K fertilization management are likely a cause of pasture decline, and they recommended that further

research be conducted to test whether liming and fertilization management can be used to restore declining pastures to a healthy status. This project is in response to that recommendation, and it was set up and initiated in 2016 on two experiment station sites and four on-ranch sites identified through the activities of the task force.

Project Objectives:

1. To quantify the effect of liming to optimum soil pH and applying P and K fertilizer on subsequent yield, percent stand, and nutritive value of already declining bahiagrass pastures on Florida ranches.
2. To determine what rates of P and K are needed to restore declining stands of perennial grasses on research center pastures in Florida.

Methods and Results:

On-Ranch Studies

Four on-ranch pastures, two in Hardee County and one each in Pasco and Sumter counties were selected from a group of pastures that were already visited and sampled as part of the activities of the UF/IFAS Pasture Grass Task Force. Pastures were chosen based on declining bahiagrass stands and soil characteristics including below-target pH, and low levels of both soil P and K. At each site, the previous soil pH and nutrient composition data were confirmed with a set of new soil samples. After confirmation of previously determined soil characteristics, each site was divided into 32 plots of 30 feet x 30 feet. Soil was sampled at six locations (1-inch cores to an 8-inch depth) per plot and the six samples from a given plot were combined into one sample for analysis in order to best quantify the soil characteristics of each plot before application of the treatments.

The eight treatments were all combinations of two levels of lime (0 or UF/IFAS recommendation based on soil test), two levels of K fertilizer (0 or 50 lb K_2O/acre), and two levels of P fertilizer (0 or 25 lb P_2O_5/acre). All plots received 50 lb/acre of nitrogen. Each of the eight treatments were replicated four times at each site. Nitrogen, lime, P, and K were applied in March, and the pastures were grazed throughout the season according to the rancher's regular management program.

Two, 1-square yard exclusion cages were securely anchored on each plot after fertilization. The amount of forage present in the caged area was quantified prior to cage placement using a calibrated disk meter. All ranches were visited monthly starting in May and continuing through September. At each visit, the amount of forage in the caged areas was measured, and the cages were then moved to other representative areas of the plot to start a new monthly cycle. At the time of initial fertilization, the percent cover of bahiagrass was measured in two quadrats per plot so that changes in bahiagrass stand could be quantified.

Data were collected at each site on initial stand characteristics in March. Regular harvests have been ongoing since May 2016. Additional data will be collected in September and October 2016 before data for the first year are summarized.

On-Station Studies

In order to fine tune the amount of K needed to reverse grass pasture decline, rate studies were initiated at the Range Cattle REC in Ona and the Beef Unit at Gainesville. Bahiagrass was used at Ona and Jiggs and Tifton 85 bermudagrass at Gainesville. At each location, areas of grass pasture were identified and soil characteristics determined.

At Ona, treatments were the factorial combination of three N fertilization levels (0, 50 lb/acre in May, or 50 lb/acre in May and August) and two levels of K fertilization (0 or 50 lb K_2O/acre) in a randomized complete block design with three replicates. Plots (36 x 45 ft) were

harvested every 6 wk. Preliminary results show that potassium fertilization did not affect yield, crude protein, or forage digestibility; however, forage tissue K concentration increased from 1.06 to 1.12% with increasing K fertilization levels. Plots fertilized with N had greater yield than control plots. A second experiment using bahiagrass was conducted in a greenhouse and compared three levels of N fertilization (0, 50, and 100 lb/acre) and four levels of K fertilization (0, 20, 40, and 80 lb K_2O/acre) with four replicates. There was a relationship between forage tissue K concentration and yield, and maximum yield occurred with tissue K concentration of 1.7%.

At Gainesville, an experiment evaluated K fertilization and cutting height effects on herbage harvested, cover, and K removal of Jiggs and Tifton 85 bermudagrasses. Treatments were two entries, two stubble heights (3 and 6 inches), and three K_2O fertilization rates (0, 20, 40 lb/acre per harvest). Defoliation occurred every 28 d, resulting in four to five harvests during the growing season. Plots received 60 lb N/acre/harvest. Herbage harvested was greater in the 3- than the 6-inch stubble treatment (3.59 and 3.27 tons/acre, respectively), and increased linearly from 3.14 to 3.63 tons/acre as K_2O fertilization increased from 0 to 40 lb/acre per harvest. Jiggs had greater cover than Tifton 85 after Year 1 (93 and 76%, respectively). Increasing K fertilization increased plant tissue K concentration (1.4, 2.0, and 2.2%), and also increased K removal in harvested herbage (96, 156, 182 lb/acre). Increasing K fertilization had a positive effect on change in soil K concentration (-6.0, 5.8, 6.2 kg ha^{-1}). Jiggs and Tifton 85 bermudagrasses are most productive when cut to 8-cm stubble and fertilized with 40 kg K_2O ha^{-1} after each harvest, but plant tissue and soil K concentration changed little with K_2O rates above 20 kg ha^{-1} $harvest^{-1}$.

Grant Deliverables:

Grant deliverables from the project proposal are shown below along with progress on each deliverable. Proposed activities on all deliverables has been completed.

Description of Deliverable	Progress with Deliverable
1. Sites selected for on-ranch and on-station studies, experiments laid out, and initial soil sampling completed	On-ranch sites were selected in Sumter, Pasco, and at two sites in Hardee county in December/January. Soil was sampled to determine if sites were appropriate for the project. After analyses, final site selection was completed in February. On-station site selection was completed on a similar time scale.
2. Initial soil analyses completed for all on-ranch and on-station experiments.	Soil analyses of individual plot areas was completed in February/March.
3. All cages constructed and delivered to on-ranch locations	Cages were constructed and delivered to on-ranch locations in March.
4. Initial fertilizer and herbicide treatments applied at on-ranch and on-station locations	All locations were fertilized according to treatments and weeds controlled as needed in March/April
5. Cages installed on all on-ranch plots and initial forage mass and percent cover measurements completed	Cages were installed at all locations in March/April and initial sampling of forage mass and percent cover were completed.
6. April through June forage sampling activities completed at all on-ranch and on-station sites	Sampling activities have been carried out monthly at all locations from May through September.

Project Summary

Deliverables 1-6 above have been completed on time at all locations. The project has progressed very well, with all methods working effectively. Sites with very low soil pH and soil P and K have been identified, so we feel confident that we will be able to effectively test the treatments to determine if they can reverse pasture decline. The results presented in this report are preliminary, reflecting the short time-frame of the contract. We look forward to continuing this work at these locations during the remainder of the 2016 and all of the 2017 growing seasons should additional funding become available.