Florida Cattle Enhancement Grant
Final Report
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Optimizing Herbicide Rates for Wiping Smutgrass and Impacts of Rainfall and Non-structural Carbohydrates on Smutgrass Control

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Background. Giant smutgrass [*Sporobolus indicus* (L.) R. Br. var. *pyramidalis* (Beauv.) Veldkamp] is native to tropical Asia, but has become a problematic weed in improved and native perennial grass pastures in central and south Florida. Control of giant smutgrass can be achieved with 1.0 lb/ha hexazinone during July, August and early September when rainfall is sufficient for uptake from the soil solution (Mislevy et al. 2002; Ferrell et al. 2006). Within the first year after hexazinone application, control of giant smutgrass often exceeds 90%, but it often becomes reestablished to original densities within 3 years after treatment. Additionally, hexazinone application costs approximately $40-50/acre for this level of giant smutgrass control. Hexazinone is not an option for smutgrass control near sensitive oak species, and control of smutgrass clumps in these areas is limited to spot-treatment with glyphosate.

Recent advances in wick-wiping devices, such as the roto-wiper, have resulted in the renewed interest in using this equipment for selective control of weedy species in pastures, especially smutgrass. Information necessary to use this equipment effectively and efficiently is needed to optimize smutgrass control. Operators of this equipment have been utilizing different concentrations of either glyphosate or hexazinone with various results. Therefore, determining the optimum rates for glyphosate and hexazinone is needed.

Although wiping smutgrass with either glyphosate or hexazinone is a potential tool for some growers, broadcast applications of hexazinone are likely to continue. Previous research (Mislevy et al. 2002) and preliminary results from 2016 indicate that rainfall is a major component of smutgrass control with hexazinone. Many pasture-level failures have been attributed to limited or excessive rainfall following hexazinone application; however, the amount of rainfall necessary to achieve optimum results is not well understood. The addition of adjuvants that purportedly decrease herbicide leaching is one option to help aid in achieving satisfactory results using hexazinone after large rainfall events. Therefore, research is needed to understand the effect of rainfall on smutgrass control following hexazinone application, and the use of specialized adjuvants to potentially decrease leaching.

Another component of smutgrass management may be related to plant physiology. Many have reported that total non-structural carbohydrates (TNC) in plant crown tissues are directly related to the level of control with herbicides (Kalmbacher et al. 1993; Mislevy et al. 1999; Mullahey and Cornell 1994; Wilson et al. 1975). Nearly all research to date has indicated that hexazinone should be applied from July through September for optimum smutgrass control, and this has always been correlated with timely rainfall needed for hexazinone incorporation into the soil solution. However, timely rainfall is often received in September, and control failures have been observed following September hexazinone applications. Therefore, smutgrass crown TNC concentrations may also be an indicator for timely hexazinone applications to obtain optimum control.

Approach.

Wiping experiment. Plots were established in smutgrass-infested bahiagrass pasture near Bowling Green to validate the appropriate glyphosate and hexazinone rates for use in large-scale field wiping systems. A hand-held wiping system (Wagner Smart Roller™) was utilized for wiping herbicide onto individual smutgrass plants on August 17, 2017. The experiment was conducted using a randomized complete block design with four replications using a 2x8 factorial treatment arrangement of two herbicides ([1] glyphosate; [2] hexazinone) and eight herbicide rates (0.0312, 0.0625, 0.125, 0.25, 0.5, 1, 2 and 4 times the X rate). The X rate for weed wiper applications with glyphosate was a concentration of 20% v/v; and for hexazinone the X rate will be 50% v/v. Since there is very little information regarding the use of hexazinone in wipers, the X rate were based on previous experience and research using older wick-type weed wipers as well as price. A nontreated control was also included. Smutgrass control will be visually estimated at 30, 60, and 365 days after treatment (DAT). These data will be utilized to determine the appropriate rates of these herbicides for use in a separate large-scale demonstration and research plots using anticipated funding through USDA-NRCS.

Effect of rainfall on hexazinone activity. Greenhouse and field experiments are being utilized to examine the effect of rainfall on smutgrass control with hexazinone. Field experiments are being conducted by applying hexazinone at 0.5, 0.75, and 1.0 lb/acre onto 10 x 90 ft plots, replicated four times in a randomized complete block design. Herbicide treatments are applied weekly, beginning in April and ending in October, and visual estimations of smutgrass control are recorded 30, 60, and 365 days after treatment. Since rainfall cannot be predicted in the field, greenhouse experiments will

be utilized to determine the amount of rainfall needed for optimum hexazinone activity and minimal leaching; two experiments will be conducted. In the first experiment, smutgrass are being grown in gallon-size pots filled with soil collected from the field. Plants will be at least 15 inches tall and 4 to 6 inches in diameter prior to treating with hexazinone at 0, 0.56, 0.75, and 1.0 lb/acre with and without Grounded. After herbicide application, rainfall will be simulated at 0, 0.25, 0.50, 1.0, 2.0, 4.0, and 8.0 inches. Smutgrass control will be estimated visually at 15 and 30 DAT, and by recording live biomass at 30 and 60 (regrowth) DAT. In a second greenhouse experiment, the same hexazinone treatments as in the first greenhouse experiment will be utilized. However, rainfall will be delayed by 0, 3, 7, 14, and 21 days after application to determine the longevity of hexazinone activity if rainfall is not received immediate after application of hexazinone. Currently plants are in the growing phase in the greenhouse and no treatments have been applied.

Total non-structural carbohydrates. Four smutgrass plants are dug monthly from at least 5 locations throughout central and south Florida and will be continued over a 2 year period in conjunction with participating county faculty. Once plants are dug, fibrous roots and top growth will be removed prior to placing plant samples on ice for transport to the laboratory. Once at the laboratory, plants will be processed further by removing all but 1 inch on top and bottom of the crown and placed in a freezer until all samples have been collected. Once all samples have been collected, they will be removed from the freezer, dried at constant temperature and ground for TNC analysis. A rapid analysis technique will be utilized for TNC concentration as described by Zhao et al. (2010).

Results. No significant results have been obtained to date in these experiments. Weekly applications of hexazinone to correlate rainfall with hexazinone efficacy was initiated near Ona. We continue to apply these treatments past the date of this report. As expected, our initial results show that without rainfall hexazinone does not adequately control smutgrass, and excessive rainfall (> 3 inches) within a week following application also results in reduced efficacy (data not shown). Final results for this experiment will be available by June, 2018. We expect data to look similar to that recorded in 2016 (Figure 1), however, efficacy was reduced significantly in early 2017 due to early season drought.

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Percentage of Completion for 2017: 100%

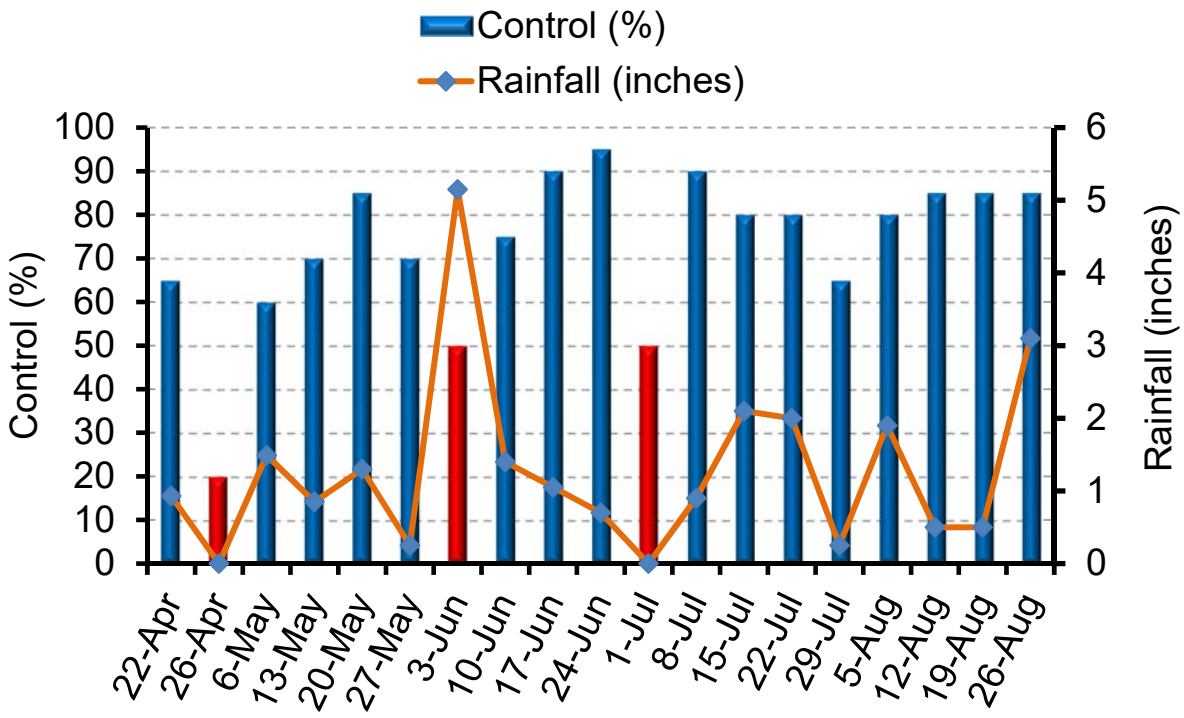

Figure 1. Impact of rainfall on hexazinone efficacy in 2016. Hexazinone was applied weekly at 2 qt/acre and rainfall was recorded for each week after application.

BUDGET FOR FLORIDA CATTLE ENHANCEMENT FUND- BUDGET JUSTIFICATION					
PROJECT TITLE: Optimizing Herbicide Rates for Wiping Smutgrass and Impacts of Rainfall and Non-structural Carbohydrates on Smutgrass Control, FCEB 39					
DETAILED LINE ITEM DESCRIPTION	QTY	% Complete	TOTAL	EXPLANATION/JUSTIFICATION OF DELIVERABLE	COMPLETION DATE
Herbicide	9	100%	$ 399.54	Herbicides were purchased for use in wiping experiments; Velpar at $80/gallon (2.5 gallons) and Glyphosate at approximately $18/gallon (7.5 gallons) were purchased.	9/1/2017
Materials and Supplies	n/a	100%	$ 3,780.05	Lab, greenhouse, and field supplies including hand wiping devices (small plot wiper applications), rainfall data loggers	9/1/2017
Plot preparation	n/a	100%	$ 17,491.24	Expenses associated with plot preparation: includes but not limited to: plot markers, fuel, sampling supplies, tape measures, rainfall data loggers, and sampling supplies.	9/1/2017
Equipment maintenance	n/a	100%	$ 155.72	Repairs for sprayer and wiping devices.	9/1/2017
Indirect Cost	N/A		$ 2,523.43		N/A
GRAND TOTAL: (equal to percentage of completion)			**$ 24,349.98**		