Potassium May Play a Role in Reducing Broomsedge Densities

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Broomsedge (*Andropogon*) species are native, warm-season, short-lived perennial bunchgrasses with an average life span of 3 to 5 years. While some species are desirable in many natural areas and native rangeland, they are problematic in bahiagrass pastures throughout central and south Florida as mature broomsedge is typically avoided by cattle. There is no easy solution to this increasing problem as there are no herbicides that will selectively remove broomsedge from grass pastures. Therefore, a comprehensive management program is needed to help reduce broomsedge infestations and invasion, especially in bahiagrass pastures.

Many extension specialists in the southeastern US suggest that soil testing followed by the appropriate amendments to increase the competitive ability of desirable species is the only way to manage broomsedge. However, with over 18 species of broomsedge present in Florida, an across the board recommendation for all species is not likely attainable. For example, bushy bluestem appears to grow better in alkaline soils (pH >7) than in acidic soils, while other species are observed growing in more acidic soils. Therefore, liming alone may or may not result in a decrease in broomsedge density over time. Furthermore, the pH target levels for desirable grasses may not inhibit the growth of broomsedge species. Phosphorus fertilization has also been suggested to decrease broomsedge invasion, but this has not been documented in Florida where typical soils, such as Spodosols, have considerable levels of phosphorus in deep soil depths.

Results from our long-term (8-yr) research have indicated that bushy bluestem density decreases over time as a result of annual fertilization (at levels of 50 lb N/A, 25 lb P_2O_5/A, and 50 lb K_2O/A). Two years after the first fertilizer application density was approximately 50% of non-fertilized plots. Liming (2,000 lb/A) that resulted in an increase in soil pH from 4.3 to 5.1 resulted in a 50% decrease in purple bluestem density within 3 years after application; lime was applied a second time 4 years after the initial application to bring the soil pH to 5.5. NPK fertilization resulted in a 58% reduction in density compared to non-treated plots after 4 years of application. However, broomsedge bluestem has not responded to application of NPK at these rates over a 5-year period, indicating that more time may be necessary to observe a decline in broomsedge bluestem density or that this species may not respond to fertilization. Micronutrient applications have not resulted in a decrease in any broomsedge species. Since NPK is having some impact on some species of broomsedge, our current research is attempting to uncover

which macronutrient (N, P, or K) is responsible for the decline in broomsedge density observed in our long-term plots.

Effect of single macronutrients on broomsedge density. Plots were established in pastures infested with broomsedge species at Ona and Buck Island Ranch in June 2017. Prior to initiating the experiments, soil and tissue were sampled for baseline measurements of soil pH as well as soil and tissue nutrient concentrations. Plots measured 100 x 100 ft, and each treatment replicated 4 times in a randomized complete block design. Broomsedge density was recorded prior to beginning the experiment in geo-referenced locations within each plot and was recorded annually prior to fertilization. Treatments included: 1) N (50 lb N/A) ± P (based on soil and tissue testing); 2) 25 lb P_2O_5/A; 3) K (50 lb K_2O/A), 4) N + P (50 lb N/A + 25 lb P_2O_5/A); 5) N + K (50 lb N/A + 50 lb K_2O/A; 6) P + K (25 lb P_2O_5/A + 50 lb K_2O/A); and 7) N + P + K (50 lb N/A + 25 lb P_2O_5/A + 50 lb K_2O/A). An untreated check was also be included to be able to observe any natural changes in time due to other management imposed on the pasture. Fertilizer has been applied annually in the spring (March-May) of each year.

Broomsedge densities in studies initiated in 2017 were not affected by macronutrient applications within one year after the first application (Table 3). However, potassium (K) did impact broomsedge densities at both locations following two years of K application. Broomsedge densities at Buck Island were reduced by 36 and 44% in plots receiving K by 2019 and 2020, respectively. Hexazinone was applied at the Ona location in 2017 to control smutgrass, and we believe that the application of hexazinone resulted in reduced broomsedge densities across all treatments by 2018. However, broomsedge began re-infesting plots in 2019, but K application has resulted in a 73 and 60% reduction in broomsedge in K-treated plots in 2019 and 2020, respectively. No other macronutrients had an impact on broomsedge densities at either location.

Table 1. Impact of potassium fertilizer on broomsedge densities at Ona and Buck Island from 2018 through 2020.

Treatment[1]	**Buck Island**			**Ona**		
	2018	**2019**	**2020**	**2018**	**2019**	**2020**
	no. of plants/m^2					
0 lb K	6.4 a[2]	7.8 a	8.4 a	0.4 a	2.6 a	4.8 a
50 lb K_2O	5.4 a	5.3 b	3.0 b	0.3 a	0.7 b	1.9 b
p-value	0.2322	0.0184	0.0007	0.3360	0.0126	0.0050

[1] Potassium was applied annually beginning in 2017 at 50 lb K_2O /acre.

[2] Values within each column followed by different letters are significantly different at $P<0.05$.

Current options to control broomsedge in pastures include spot-treatment or a wiper application using glyphosate. For spot-treatments, a 1-2% v/v solution is usually sufficient. A glyphosate

concentration of 10% v/v has been successful at the Range Cattle Research and Education Center. In August 2014 glyphosate (10% v/v) was wiped onto broomsedge in two directions. Within a 2-week period, broomsedge plants began to show signs of glyphosate activity (Figure 1). Unfortunately, these pastures were mowed at this time for a grazing trial. However, by 1 year after treatment, the broomsedge population declined by approximately 70%. This pasture was wiped a second time in the fall of 2015 to control escapes from the first application. After investigating this pasture in June 2016, it appears that we have controlled nearly 95% of the original population (Figure 2).

Since broomsedge species are difficult to remove without spot-treatment or by using a weed wiper, it is important to limit their spread within or across pastures. If broomsedge is beginning to invade certain areas within a pasture or has escaped a previous wiper treatment due to coverage issues, be sure to spot-treat those areas to prevent seed production as the seeds are wind-dispersed (Figure 3). Additionally, it is important to implement appropriate fertilization programs. Bahiagrass tends to take a lot of abuse because it tolerates adverse conditions including overgrazing, minimum fertilization inputs, and soil moisture extremes, but overlooking these conditions may be the underlying cause of broomsedge infestations in many areas of the state.

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Figure 1. Broomsedge response 2 weeks after wiping with a 10% v/v glyphosate solution in August 2014. Photograph by B. Sellers.

Figure 2. Response of bahiagrass pasture following two annual fall wiper applications of 10% v/v glyphosate. Approximately 95% of the broomsedge has been removed from this pasture. Photograph by B. Sellers.

Figure 3. Regrowth of broomsedge plants that are growing in the fence line of the wiped bahiagrass pasture. These plants should be spot-treated with glyphosate to prevent further seed production. Photograph by B. Sellers.

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