Nitrogen Fertilization and DDGS Supplementation Reduces Annual Weeds in Pastures

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Summary

Ongoing research has found body weight (BW) gains of steers supplemented with corn dried distillers grains plus solubles (DDGS) on unfertilized smooth bromegrass pasture (SUPP) to be greater than unsupplemented steers on N fertilized (FERT) and unfertilized, control (CONT) smooth bromegrass pasture. In the seventh year of the study, annual weeds increased to 20%, 9%, and 2% of relative cover within CONT, SUPP, and FERT pastures, respectively. Supplementation of DDGS on unfertilized pastures improves steer BW gains and reduces N inputs while providing intermediate resistance to annual weed invasion. Annual N fertilization maximizes forage yield and minimizes annual weeds in pasture.

Introduction

Research conducted at the Agricultural Research and Development Center (ARDC) near Mead, Neb., since 2005 has found ADG and total BW gain per acre of steers in DDGS supplemented pastures (SUPP) exceed those of steers in control (CONT) and fertilized (FERT) pastures (*2012 Nebraska Beef Cattle Report*, p. 49). Steers consumed less forage in SUPP, but total N intake and retention was greater on per steer and per acre bases in SUPP than in CONT and FERT pastures thereby improving N use efficiency (*Journal of Animal Science,* 89:1146).

A remaining unknown in this research was the impact of treatments on pasture vegetation. Nitrogen input is known to influence vegetation dynamics, and in this experiment, annual N input from DDGS and fertilizer averaged 44 and 80 lb/ac in SUPP and FERT, respectively. In 2010 and 2011, we examined how the previous six years of management in CONT, SUPP, and FERT treatments affected vegetation by measuring relative basal and aerial cover of plant species along with forage yield in the pastures. We hypothesized that declining N inputs from FERT to SUPP to CONT would result in increasing cover of Kentucky bluegrass, a perennial grass known to increase in low-input pastures.

Procedure

Research was conducted in smooth bromegrass pastures at ARDC. Treatments included unfertilized, control (CONT) pasture stocked initially with steers at 2.5 animal unit months (AUM)/ac, unfertilized SUPP pasture stocked initially at 3.7 AUM/ac with steers supplemented with 5 lb/head daily of DDGS, and FERT pasture stocked initially with steers at 3.7 AUM/ac. Urea was surface applied to FERT pasture at 80 lb N/ac in late March to early April of each year. Each treatment also received an estimated 6 lb N/ac annually from atmospheric deposition resulting in total N input of 6, 50, and 86 lb/ac in CONT, SUPP, and FERT, respectively. Each treatment was replicated three times, split into six paddocks and rotationally grazed from late April through September of each year (160 d). With the six paddocks, each FERT and SUPP pasture was 4.9 acres, while each CONT pasture was 7.2 acres. There were five cycles of grazing per year in each set of six paddocks. Stocking density varied across the season as put-and-take cattle were used to maintain an end-of-season standing crop of 1,070 lb/ac or a 4-inch stubble height across treatments and years. Stocking rates after adjustments for put-and-take cattle averaged 3.5, 5.6, and 5.4 AUM/ac in CONT, SUPP, and FERT, respectively. With the exception of digging out thistles and spot spraying around feed bunks and water tanks, broadleaf weed control was minimal.

Relative basal and foliar cover of plant species was measured within one of the six paddocks contained within each experimental unit on Oct. 7 2010 and Oct. 13 2011. Forage yield of smooth bromegrass and other species also was measured through clipping of forage at ground level within each treatment in June and October, 2009 through 2011. Dry matter yields were determined after drying forage samples for 60 hours in a forced-air oven at 140°F. Analysis of variance was conducted with mixed model procedures.

Results

Relative basal and foliar cover of plant species depended on treatment and year. From 2010 to 2011, relative basal cover of smooth bromegrass decreased by 24, 11, and 4 percentage points in CONT, SUPP, and FERT treatments, respectively (Figure 1). Contrary to our hypothesis, treatment did not affect relative basal cover of Kentucky bluegrass. Although an increase of Kentucky bluegrass cover from 5% in 2010 to 8% in 2011 was observed, the increase was not enough to compensate for reductions of smooth bromegrass cover. Increasing the most from 2010 to 2011 in CONT and SUPP was relative basal cover of annual weeds, particularly foxtail species (Figure 1). Relative foliar cover, although more variable, followed patterns similar to those of relative basal cover with differences between treatments observed in 2011 (data not shown).

Forage yield also depended on treatment and year (Table 1). Smooth bromegrass yield was greater in FERT than either SUPP or CONT treatments in all years, while yield of other species was similar between these treatments in 2009 and 2010 but not in 2011. Overall yield of other species consisted of 2%, 1%, and 1% of total forage yields in CONT, SUPP, and FERT treatments in 2009 and 2010. In 2011, however, overall yield of other species accounted for 20%, 7%, and 1% of total forage yields in CONT, SUPP, and FERT treatments, respectively. Yield of smooth bromegrass was similar between CONT and SUPP treatments in 2009 and 2010 but was significantly greater in the SUPP than CONT treatment in 2011. Overall, results complement those of other studies where N input had been found to increase mass and density of perennial cool-season grasses thereby limiting light penetration and establishment of other species in grasslands.

Timing and form of N input may have contributed to vegetation changes, but compared to differences in total N inputs, their effects appear small. The FERT treatment received most N input (86 lb/ac) during late spring in the form of 80 lb N/ac from urea fertilizer and 6 lb N/ac through atmospheric deposition. Total N consumed in forage, retention, and excretion across the grazing season was estimated at 93, 7, and 86 lb N/ac, respectively. On the other hand, N input in SUPP (50 lb N/ac) occurred throughout the grazing season through daily feeding of DDGS (44 lb N/ac) and atmospheric deposition (6 lb N/ac). Total N consumed in forage and DDGS, retention, and excretion were estimated at 110, 10, and 100 lb N/ac, respectively. Thus, although relative cover of annual weeds species, such as the warm-season foxtail species, was greater in SUPP compared to FERT, their invasion appears to be predominantly caused by differences in total N input rather than N excretion. Difference between these two systems in total N excretion over the grazing season was 14 lb/ac in favor of SUPP whereas the difference in total N input was 36 lb/ac in favor of FERT.

Annual weeds such as foxtail species are well adapted to pastures but often lie dormant in the soil seed bank until favorable disturbances and environmental conditions promote germination and emergence. Our study revealed annual N fertilization at 80 lb/ac maintained excellent cover of smooth bromegrass and provided nearly complete suppression of annual weeds. The progressively greater N input in CONT, SUPP, and FERT treatments also resulted in overall forage yields of smooth bromegrass that across years averaged 5,543, 6,013, and 9,015 lb/ac, respectively. Although SUPP did not maintain as much cover and yield of smooth bromegrass as FERT, smooth bromegrass cover and yield in SUPP were greater than CONT. In addition, SUPP resulted in better animal gains than CONT and FERT (*2012 Nebraska Beef Cattle Report*, p. 49) while improving N use efficiency on per animal and per acre bases (*Journal of Animal Science*, 89: 1146).

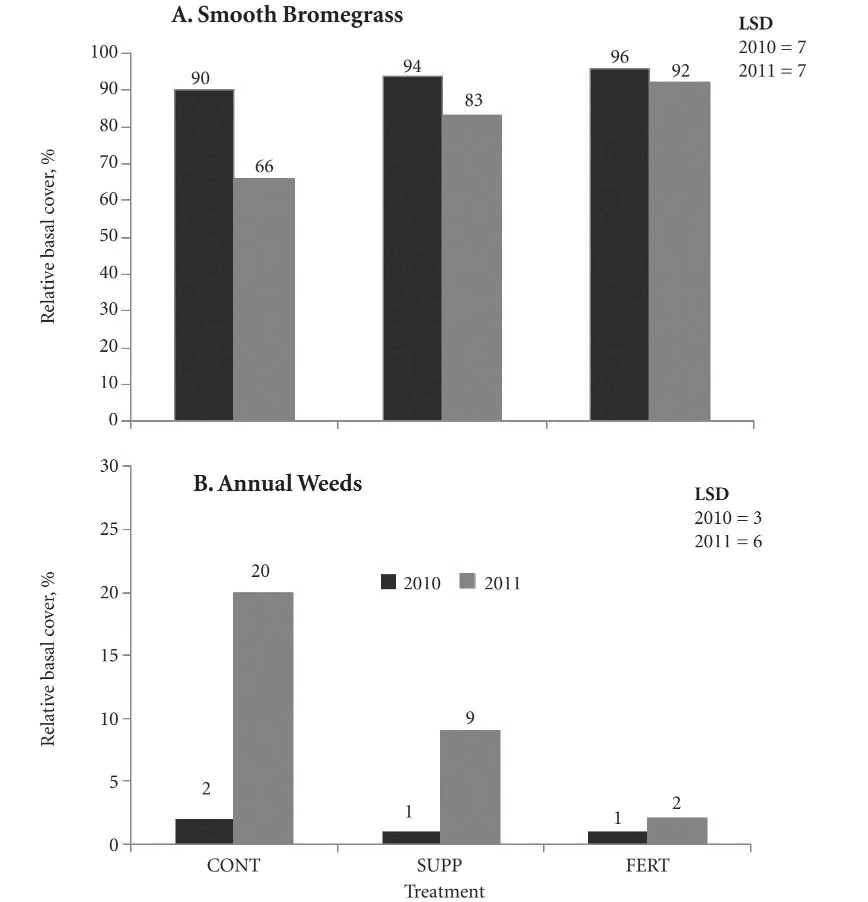

Figure 1. Cover of smooth bromegrass (A) and annual weeds (B) in unfertilized (CONT), unfertilized with cattle supplemented with dried distillers grains plus solubles (SUPP), and N-fertilized (FERT) pastures at Mead, Neb.

Table 1. Forage yield of smooth bromegrass and other species in unfertilized (CONT), unfertilized with cattle supplemented with corn dried distillers grains plus solubles (SUPP), and N-fertilized (FERT) pastures at Mead, Neb.

		Forage Yield	
Year	Treatment	Smooth Bromegrass	Other Species
		lb/ac	
2009	CONT	5849	135
	SUPP	6490	41
	FERT	8549	6
	LSD	739***	138
2010	CONT	5179	58
	SUPP	4784	13
	FERT	8096	155
	LSD	1979*	241
2011	CONT	5624	1387
	SUPP	6792	522
	FERT	10503	116
	LSD	1008***	700*

* Significant at the 0.05 probability level.
*** Significant at the 0.001 probability level.

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