Effects of Supplementation on Late Summer Weight Gain of Stocker Cattle Grazing Tallgrass and Midgrass Prairie

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Story in Brief

Two hundred twenty-five crossbred steers (527 lb) of mixed origin were grazed at a variety of stocking rates from early April through late September at two locations. A monensin-containing 30% crude protein cube and a monensin-containing trace mineralized salt mix were fed during the late summer to determine their effects on animal performance at tallgrass and midgrass prairie sites. The locations were the Marvin Klemme Range Research Station (Bessie, OK, Washita County) and the Cross-Timbers Experimental Range (Stillwater, OK, Payne County). Steers fed protein had numerically higher rate of gain during the late summer at both sites than those fed mineral, and cattle at Stillwater had higher late summer rate of gain than those at Klemme. No statistical difference in rate of gain was found between steers fed either supplement at Klemme. However, at Stillwater, the protein supplemented cattle showed increased rate of gain compared with mineral fed cattle. This leads us to believe that protein was the first limiting nutrient on tallgrass prairie. The limited steer performance response to protein supplementation at Klemme may indicate that crude protein was not the first limiting nutrient on mixed grass prairie. While protein supplementation did numerically increase rate of gain at both locations, the differences in steer response due to the forage quality and quantity of the two forage types indicates a need for location and climate specific supplementation strategies based on forage type.

(Key Words: Stocker Cattle, Forage Type, Protein Supplementation.)

Introduction

Many late summer supplementation programs of stocker cattle in Oklahoma are based on the seasonal changes in forage quality (crude protein and energy) of tallgrass species. The quality of these grasses tends to decline rapidly during the late summer, limiting late summer weight gains for stocker cattle grazing season long. While this decline is evident in both tallgrass and midgrass prairie, the quality of mixed grass prairie may not fall below critical levels for extended periods of time. Gunter et al. (1991) found June to be the only month crude protein (CP) was limiting stocker cattle performance, while energy (total digestible nutrients; TDN) was consistently deficient. This lack of CP deficiency on mixed grass prairie may reduce the economical benefit of protein supplementation typically observed on tallgrass prairie. This study compares the results of two common supplementation strategies on midgrass prairie in western Oklahoma and tallgrass prairie in north-central Oklahoma.

Materials and Methods

Study Sites. The Klemme site is located 97 miles west of Oklahoma City, OK, and is classified as a Red Shale range site. The Station supports mixed grass prairie with major species (>50%) including sideoats grama, blue grama and buffalograss. Average annual forage production is estimated to be 2000-2200 lb per acre (lb/A) with higher levels in years of good rainfall. The nearest weather station at Clinton, OK receives 27 in of average rainfall, of which 19 in falls during the April-September grazing period covered in this trial. The stocking rates ranged from 4.5 to 10.2 acres per steer for 185 d and averaged 7.2 acres per steer. The Cross-Timbers Experimental Range (CTER) site classifications are shallow, shallow eroded and sandy savannah, as well as shallow prairie. The vegetation is post oak-blackjack oak upland forest intermixed with tallgrass prairie. The average annual forage production is estimated to be 4500-5000 lb/A. The average annual rainfall is 33 in with 65% falling during May-October. The stocking rates ranged from 2.3 to 5.1 acres per steer for 177 d and averaged 3.4 acres per steer.

Cattle. On April 1, 1997, 89 mixed breed stocker cattle were received, weighed, processed and implanted with Synovex-S at the Oklahoma State University Research Range, and 136 steers from a winter supplementation study near this site were also weighed and implanted with Synovex-S. All weights recorded in Stillwater came following an overnight shrink without feed and water. Steers were randomly allotted and moved to pastures until the initiation of the supplementation period. Terrain (0-12% slopes), grass availability and access to fresh water were similar in all pastures at both locations. Cattle were weighed again on June 20 at Stillwater and June 26 at Klemme. Weights of Klemme cattle were taken after an overnight removal of access to water. Steer weights at Klemme were shrunk 3% before statistical analysis due to the inability to remove total access to grass. Supplementation was initiated on June 20 at Stillwater and June 26 at Klemme. Final weights were taken at Stillwater on September 25 and at Klemme on October 7, using the same procedures as previously described. Supplementation was removed from Klemme cattle for one week prior to final weighing to maintain similar days of supplementation at both locations.

Supplements. Treatments (Table 1) were each randomly assigned to four pastures at Stillwater and two pastures at Klemme. The supplements consisted of a mid-protein, fiber-based, (MP) 30% CP supplement and a trace mineralized salt mix (TMS), formulated with equal levels (150 mg/steer daily) of monensin. The MP was offered at 2.5 lb/steer daily, prorated for three feedings per week while the TMS was fed free choice in an attempt to achieve intakes of approximately 3 oz per steer per day. Amounts fed were recorded and no feed refusals were noted. Cattle were group fed in metal bunks during the supplementation period. Supplement conversions (Table 3) in pound of supplement per added pound of gain and cost of added gain were calculated. The LS ADG of the TMS cattle at each location was used as a baseline and the pound of supplement fed per steer per day was divided by the increase in LS ADG to obtain the ratio of supplement to added gain. Cost of added gain was calculated using a value of $200 per ton for MP.

Analysis. Data were analyzed as a replicated 2 x 2 factorial arrangement. Treatments were location (Klemme and Stillwater) and supplement fed (MP and TMS). Cattle performance variables were analyzed using the GLM procedure of SAS (1992). Variables analyzed were rate of gain (ADG) in the early season (ES; April-July), late season (LS; July-September) and season long (SL; April-September) grazing periods. The effects measured included site, supplement treatment and the appropriate interactions. Due to differences in cattle weights at the initiation of supplementation between sites, the use of that weight as a covariate was tested. No effect (P>.22) of weight at the initiation of supplementation was found and no interaction (P>.56) between covariate and any main effect was noted.

Results and Discussion

Above average precipitation in both amount and frequency at both locations was observed for the grazing season and the 6 mo prior. This resulted in above average quantity and quality of grass during the summer grazing season. Gains for all pastures at both locations were greater than historical gain data. This was assumed to be due to the precipitation patterns. The higher than expected gains at Klemme caused weights (Table 2) at the initiation of supplementation to be different. Since steer weights were different, ADG was used to make comparisons and total pounds of gain were not compared.

Intake of both MP and TMS (Table 1) were similar at both locations and lower than expected. This was due to an adaptation to feed period at the initiation of supplementation and the ending of supplementation prior to the end of grazing in an attempt to equalize ruminal fill and to maintain similar days on supplement at both locations. The MP was also fed according to the number of cattle present at the feeder to reduce the possibility of steers consuming a large dose of monensin. The conversions and cost of gain (Table 3) for the MP supplement were favorable at Stillwater while being economically unfeasible at Klemme.

Steer ADG was similar (P=.88) for all cattle prior to the initiation of supplementation. This indicates no difference in plane of nutrition or pasture potential prior to the supplementation period for the MP pastures compared with the TMS pastures. However, cattle at Klemme had increased (P<.01) ADG during the ES period (2.58 vs 1.51 lb/d) compared with steers at Stillwater. This may be the result of site and forage type differences. A site x supplement interaction (P<.02) was found for ADG during the LS supplementation period (Table 3). Steers fed MP vs TMS at Stillwater had increased (P<.01) LS ADG while no difference (P>.10) in LS ADG was found between treatments for the Klemme cattle. There was a trend (P<.10) for an interaction between site and supplement for SL ADG. Steers at Klemme had similar (P>.71) SL ADG while Stillwater cattle showed increased (P=.01) SL ADG due to MP supplementation. Steers fed MP at Klemme and Stillwater had similar (P>.77) SL ADG while those fed TMS on midgrass had increased (P<.05) SL ADG compared with tallgrass.

While differences in animal performance between sites may have resulted from differences in forage quality and/or quantity, no standing crop or diet quality data are available for this study to support those conclusions. The NRC (1984) requirements for a 600 lb steer gaining 1.8-2.0 lb/d are between 10.2 and 10.5% CP and 67% TDN. Typical diets (Table 4) at both locations would seem to be deficient in TDN unless overall intake was high enough to overcome the lack of TDN concentration. However, in this study at Klemme, the diets may not have ever been below the required level of CP. This difference allowed MP supplementation to increase both LS and SL steer ADG at Stillwater but appeared to limit the effectiveness of feeding MP on LS and SL grazing ADG at Klemme. The limited response in animal performance to protein supplementation at Klemme indicates that forage quality was adequate to support a SL ADG of almost 2 lb/d. In a related trial (Bodine and Purvis, 1997, unpublished data) at the Klemme site, feeding 5 lb of a 15% CP energy supplement resulted in the greatest response in animal performance. The results at Klemme indicate that in an excellent growing year, forage protein quantity is not first limiting for stocker cattle performance on midgrass prairie. However, the increased steer ADG for MP fed cattle at Stillwater for LS and SL grazing periods demonstrates that protein supplementation increases ADG during the feeding period and results in increased ADG for the entire grazing season on tallgrass prairie. The response to supplemental protein indicates that forage protein quantity of tallgrass prairie was first limiting, even in a year of excellent rainfall.

Due to the different responses to MP at each site for both LS and SL periods, different supplementation strategies might be considered for midgrass native range sites than those typically used for tallgrass prairie. The main tool in determining the correct supplementation strategy for any pasture in a given year is an understanding of the forage quality of that site. This is difficult since yearly variations in the growth patterns of grass due to climate can drastically change the quality. The best approach is to sample pastures and obtain a forage analysis to aid in determining supplementation strategies. The feeding of an MP supplement significantly increased steer ADG on tallgrass prairie but cattle fed this supplement showed little response while grazing midgrass prairie. This indicates that even in favorable growing seasons (i.e., high rainfall) CP is the first limiting nutrient on tallgrass prairie but not on short and midgrass prairie range.

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Table 1. Treatments and intakes.

	Intake per steer	
Supplements	*Klemme*	*Stillwater*
Monensin Trace Mineral Salt (TMS)[a]	2.16 oz/d	2.21 oz/d
Mid-protein fiber-based 30% CP (MP)[b]	2.24 lb/d	1.99 lb/d

[a]TMS contained 50 mg of monensin/oz.
[b]MP contained 60 mg of monensin/lb.

Table 2. Weights of cattle and days on trial.				
	Klemme		*Stillwater*	
Pastures	*MP – 2*[a]	*TMS - 2*	*MP - 4*	*TMS - 4*
Weights				
Starting (April)	*535*	*551*	*513*	*515*
Mid-season (June)	*760*	*782*	*648*	*644*
Ending (Sept)	*917*	*927*	*884*	*842*
Days on Trial				
Late season (LS)	101		97	
Season long (SL)	185		177	
[a]Treatment and number of pastures at each site.				

Table 3. Cattle performance.				
	Klemme		*Stillwater*	
Item (lb)	*MP*	*TMS*	*MP*	*TMS*
Early season ADG	2.54[a]	2.62[a]	1.54[b]	1.48[b]
Late season ADG	1.56[a]	1.44[a]	2.43[b]	2.04[c]
Season long ADG	1.97[a]	1.95[a]	1.99[a]	1.76[b]
Supplement Conversions				
#Fed/#gain(vs TMS)	18.67	---	5.10	---
Cost$/#gain(vs TMS)	$1.87	---	$.51	---
[a,b,c]Values within row without common superscripts differ (P<.05).				

Table 4. Monthly chemical composition of midgrass and tallgrass prairie.							
Item (%DM)	*April*	*May*	*June*	*July*	*Aug*	*Sept*	*Oct*
Tallgrass[ab]							
CP	13.8	14.6	11.5	10.5	9.7	9.0	8.2
TDN	63.5	70.0	67.5	66.5	61.5	58.5	59.5
Midgrass[ab]							
CP	12.0	13.0	15.0	13.5	14.8	11.0	10.0
TDN	67.0	71.7	65.3	67.5	59.0	63.0	63.5
[a]Gunter, et al. (1991) [b]Purvis, unpublished data. (1997)							

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