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Evaluation of Supplemental Energy Source for Grazing Stocker Cattle

Abstract

A total of 216 steers grazing smooth bromegrass pastures were used to evaluate the effects of supplemental energy source on available forage, grazing gains, subsequent finishing gains, and carcass characteristics in 2014, 2015, 2016, 2017, 2018, and 2019. Supplementation treatments evaluated were: no supplement, a supplement with starch as the primary source of energy, and a supplement with fat as the primary energy source. Supplements were formulated to provide the same quantity of protein and energy per head, daily. Supplementation with the starch-based or fat-based supplement during the grazing phase resulted in higher ($P < 0.05$) grazing gains than feeding no supplement during all six years. In 2014, 2016, 2017, 2018, and 2019, grazing gains of steers supplemented with the starch-based or fat-based supplement were similar ($P > 0.05$). In 2015, steers supplemented with the fat-based supplement had greater ($P < 0.05$) grazing gains than those that received the starch-based supplement. In 2014, supplementation during the grazing phase had no effect ($P > 0.05$) on finishing gain, feed intake, and feed:gain. Steers supplemented with the starch-based supplement had greater ($P < 0.05$) final finishing liveweight, and greater ($P < 0.05$) hot carcass weight than those that received no supplement. In 2015, steers fed the fat-based supplement had higher ($P < 0.05$) final finishing liveweight, greater ($P < 0.05$) hot carcass weight, and lower ($P < 0.05$) finishing gain than those supplemented with the starch-based supplement or fed no supplement. In 2016, steers fed the starch-based or fat-based supplement had greater ($P < 0.05$) hot carcass weight and higher ($P < 0.05$) marbling scores than those fed no supplement. Supplementation had no effect ($P > 0.05$) on finishing gains. In 2017, steers fed the starch-based supplement had greater ($P < 0.05$) finishing gain and lower ($P < 0.05$) feed:gain than those fed no supplement and steers that were supplemented while grazing had greater ($P < 0.05$) hot carcass weight than those that received no supplement. In 2018, steers fed the starch-based or fat-based supplement had greater ($P < 0.05$) hot carcass weight and higher ($P < 0.05$) marbling scores than those fed no supplement. Supplementation treatment had no effect ($P > 0.05$) on finishing gains.

Keywords

grazing, stocker cattle, smooth bromegrass, energy, supplementation

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Evaluation of Supplemental Energy Source for Grazing Stocker Cattle

L.W. Lomas, J.K. Farney, and J.L. Moyer

Summary

A total of 216 steers grazing smooth bromegrass pastures were used to evaluate the effects of supplemental energy source on available forage, grazing gains, subsequent finishing gains, and carcass characteristics in 2014, 2015, 2016, 2017, 2018, and 2019. Supplementation treatments evaluated were: no supplement, a supplement with starch as the primary source of energy, and a supplement with fat as the primary energy source. Supplements were formulated to provide the same quantity of protein and energy per head, daily. Supplementation with the starch-based or fat-based supplement during the grazing phase resulted in higher ($P < 0.05$) grazing gains than feeding no supplement during all six years. In 2014, 2016, 2017, 2018, and 2019, grazing gains of steers supplemented with the starch-based or fat-based supplement were similar ($P > 0.05$). In 2015, steers supplemented with the fat-based supplement had greater ($P < 0.05$) grazing gains than those that received the starch-based supplement. In 2014, supplementation during the grazing phase had no effect ($P > 0.05$) on finishing gain, feed intake, and feed:gain. Steers supplemented with the starch-based supplement had greater ($P < 0.05$) final finishing liveweight, and greater ($P < 0.05$) hot carcass weight than those that received no supplement. In 2015, steers fed the fat-based supplement had higher ($P < 0.05$) final finishing liveweight, greater ($P < 0.05$) hot carcass weight, and lower ($P < 0.05$) finishing gain than those supplemented with the starch-based supplement or fed no supplement. In 2016, steers fed the starch-based or fat-based supplement had greater ($P < 0.05$) hot carcass weight and higher ($P < 0.05$) marbling scores than those fed no supplement. Supplementation had no effect ($P > 0.05$) on finishing gains. In 2017, steers fed the starch-based supplement had greater ($P < 0.05$) finishing gain and lower ($P < 0.05$) feed:gain than those fed no supplement and steers that were supplemented while grazing had greater ($P < 0.05$) hot carcass weight than those that received no supplement. In 2018, steers fed the starch-based or fat-based supplement had greater ($P < 0.05$) hot carcass weight and higher ($P < 0.05$) marbling scores than those fed no supplement. Supplementation treatment had no effect ($P > 0.05$) on finishing gains.

Introduction

Supplementation of grazing cattle is most economically feasible when cattle prices are high, relative to the price of grain. Energy supplementation of grazing ruminants may reduce forage intake and digestibility, but energy supplementation at low levels (less than 0.4% bodyweight) has been shown to have little effect on forage intake when

crude protein was not limiting. Several studies have evaluated the effect of supplementation on stocker cattle gains and forage utilization during the grazing phase, but few have evaluated the effects of supplementation during the grazing phase on subsequent finishing performance and carcass traits. This research seeks to obtain a more thorough understanding of the interactions among grazing nutrition and management, finishing performance, and carcass traits to facilitate greater economic utilization of these relationships.

Experimental Procedures

Thirty-six steer calves of predominately Angus breeding were weighed on two consecutive days, stratified by weight, and randomly allotted to nine 5-acre smooth bromegrass pastures on April 9, 2014 (446 lb); April 7, 2015 (488 lb); April 6, 2016 (444 lb); March 21, 2017 (437 lb); March 27, 2018 (443 lb); and April 9, 2019 (468 lb). Three pastures of steers were randomly assigned to one of three supplementation treatments (3 replicates per treatment) and were grazed for 181, 224, 223, 238, 224, and 189 days in 2014, 2015, 2016, 2017, 2018, and 2019, respectively. Supplementation treatments in 2014 and 2015 were: no supplement, 4.25 lb per head daily of a starch-based supplement, or 4.5 lb per head daily of a fat-based supplement. In 2016, 2017, 2018, and 2019, the starch-based supplement and fat-based supplement were both fed at 4.25 lb per head daily. Supplements were formulated to provide the same amount of protein (0.7 lb in 2014 and 2015 and 0.4 lb in 2016, 2017, 2018, and 2019) and energy (3.3 lb of TDN in 2014 and 2015 and 3.4 lb of TDN in 2016, 2017, 2018, and 2019) per head daily. Pastures were fertilized with 100 lb/a of nitrogen (N) on February 24, 2014; February 12, 2015; February 11, 2016; February 10, 2017; February 13, 2018; and March 18, 2019. Pastures were stocked with 0.8 steers/a and grazed continuously until October 7, 2014 (181 days); November 10, 2015 (224 days); November 15, 2016 (223 days); November 14, 2017 (238 days); November 6, 2018 (224 days), and October 15, 2019 (189 days) when steers were weighed on two consecutive days and grazing was ended.

Cattle in each pasture were group-fed supplement in meal form on a daily basis in metal feed bunks, and pasture was the experimental unit. No implants or feed additives were used during the grazing phase. Weight gain was the primary measurement. Cattle were weighed every 28 days. Cattle were treated for internal and external parasites before being turned out to pasture and later were vaccinated for protection from pinkeye. Cattle had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt. Forage availability was measured approximately every 28 days in 2014, 2015, 2016, and 2017 with a disk meter calibrated for smooth bromegrass.

After the grazing period, cattle were shipped to a finishing facility, implanted with Synovex S, and fed a diet of 80% whole-shelled corn, 15% corn silage, and 5% supplement (dry matter basis) for 125, 97, 98, 91, and 112 days in 2014, 2015, 2016, 2017, and 2018, respectively. All cattle were slaughtered in a commercial facility at the end of the finishing period, and carcass data were collected. Cattle that grazed these pastures in 2019 were being finished for slaughter at the time that this report was written.

Results and Discussion

Grazing and subsequent finishing performance of steers that grazed smooth bromegrass pastures are presented by supplementation treatment for 2014, 2015, 2016, 2017, and 2018 in Tables 1, 2, 3, 4, and 5, respectively. Grazing performance only is presented for 2019 in Table 6. Supplementation treatment had no effect ($P > 0.05$) on the quantity of forage available for grazing in any of the years that it was measured. Pastures grazed by supplemented steers might be expected to have greater available forage DM as consumption of supplement by steers grazing these pastures would likely reduce forage intake thereby resulting in more residual forage. However, the levels of supplement fed in this study were likely small enough that forage consumption was not affected.

Supplemented steers had greater ($P < 0.05$) weight gain, daily gain, and steer gain/a than those that received no supplement in all six years. In 2014, 2016, 2017, 2018, and 2019, grazing weight gain, daily gain, and gain/a were not different ($P > 0.05$) between steers that were supplemented with the starch-based or fat-based supplement. In 2015, steers supplemented with the fat-based supplement had greater ($P < 0.05$) grazing gains than those that received the starch-based supplement.

In 2014, steers fed the starch-based supplement had greater ($P < 0.05$) final finishing liveweight, greater ($P < 0.05$) hot carcass weight, greater ($P < 0.05$) overall (grazing + finishing) gain, and greater ($P < 0.05$) overall daily gain than those that received no supplement. Supplementation during the grazing phase had no effect ($P > 0.05$) on finishing weight gain, feed intake, feed:gain, backfat, ribeye area, yield grade, or marbling score.

In 2015, steers supplemented with the fat-based supplement had higher ($P < 0.05$) slaughter weight, higher hot ($P < 0.05$) carcass weight, and lower ($P < 0.05$) finishing gain than those fed no supplement or supplemented with the starch-based supplement.

In 2016, 2017, and 2018, steers that were supplemented during the grazing phase maintained their weight advantage from grazing and were heavier ($P < 0.05$) at the end of the finishing phase, had greater ($P < 0.05$) hot carcass weight, and greater ($P < 0.05$) overall gain than those that received no supplement. Final finishing weight and hot carcass weight were similar ($P > 0.05$) for steers supplemented with starch or fat during the grazing phase.

In 2016, dry matter intake was lower ($P < 0.05$) for steers that received no supplement while grazing than for those supplemented with fat, which may be due at least in part to the unsupplemented steers being lighter weight. Supplementation treatment during the grazing phase had no effect ($P > 0.05$) on backfat thickness, ribeye area, or percentage grading USDA Choice. Steers supplemented with starch during the grazing phase had lower ($P < 0.05$) numerical yield grades than those supplemented with fat. Steers supplemented with starch or fat during the grazing phase had higher ($P < 0.05$) marbling scores than those that received no supplement. Marbling scores and overall gains were similar ($P > 0.05$) between those supplemented with starch or fat.

In 2017, steers fed the starch-based supplement had greater ($P < 0.05$) finishing gain and lower ($P < 0.05$) feed:gain than those fed no supplement. Final finishing weight, hot carcass weight, and overall gain were similar ($P > 0.05$) for steers supplemented with starch or fat during the grazing phase. Supplementation treatment during the grazing phase had no effect ($P > 0.05$) on backfat thickness, ribeye area, yield grade, marbling score, or percentage grading USDA Choice.

In 2018, steers fed the starch-based supplement had higher ($P < 0.05$) marbling scores than those that received no supplement while grazing. Supplementation treatment during the grazing phase had no effect ($P > 0.05$) on finishing gain, feed:gain, backfat thickness, ribeye area, yield grade, or percentage grading USDA Choice. Marbling scores and overall gains were similar ($P > 0.05$) between those supplemented with starch or fat.

Under the conditions of this study, supplementation of stocker cattle grazing smooth bromegrass pasture improved grazing performance, and increased slaughter weight and carcass weight. Most of the increase in slaughter weight and carcass weight can be attributed to greater gains of supplemented cattle during the grazing phase. Supplemental energy source while grazing had little effect on carcass quality.

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Table 1. Effect of supplemental energy source on grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Kansas State University Southeast Research and Extension Center, 2014

	Supplemental energy source		
Item	None	Starch	Fat
Grazing phase (181 days)			
Number of head	12	12	12
Initial weight, lb	446	446	446
Final weight, lb	706a	817b	810b
Gain, lb	260a	371b	364b
Daily gain, lb	1.43a	2.05b	2.01b
Gain/a, lb	208a	296b	291b
Supplement consumption, lb/head per day	0	4.25	4.5
Supplement, lb/additional gain, lb	---	6.9	7.8
Average available forage dry matter, lb/a	7,140	7,128	6,985
Finishing phase (125 days)			
Beginning weight, lb	706a	817b	810b
Ending weight, lb	1241a	1338b	1307ab
Gain, lb	535	522	497
Daily gain, lb	4.28	4.17	3.98
Daily dry matter intake, lb	26.1	27.0	24.7
Feed:gain	6.11	6.49	6.20
Hot carcass weight, lb	769a	830b	810ab
Backfat, in.	0.45	0.50	0.47
Ribeye area, sq. in.	11.2	12.1	12.1
Yield grade	2.8	3.0	2.8
Marbling score[1]	630	648	650
Percentage USDA grade Choice	100	100	100
Overall performance (grazing plus finishing; 306 days)			
Gain, lb	795a	892b	861ab
Daily gain, lb	2.60a	2.92b	2.81ab

[1]600 = modest, 700 = moderate.
Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Table 2. Effect of supplemental energy source on grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Kansas State University Southeast Research and Extension Center, 2015

	Supplemental energy source		
Item	None	Starch	Fat
Grazing phase (224 days)			
Number of head	12	12	12
Initial weight, lb	489	488	488
Final weight, lb	753a	833b	886c
Gain, lb	264a	345b	398c
Daily gain, lb	1.18a	1.54b	1.78c
Gain/a, lb	211a	276b	318c
Supplement consumption, lb/head per day	0	4.25	4.5
Supplement, lb/additional gain, lb	---	11.8	7.5
Average available forage dry matter, lb/a	6,601	6,644	6,484
Finishing phase (97 days)			
Beginning weight, lb	753a	833b	886c
Ending weight, lb	1169a	1208a	1307b
Gain, lb	417a	374b	420a
Daily gain, lb	4.30a	3.86b	4.33a
Daily dry matter intake, lb	26.2	26.0	26.3
Feed:gain	6.09	6.74	6.08
Hot carcass weight, lb	725a	749a	810b
Backfat, in.	0.42	0.46	0.49
Ribeye area, sq. in.	11.7	11.7	12.2
Yield grade	2.3	2.8	2.8
Marbling score[1]	639	631	639
Percentage USDA grade Choice	100	100	100
Overall performance (grazing plus finishing; 321 days)			
Gain, lb	681a	719a	818b
Daily gain, lb	2.12a	2.24a	2.55b

[1]600 = modest, 700 = moderate.
Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Table 3. Effect of supplemental energy source on grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Kansas State University Southeast Research and Extension Center, 2016

	Supplemental energy source		
Item	None	Starch	Fat
Grazing phase (223 days)			
Number of head	12	12	12
Initial weight, lb	445	444	444
Final weight, lb	754a	871b	856b
Gain, lb	309a	426b	412b
Daily gain, lb	1.39a	1.91b	1.85b
Gain/a, lb	247a	341b	329b
Supplement consumption, lb/head per day	0	4.25	4.25
Supplement, lb/additional gain, lb	---	8.2	9.2
Average available forage dry matter, lb/a	7,403	7,402	7,309
Finishing phase (98 days)			
Beginning weight, lb	754a	871b	856b
Ending weight, lb	1167a	1274b	1280b
Gain, lb	412	403	424
Daily gain, lb	4.21	4.11	4.33
Daily dry matter intake, lb	26.7a	27.7ab	28.5b
Feed:gain	6.36	6.75	6.58
Hot carcass weight, lb	723a	790b	794b
Backfat, in.	0.43	0.44	0.45
Ribeye area, sq. in.	11.9	12.4	12.1
Yield grade	2.4ab	2.3a	2.8b
Marbling score[1]	632a	684b	710b
Percentage USDA grade Choice	100	100	100
Overall performance (grazing plus finishing; 321 days)			
Gain, lb	722a	829a	836b
Daily gain, lb	2.25a	2.58b	2.60b

[1]600 = modest, 700 = moderate.
Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Table 4. Effect of supplemental energy source on grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Kansas State University Southeast Research and Extension Center, 2017

	Supplemental energy source		
Item	None	Starch	Fat
Grazing phase (238 days)			
Number of head	12	12	12
Initial weight, lb	431	437	443
Final weight, lb	807a	912b	942b
Gain, lb	376a	475b	499b
Daily gain, lb	1.58a	2.00b	2.10b
Gain/a, lb	301a	380b	399b
Supplement consumption, lb/head per day	0	4.25	4.25
Supplement, lb/additional gain, lb	---	10.1	8.2
Average available forage dry matter, lb/a	6,371	6,369	6,293
Finishing phase (91 days)			
Beginning weight, lb	807a	912b	842b
Ending weight, lb	1104a	1304b	1301b
Gain, lb	297a	392b	359ab
Daily gain, lb	3.26a	4.31b	3.95ab
Daily dry matter intake, lb	26.4	28.0	27.0
Feed:gain	8.26a	6.49b	6.87ab
Hot carcass weight, lb	662a	783b	780b
Backfat, in.	0.39	0.45	0.50
Ribeye area, sq. in.	11.6	12.8	12.4
Yield grade	2.4	2.4	2.8
Marbling score[1]	650	646	692
Percentage USDA grade Choice	92	92	100
Overall performance (grazing plus finishing; 329 days)			
Gain, lb	673a	868b	858b
Daily gain, lb	2.04a	2.64b	2.61b

[1]600 = modest, 700 = moderate.
Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Table 5. Effect of supplemental energy source on grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Kansas State University Southeast Research and Extension Center, 2018

	Supplemental energy source		
Item	None	Starch	Fat
Grazing phase (224 days)			
Number of head	12	12	12
Initial weight, lb	443	443	443
Final weight, lb	742a	864b	880b
Gain, lb	299a	421b	437b
Daily gain, lb	1.33a	1.88b	1.95b
Gain/a, lb	239a	336b	350b
Supplement consumption, lb/head per day	0	4.25	4.25
Supplement, lb/additional gain, lb	---	7.7	6.9
Finishing phase (112 days)			
Beginning weight, lb	742a	864b	880b
Ending weight, lb	1177a	1321b	1302b
Gain, lb	435	457	421
Daily gain, lb	3.88	4.08	3.76
Daily dry matter intake, lb	27.7	28.8	28.0
Feed:gain	7.14	7.08	7.47
Hot carcass weight, lb	706a	793b	781b
Backfat, in.	0.49	0.52	0.57
Ribeye area, sq. in.	11.5	12.1	12.0
Yield grade	2.7	2.9	2.9
Marbling score[1]	706a	768b	713ab
Percentage USDA grade Choice	100	100	100
Overall performance (grazing plus finishing; 336 days)			
Gain, lb	733a	878b	858b
Daily gain, lb	2.18a	2.61b	2.55b

[1]700 = moderate, 800 = slightly abundant.
Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Table 6. Effect of supplemental energy source on grazing performance of steers grazing smooth bromegrass pastures, Kansas State University Southeast Research and Extension Center, 2019

	Supplemental energy source		
Item	None	Starch	Fat
Grazing phase (189 days)			
Number of head	12	12	12
Initial weight, lb	468	468	468
Final weight, lb	684a	803b	793b
Gain, lb	215a	335b	325b
Daily gain, lb	1.14a	1.77b	1.72b
Gain/a, lb	172a	268b	260b
Supplement consumption, lb/head per day	0	4.25	4.25
Supplement, lb/additional gain, lb	---	6.7	7.3

Means within a row followed by the same letter are not significantly different ($P < 0.05$).