K-STATE Research and Extension

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Effect of Corn Type and Form of Supplement on Grazing Steers – Year 3

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Summary

Eighty stocker steers were grazed on bromegrass from the middle of May to the beginning of November and were provided five different feeds while on grass during the summer. Treatments evaluated included (1) mineral only; (2) free-choice supplementation in the form of liquid feed (MIX30), or (3) block format (Mintrate 40 Red); and hand-fed supplements of 60% corn:40% dried distillers grains at 0.5% of body weight on a dry matter basis offered daily where the corn was either an (4) isoline corn (ISO; parent genetic line) or (5) Enogen feed corn (ENO; includes the alpha-amylase gene). Steers were weighed every 28 days while on grass and were measured for carcass quality by ultrasound prior to being placed in feedlot. Hand-fed steers had greater gain than self-fed supplemented steers and these hand-fed steers tended to have more muscle depth coming off grass than other supplemented steers. There was no difference in backfat nor marbling scores off grass for any treatments evaluated. Loin muscle depth was greater for supplemented steers as compared to non-supplemented. Overall, if a steer was supplementally fed, it had 64 pounds more weight than if fed a mineral only, and this advantage was driven primarily by hand-fed supplements. However, each operation needs to calculate cost of production and ease of feeding daily over the convenience of self-fed supplements.

Introduction

Supplementation is important in cattle production because it could (1) fill the gap in a limiting nutrient; (2) allow an increase of gains on the same amount of acreage; (3) allow for an increased number of cattle on the same amount of acreage; (4) supply feed additives; (5) provide increased frequency of monitoring of animals from a husbandry perspective; and (6) stretch the forage supply. Cattle management is different based on geographic location, access to labor, distance to cattle from a feed source, forage types, and economic goals. A variety of supplements for grazing cattle have been developed to meet operational objectives. Determining which supplement best fits an operation can be daunting.

Enogen feed corn was developed for the ethanol industry as it contains the alpha-amylase gene that improves efficiency of ethanol production. The amylase trait helps

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convert starch to sugar more efficiently, which helps in the production of ethanol. In addition to ethanol production benefits, researchers have found this same benefit in cattle production so that feed efficiency can be increased by 5%.

The purpose of this study was to evaluate the effect of cattle gain of stocker steers grazing bromegrass during the summer (1) based on method of supplementation (hand-fed versus self-fed); and (2) type of corn (amylase gene included or not).

Experimental Procedures

Twenty brome pastures were used in a completely randomized research project at the Southeast Research and Extension Center in Parsons, KS. Treatments consisted of one of five different supplementation feeds: (1) control treatment where calves received free-choice mineral (CON); (2) MIX30 (Agridyne, LLC; MIX30; MIX30); (3) Mintrate 40 Red block (ADM Alliance Nutrition; BLOCK); (4) hand-fed supplement of 60% corn:40% DDG (DM-basis) daily where corn was Enogen feed corn (Syngenta, ENO); and (5) hand-fed supplement of 60% corn:40% DDG (DM-basis) daily where corn was an isoline corn (Syngenta, ISO). The isoline corn is the parent corn to the Enogen feed corn line that does not include the alpha-amylase gene. Enogen feed corn includes the alpha-amylase gene, which is involved in starch digestion. Hand-fed supplements were fed daily at 0.5% of body weight on DM basis and adjusted every 28 days based on calf weights. The liquid feed supplement was fed in an open-topped tub. Blocks were fed by free-choice to the steers and placed in bunks containing all pieces of the blocks. The loose mineral was fed in mineral feeders with weather guards to the cattle on the CON treatment and the hand-fed treatments (ENO and ISO). Mineral was supplied to the BLOCK and MIX30 treatment groups through the free-choice supplements. Nutrient profiles of treatments are found in Table 1.

The blocks and liquid tubs were weighed weekly to estimate intake. A new block was added when less than ¼ of the old block remained in the feed tub. New liquid was added weekly after agitation in storage tote and agitation in the feeding tubs was done with a paint stirrer.

Pastures were fertilized in March 2023, based on recommendations from soil test for phosphorus and potassium and all pastures had 100 lb of nitrogen per acre applied in 46-0-0 form.

Cattle Specifics

Weaned and vaccinated steers (587 ± 15.3 lb) were used and stocked at 4 head per pasture on 5-acre pastures. There were four pastures of each treatment. Steers were weighed on two consecutive days and placed on brome pastures (May 10 and 11, 2023). Steers were wormed prior to turnout with a white wormer (Valbazen, Zoetis Inc.).

Steers were tested by ultrasound (Aloka 500 with CPEC feedlot software) to detect any differences in ribeye area, backfat, and marbling on the last day of the grazing period (November 1; 170 days on grass).

Results and Discussion

Supplement offered during the summer did impact cattle gains ($P < 0.001$; Table 2). Steers on the hand-fed diet (ISO and ENO) had greater ADG, total gain, and final weight off grass than those on the CON, MIX30, and BLOCK treatments. There was no difference in ADG between ENO and ISO treatments at any measurement point ($P > 0.37$, Table 2). Supplemented cattle did gain more than CON steers ($P = 0.04$; Table 2); however, this difference was driven by the much greater gains found with ISO and ENO fed cattle as the MIX30 and BLOCK treatment groups had similar gains as CON cattle.

There were variable average daily gain responses through the entire grazing and supplementation feeding period. For the time between days 28 and 56 on grass, steers that were supplemented outgained non-supplemented steers (mineral only steers; Table 2). Again, between the days of 140 and 170 on grass the supplemented steers outperformed non-supplemented steers (Table 2). Hand feeding resulted in greater gains as compared to cattle that received self-fed supplements in measurements between days 56 and 84, and days 130 to 170 on grass (Table 2).

For actual steer weights, the steers had to be on grass for 112 days with their respective supplements before there were differences in treatments (Figure 1). At this point the ISO steers had greater body weights than MIX30, CON, and BLOCK. This same advantage continued through the grazing period, when by the end of the grazing period, both the hand-fed treatments (ISO and ENO) had heavier body weights than all the other treatments. The supplemented steers averaged 64 pounds more weight off grass as compared to those that received mineral only.

Ultrasound data at the end of the grazing period showed a tendency for loin muscle to be greater for ISO fed steers as compared to CON steers ($P = 0.10$; Table 2). Steers that were supplemented had greater muscle than non-supplemented steers ($P = 0.05$). Hand-fed steers tended ($P = 0.08$) to have more muscle than self-supplemented steers. There were not differences in marbling score nor backfat.

Conclusions

Comparable to what has been found in the 3 other years of data collection (Farney et al., 2021; 2022; 2023), the hand-fed supplementation results in greatest cattle gains while on grass as compared to free-choice products. Even though statistically there was no difference in gains with other free-choice supplements as compared to mineral only, overall if a steer was supplemented on bromegrass in 2023 and allowed to graze for 170 days, it averaged 64 more pounds than a steer provided with only a mineral. Before implementing a hand-fed supplementation strategy a producer must calculate all the costs of production that go into the additional labor, fuel, equipment, and infrastructure to complete this management practice as compared to self-fed supplements.

References

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Table 1. Nutrient profiles of supplements fed to steers

Item on dry matter basis	Free-choice mineral (CON)	MIX30 (MIX30)	Mintrate 40 Red Block (BLOCK)	60% corn: 40% DDG (ENO or ISO)
Crude protein, %	5.69	38.35	40	18.3
NPN, %	--	18.98	12	--
Fat, %	--	24.52	1.5	6.66
TDN, %	--	109.5	--	90
Calcium, %	16.67	0.21	3	0.09
Phosphorus, %	3.33	1.33	1.5	0.55
Salt, %	22.54	2.77	12.5	--
Magnesium, %	2.51[1]	2.23	0.3	0.20
Potassium, %	0.89	1.79	1.0	0.83
Iron, ppm	5,546	--	--	75
Copper, ppm	1,153[2]	7.75[2]	250[3]	2.48
Zinc, ppm	3,471[2]	115.08[2]	1,000[4]	25.6
Manganese, ppm	1,817[2]	29.6[2]	750[4]	7.86
Selenium, ppm	22	0.34	6.6	--
Iodine, ppm	333	--	20	--
Cobalt, ppm	13	--	20[5]	--
Vitamin A, IU	141,667	17,451	50,000	--
Vitamin D, IU	14,167	3,854	5,000	--
Vitamin E, IU	172	101	50	--

Free-choice mineral formulated for stocker cattle (Wildcat Feeds LLC) to be consumed at 4 oz/hd/d; 60% corn:40% DDG nutrient profiles are based on average book values for each ingredient. Steers on the hand-fed supplement were also given the same free-choice mineral as control.

[1]Nuplex Mg/K, Nutech Biosciences, Inc. (Oneida, NY), contributed 25% of the magnesium in the minerals.

[2]Nuplex 3-chelate blend, Nutech Biosciences, Inc. (Oneida, NY), contributed 25% of the copper, zinc, and manganese of the total trace mineral supplied in the minerals.

[3] Zinpro zinc methionine.

[4] CoMax patented form of cobalt from ADM.

[5] IntelliBond hydroxy copper.

Table 2. Steer gain and carcass measures during the grazing period

	Treatment						*P* - value			
Item	CON[1]	MIX30	Block[2]	ISO[3]	ENO[4]	SEM[5]	Trt[6]	Hand vs. Self[7]	Supple. vs. No[8]	ISO vs. ENO[9]
Start weight, lb	588	585	589	592	582	15.2	0.99	0.99	0.95	0.68
Final grazing weight, lb	838[b]	856[b]	865[b]	952[a]	935[a]	19.8	**0.001**	**<0.0001**	**0.01**	0.54
Grazing ADG, lb/d	1.47[b]	1.59[b]	1.64[b]	2.11[a]	2.07[a]	0.11	**0.002**	**0.01**	**0.01**	0.77
Total gain, lb	249[b]	271[b]	276[b]	360[a]	352[a]	19.0	**0.001**	**0.01**	**0.01**	0.77
Period average daily gain (ADG), lb/d										
d 28	1.99	2.29	2.13	2.49	2.56	0.45	0.88	0.49	0.46	0.91
d 56	1.64	2.12	2.03	2.53	2.15	0.25	0.23	0.29	**0.07**	0.33
d 84	1.38[ab]	1.55[ab]	1.27[b]	2.11[a]	2.05[a]	0.25	**0.08**	**0.02**	0.20	0.86
d 112	1.27	0.38	1.08	1.19	1.44	0.36	0.31	0.12	0.55	0.63
d 140	2.47	2.75	2.16	2.84	2.98	0.28	0.30	0.13	0.52	0.72
d 170	0.14[c]	0.54[bc]	1.11[ab]	1.36[a]	1.50[a]	0.23	**0.004**	**0.02**	**0.002**	0.67
Ultrasound carcass measures: grazing phase										
Back fat, in.	0.15	0.16	0.16	0.18	0.20	0.01	0.42	0.12	0.20	0.71
Marbling[10,11]	5.04	4.99	4.93	4.93	4.79	0.18	0.90	0.58	0.50	0.64
Loin depth, mm	49.7[b]	51.6[ab]	52.0[ab]	55.7[a]	54.3[ab]	1.65	**0.10**	**0.07**	**0.05**	0.58

[abc]Values indicate treatment differences within row with $P < 0.05$.
[1]CON: control treatment received free choice mineral (Wildcat Feed, LLC).
[2]Block: Mintrate 40 block (ADM Alliance Nutrition).
[3]ISO: 40:60 blend of dried distillers grains (DDG) and cracked corn offered at 0.5% of body weight (DM-basis) daily. Corn is isoline variety that is parent genetic line to the Enogen feed corn (Syngenta).
[4]ENO: Enogen feed corn (Syngenta) fed daily at 0.5% of body weight (DM-basis) in a 60%:40% of corn and DDG.
[5]SEM: standard error of means.
[6]Trt: *P*-value comparison between all 5 treatments.
[7]Hand vs. Self: *P*-value comparison between free-choice treatments (MIX30 and Block) and hand-fed treatments (ISO and ENO).
[8]Supple. vs. No: *P*-value comparison non-supplemented (CON) and supplemented (MIX30, Block, ISO, and ENO).
[9]ISO vs. ENO.: *P*-value comparison between corn variety treatments (isoline or Enogen-feed corn).
[10]Ultrasound marbling score: 5.0–5.9 is Small 00–90 (CUP labs, 2007; *https://www.cuplab.com/Files/content/V.%201%20IMF%20or%20Marbling%207-1-07.pdf*).
[11]U.S. Department of Agriculture marbling scores: 300–399: Slight 0–90; 400–499: Small 0–90; and 500–599: Modest 0–90.

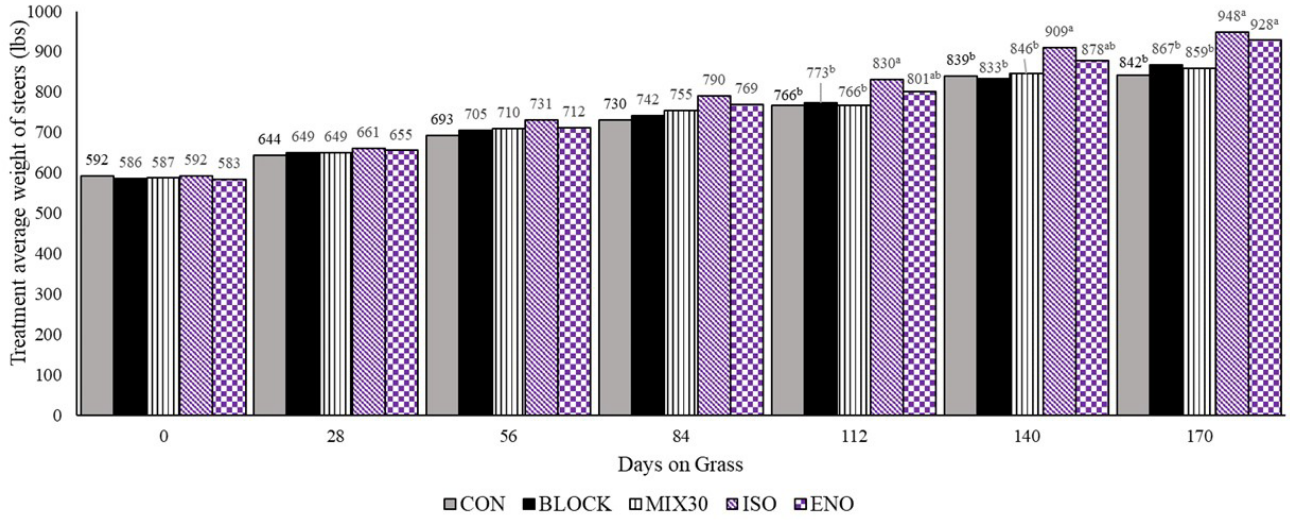

Figure 1: Average treatment weight of steers based on days of grazing bromegrass.
[ab] Letters within period are different at $P < 0.05$.
CON: control treatment received free choice mineral (Wildcat Feed, LLC) in a gray solid bar.
Block: Mintrate40 block (ADM Alliance Nutrition) in a black solid bar.
MIX30: Mix30 (Agridyne) is a bar with white and black upright lines.
ISO: 40:60 blend of dried distillers grains (DDG) and cracked corn offered at 0.5% of body weight (DM-basis) daily. Corn is isoline variety that is the parent genetic line to the Enogen feed corn (Syngenta). This treatment is represented by a bar with white and purple diagonal lines.
ENO: Enogen feed corn (Syngenta) fed daily at 0.5% of body weight (DM-basis) in a 60%:40% of corn and DDG. This treatment is represented by bars with purple and white checks.