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Effect of Corn Type and Form of Supplement on Grazing Steers – Year 2

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Summary

Eighty stocker steers were grazed on bromegrass from the end of May to the middle of August 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 alpha-amylase gene). Steers were weighed every 28 days while on grass and were measured for carcass quality by ultrasound prior to being sold. Hand-fed steers had greater gain than self-fed supplemented steers and these steers tended to have more backfat, marbling, and did have more muscle depth coming off grass than other supplemented steers. Steers that received free-choice mineral or self-fed supplements also had lower gains than steers being hand-fed supplement. During a drought year overall, supplemented steers had a greater gain than non-supplemented controls (receiving mineral only). This advantage became apparent after 56 days on grass when the drought was the most severe and the difference may have become more pronounced if the steers hadn't been removed from the pasture due to limited biomass. Overall, hand-feeding is the method that maintained a more consistent gain, regardless of pasture quality and biomass production. Evaluation of operational costs of production need to be evaluated before determining if the hand-feeding management strategy is the best for returns to the operation.

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 feed source, forage types, and economic goals. Various supplements for grazing cattle have been developed to meet operational objectives. Determining which supplement best fits an operation can be daunting.

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Enogen feed corn is a product that was developed for the ethanol industry as it contains the alpha-amylase gene which improves efficiency of ethanol production. The amylase trait helps 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 steers 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 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 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 was remaining 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 2022, based on recommendations from soil tests for phosphorus and potassium and all pastures had 100 lb of nitrogen applied in 46-0-0 form.

Cattle Specifics

Weaned and vaccinated steers (571 ± 67 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 23 and 24, 2022). 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 (August 16, 2022; 84 days on grass). Cattle were turned out late and removed early from pastures as drought, through the fall of 2021 and limited rainfall in June through

August, reduced the amount of forage available and thus grazing was terminated early in the grazing period.

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 and final weight off grass than CON, MIX30, and BLOCK treatments. There was no difference in ADG between ENO and ISO treatments ($P = 0.62$, 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 MIX30 and BLOCK had similar gains as CON cattle.

At day 28 of being on brome there was no difference in ADG between the treatments ($P = 0.17$). However, those that were supplemented with a protein and energy feed did have a higher ADG as compared to control steers ($P = 0.03$; control steers averaged 2.59 lb/d ADG and all supplemented steers averaged 2.49 pounds/day). This gain advantage was driven entirely by the ISO and ENO hand-fed treatments, as the MIX30 and BLOCK steers had a lower ADG than CON. During the next 28-day period, average daily gains were almost statistically different, where ENO supplemented steers had a greater gain than CON and BLOCK steers, with ISO and MIX30 being intermediate ($P = 0.11$). Hand-fed steers had a greater ADG than those fed a free-choice feed ($P = 0.03$). By the last 28-day period on grass the cattle did have varying ADG ($P = 0.001$). Steers on ENO and ISO treatments gained more than CON steers with MIX30 and BLOCK being intermediate (Figure 1). This difference was probably observed as the forage biomass availability was beginning to be depleted, thus the supplemented steers had some additional energy and protein that wasn't being supplied in the grass and mineral treatment only.

Ultrasound data at the end of the grazing period showed a tendency for backfat to be thicker when steers were supplemented with ISO and ENO compared with CON and MIX30 steers ($P = 0.06$). Supplemented steers all had more backfat than non-supplemented steers ($P = 0.03$). Backfat tended ($P = 0.07$) to be increased with the hand-fed steers as compared to other treatments, however, visual appraisal would not have resulted in a "dock" in price at the sale barn (Table 2). Marbling was not different when comparing all treatments, however, steers that were hand-fed tended to have a greater marbling score after the 84 day grazing period ($P = 0.09$). Loin muscle depth was greater for ISO and ENO supplemented steers as compared to CON and BLOCK supplemented steers ($P = 0.001$). Hand-fed steers supplemented with a corn/DDG feed had a greater loin muscle depth than self-fed steers ($P = 0.0002$). Steers that were supplemented had more muscle than CON steers ($P = 0.03$), but this was primarily caused by the extra muscling advantage of the ISO and ENO steers. There were no differences in ISO or ENO in carcass measures following a grazing period.

Conclusions

Similar to what has been found in 2 other years of data collection (Farney et al., 2021; 2022) hand-fed supplementation results in greatest cattle gains while on grass as compared to free-choice products. Supplementation during the drought of 2022 did improve steers' gains over those that were not supplemented, and this advantage

would have become even more apparent if steers would have remained on the pasture longer. Since steers were removed from the pasture to reduce potential over-grazing and extremely limiting our steer performance because of low forage biomass, we were not able to capture the magnitude of advantage to supplementing cattle while on grass. Hand-fed supplemented steers had a tendency to have increased marbling, backfat, and loin muscle depth as compared to self-supplemented steers. 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

Farney, J. K. and Malone, K. (2021) "Form of Supplement and Addition of Ionophore Effects on Steer Performance while Grazing Bromegrass and Subsequent Effects in Feedlot and Carcass Measures," *Kansas Agricultural Experiment Station Research Reports*: Vol. 7: Iss. 2. *https://doi.org/10.4148/2378-5977.8041*

Farney, J. K. and Bottorff, T. (2022) "Effect of Corn Type and Form of Supplement on Grazing Steers," *Kansas Agricultural Experiment Station Research Reports*: Vol. 8: Iss. 3. *https://doi.org/10.4148/2378-5977.8288*

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	574	571	570	572	572	17.5	1.00	1.00	1.00	1.00
Final grazing weight, lb	681	669	685	732	746	19.1	**<0.0001**	**<0.0001**	**0.04**	0.41
Grazing ADG, lb/d	1.27[b]	1.33[b]	1.37[b]	1.90[a]	2.07[a]	0.13	**0.001**	**<0.001**	**0.02**	0.37
	Period average daily gain (ADG), lb/d									
d 28	2.59	2.00	2.21	2.54	2.83	0.24	0.17	**0.03**	0.47	0.40
d 56	0.90	1.11	0.83	1.41	1.58	0.22	0.11	**0.03**	0.19	0.59
d 84	0.32	0.89	1.20	1.75	1.79	0.22	**0.001**	**<0.001**	**<0.001**	0.88
	Ultrasound carcass measures: grazing phase									
Back fat, in.	0.10[c]	0.12[bc]	0.15[abc]	0.17[a]	0.16[ab]	0.01	**0.06**	**0.07**	**0.03**	0.90
Marbling[10,11]	5.27	5.33	5.37	4.92	5.15	0.18	0.42	**0.09**	0.70	0.37
Loin depth, mm	46.7[c]	48.6[bc]	46.7[c]	53.1[ab]	55.0[a]	1.65	**0.001**	**0.0002**	**0.03**	0.42

[abcd]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.

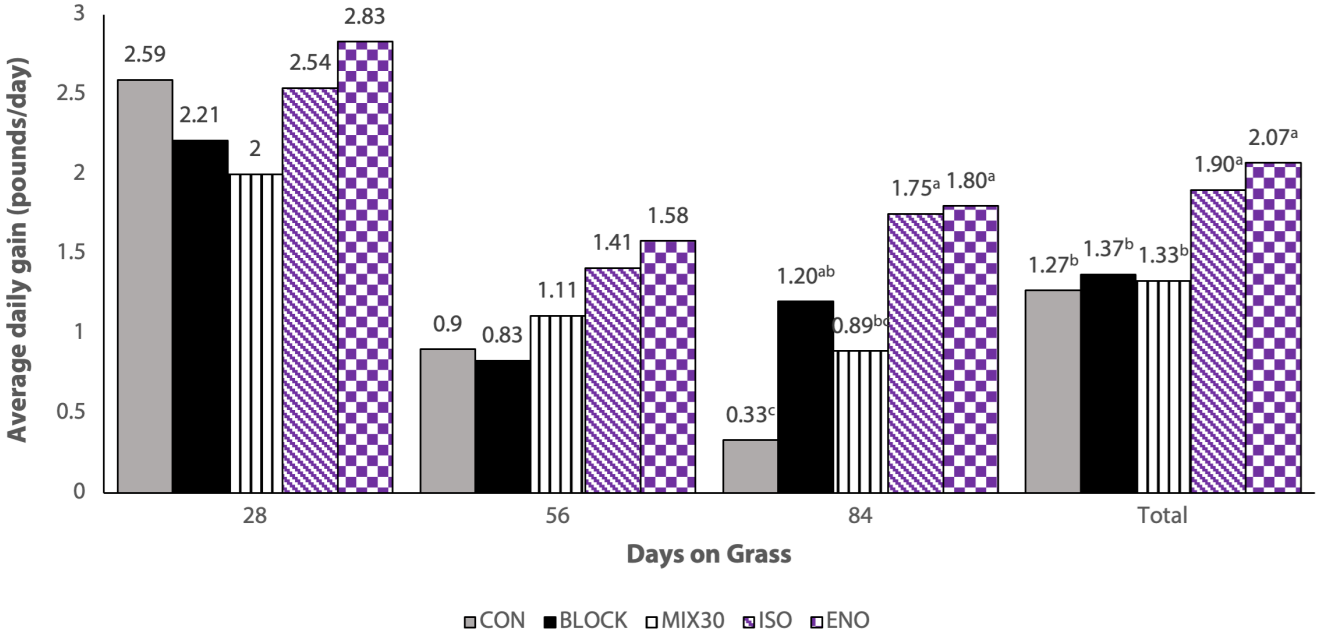

Figure 1. Average daily gains of steers by treatment measured for each 28-day period while on grass. Gains during the 28-day period when first on grass treatments were not different (*P* = 0.17). During the weight period between days 28 and 56 on grass there was no difference in ADG based on treatment (*P* = 0.11). The grazing period between days 56 and 84 on grass was different at *P* = 0.001. Overall average daily gain was different at *P* = 0.001.

[abc] Letters within period are different at $P < 0.05$.

CON: control treatment received free choice mineral (Wildcat Feed, LLC).

Block: Mintrate 40 block (ADM Alliance Nutrition).

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).

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