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Effect of Corn Type and Form of Supplement on Grazing Steers

J. K. Farney
Kansas State University, jkj@ksu.edu

T. Bottorff
Kansas State University, tylerbottorff@k-state.edu

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Abstract

Eighty stocker steers were grazed on bromegrass from April 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 alpha-amylase gene). Steers were weighed every 28 days while on grass and were carcass quality measured by ultrasound prior to placement in the feedlot. Hand-fed steers had greater gain than self-fed supplemented steers and these steers also had more backfat and tended to 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. Within the first 28 days of the study, the hand-fed steers began weighing more and weighed 125 pounds more than the free-choice supplemented and control steers. On average hand-fed steers had a 0.6 lb/d greater ADG than control steers and those consuming free-choice supplement. Cost of gain was the highest with hand-fed steers at $0.27/pound, but even so profit was greatest with the hand-fed cattle.

Keywords

amylase corn, protein block, liquid feed, hand-fed

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Effect of Corn Type and Form of Supplement on Grazing Steers

J.K. Farney and T. Bottorff[1]

Summary

Eighty stocker steers were grazed on bromegrass from April 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 alpha-amylase gene). Steers were weighed every 28 days while on grass and were carcass quality measured by ultrasound prior to placement in the feedlot. Hand-fed steers had greater gain than self-fed supplemented steers and these steers also had more backfat and tended to 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. Within the first 28 days of the study, the hand-fed steers began weighing more and weighed 125 pounds more than the free-choice supplemented and control steers. On average hand-fed steers had a 0.6 lb/d greater ADG than control steers and those consuming free-choice supplement. Cost of gain was the highest with hand-fed steers at $0.27/pound, but even so profit was greatest with the hand-fed cattle.

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 forage supply. Cattle management is different based on geographic location, access to labor, distance to cattle from 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 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

[1] Undergraduate intern, Department of Animal Science, College of Agriculture, Kansas State University.

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) Mint-rate 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 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 2021, based on recommendations from soil test for phosphorus and potassium and all pastures had 100 lb of nitrogen applied in 46-0-0 form.

Cattle Specifics

Weaned and vaccinated steers (568 ± 17 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 (April 19, 2021). Steers were wormed prior to turnout with a white wormer (Valbazen, Zoetis Inc.).

Steers were ultrasounded (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 7, 2021; 200 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 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 calves ($P < 0.01$; 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.

Beginning at the 28-day weigh date (Figure 1), the hand-fed treatments (ISO and ENO) had cattle that had greater gains and they maintained this advantage through the entire grazing period. Some of the most distinct periods where the hand-fed supplement resulted in greater gains were the last 56 days of the study (Figure 1) when the brome was fully dormant and total forage biomass was decreasing (data not presented). During this period the steers on ENO and ISO maintained between a 0.5 to 1 lb/d greater average daily gain than either CON or self-fed supplements and during the final 28-day period were the only ones that gained weight (Figure 1).

Ultrasound data at the end of the grazing period indicated very few differences between the feeding systems. Backfat was statistically 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 by any treatment. Loin muscle depth tended to increase with the hand-fed treatments as compared to the other treatments. There were no differences in ISO or ENO in carcass measures following a grazing period.

Costs of gain were different for each treatment group and were \$0.05, \$0.08, \$0.25, and \$0.27 per pound of gain for control, MIX30, block, and hand-fed treatments, respectively. These values were based on 2021 costs for products and delivery costs for each treatment. Intake was determined based on actual intake of feed ingredients for the steers during 2021. Delivery costs were determined based on feeding 100 head of stockers and traveling 20 miles round trip to feeding location and based on 2021 costs. The cost of production was high in 2021 (i.e., \$6/bu corn; \$3.25/gallon diesel cost). On average the hand-fed calves sold for \$1525 whereas the control and free-choice supplements averaged \$1357 (*https://usda.library.cornell.edu/concern/publications/gb19f584t?locale=en&page=2#release-items*). Even though the cost of gain was greatest for hand-fed calves, the extra weight and total sale price resulted in a greater net profit for hand-fed calves as compared to all other treatments. On average it cost \$41, \$95, and \$86 more per head to hand-feed supplement as compared to block, mineral, and MIX30, respectively. Even so, net profit was \$127, \$73, and \$82 more for hand-fed steers than block, mineral, and MIX30, respectively. All these values were based on 2021 costs of production and sale prices.

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

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] IntelliBond hydroxy copper.

[4] Zinpro zinc methionine.

[5] CoMax patented form of cobalt from ADM.

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	568	568	568	568	568	17.5	1.00	1.00	1.00	1.00
Final grazing weight, lb	854	841	844	980	967	19.1	<0.0001	<0.0001	0.01	0.62
Grazing ADG, lb/d	1.43	1.36	1.38	2.06	2.00	0.06	<0.0001	<0.0001	<0.001	0.43
Period average daily gain (ADG), lb/d										
d 28	4.35	3.86	4.52	4.91	4.85	0.17	<0.001	0.001	0.36	0.79
d 56	1.08	1.23	1.14	1.33	1.78	0.21	0.19	0.10	0.24	0.15
d 84	1.16	0.80	1.22	2.06	1.75	0.23	0.01	0.001	0.26	0.35
d 112	1.79	2.10	1.14	1.83	1.63	0.29	0.25	0.70	0.72	0.63
d 140	0.61	0.21	1.01	1.57	1.44	0.28	0.02	0.006	0.18	0.74
d 168	2.05	1.53	1.15	1.82	2.33	0.34	0.17	0.05	0.38	0.30
d 200	-0.84	0.01	-0.34	1.19	0.44	0.22	0.0001	0.0005	0.0003	0.03
Cumulative ADG grazing period, lb/d										
d 56	2.72	2.53	2.83	3.12	3.31	0.12	<0.0001	<0.0001	0.08	0.24
d 84	2.20	1.95	2.29	2.77	2.79	0.11	<0.0001	<0.0001	0.04	0.87
d 112	2.10	1.99	2.00	2.53	2.51	0.09	0.001	<0.0001	0.14	0.82
d 140	1.80	1.64	1.80	2.34	2.29	0.08	<0.0001	<0.0001	0.02	0.66
d 168	1.84	1.62	1.69	2.25	2.30	0.08	<0.0001	<0.0001	0.18	0.71
Ultrasound carcass measures: grazing phase										
Back fat, in.	0.16	0.17	0.16	0.21	0.23	0.02	0.04	0.007	0.11	0.50
Marbling[9,10]	5.01	4.99	4.93	4.93	4.81	0.17	0.92	0.58	0.64	0.63
Loin depth, mm	50.6	50.0	52.1	53.7	54.2	1.49	0.26	0.07	0.28	0.83

[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).
[9]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).
[10]U.S. Department of Agriculture marbling scores: 300–399: Slight 0–90; 400–499: Small 0–90; and 500–599: Modest 0–90.

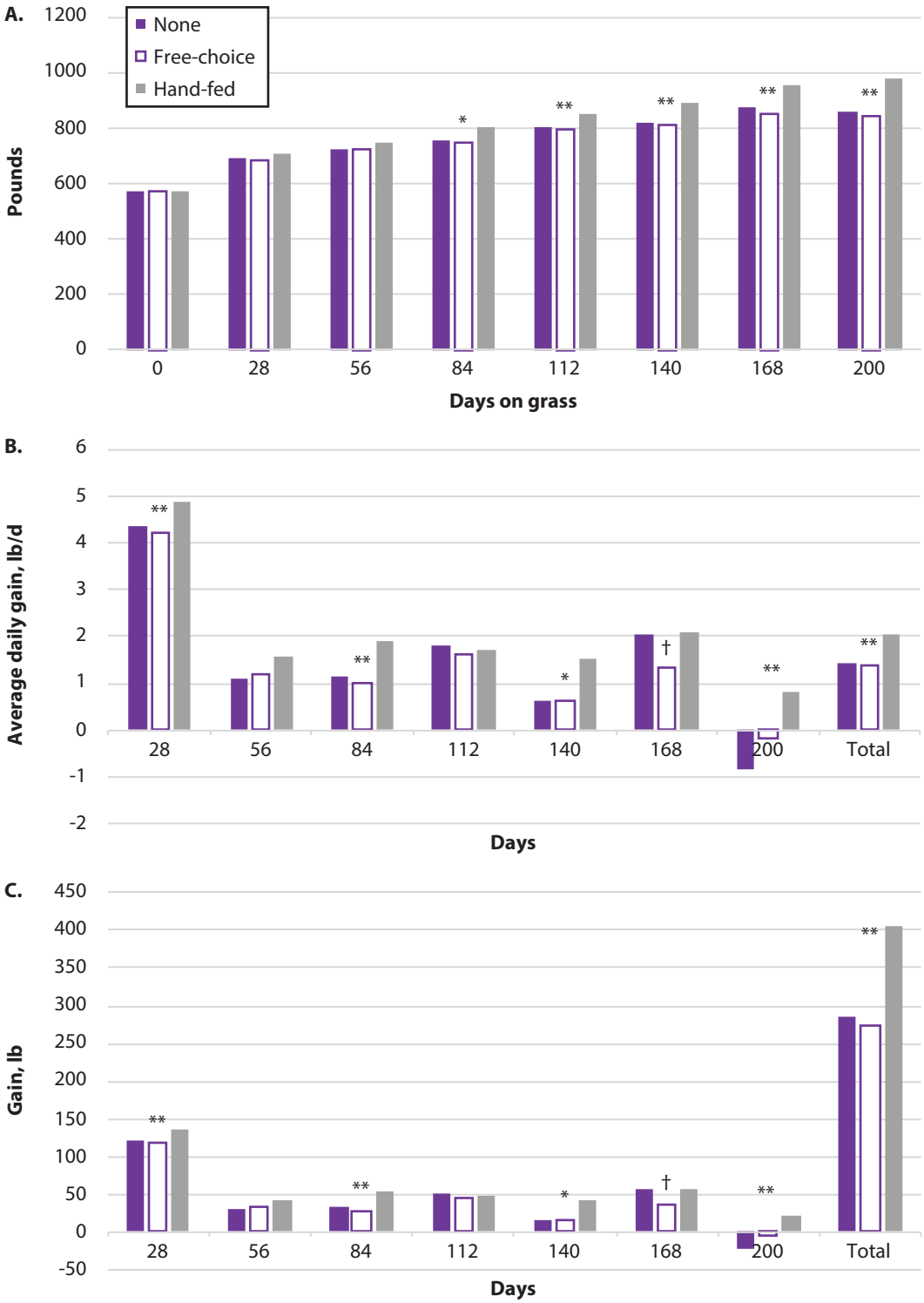

Figure 1. Steer weight, ADG, and total gains categorized by type of supplement; measured every 28 days.
* P <0.01; ** P < 0.001; † P < 0.10
Panel A: Steer weights by type of supplement, measured every 28 days.
Panel B: Average daily gain calculated every 28 days and total average daily gain based on type of supplement.
Panel C: Gain in each 28-day period based on type of supplement.
None: control treatment where steers received free-choice mineral.
Free-choice: steers received supplemental energy and protein from liquid feed (MIX30, AgriDyne) or block form (Mintrate 40 Red Block, ADM Nutrition).
Hand-fed: steers were supplemented at 0.5% of body weight on DM-basis with a blend of 60% corn and 40% dried distillers grains (DDGs) daily. Corn was an isoline genetic line or Enogen feed corn (Syngenta).