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Abstract

Stocker steers were grazed on bromegrass from April to the end of August and were supplemented with several different forms of products. Treatment structure was a $2 \times 2 + 2$ factorial (six total treatments). Treatments evaluated included mineral only; free-choice supplementation in the form of liquid feed (MIX30) or block format (Mintrate); hand-fed supplement of corn:dried distillers grains at 0.25% of body weight on a dry matter basis offered three times per week; and ionophore (Rumensin) was included in one block and hand-fed supplement. Steers were weighed every 28 days while on grass and in the feedlot. Steers were ultrasounded prior to placement in the feedlot and harvested when they reached at least 0.4-in. backfat and scanned Choice at 115 days on feed. There was no difference in steer gains during the grazing phase or feedlot phase based on all treatments, or if ionophore was included. However, during the grazing period hand-fed steers had greater gain than self-fed supplemented steers and these steers also had more backfat coming off-grass than other supplemented steers. During the finishing phase the steers that were on the self-fed supplement while on grass compensated and had a greater average daily gain than hand-fed steers. Hand-fed supplemented steers tended to have a more backfat at harvest and subsequently higher (but still acceptable) yield grade. Steers that were supplemented with MIX30 tended to have a greater average daily gain (ADG) in the feedlot than hand-fed steers, with block supplemented steers being intermediate. Additionally, MIX30 steers had a heavier final weight prior to harvest than block supplemented steers, with hand-fed being intermediate. There was no difference in ADG or total gain for the entire system (grazing and feedlot period).

Keywords

liquid feed, pressed block, hand-fed, marbling

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Form of Supplement and Addition of Ionophore Effects on Steer Performance while Grazing Bromegrass and Subsequent Effects in Feedlot and Carcass Measures

J.K. Farney and K. Malone¹

Summary

Stocker steers were grazed on bromegrass from April to the end of August and were supplemented with several different forms of products. Treatment structure was a $2 \times 2 + 2$ factorial (six total treatments). Treatments evaluated included mineral only; free-choice supplementation in the form of liquid feed (MIX30) or block format (Mint-rate); hand-fed supplement of corn:dried distillers grains at 0.25% of body weight on a dry matter basis offered three times per week; and ionophore (Rumensin) was included in one block and hand-fed supplement. Steers were weighed every 28 days while on grass and in the feedlot. Steers were ultrasounded prior to placement in the feedlot and harvested when they reached at least 0.4-in. backfat and scanned Choice at 115 days on feed. There was no difference in steer gains during the grazing phase or feedlot phase based on all treatments, or if ionophore was included. However, during the grazing period hand-fed steers had greater gain than self-fed supplemented steers and these steers also had more backfat coming off-grass than other supplemented steers. During the finishing phase the steers that were on the self-fed supplement while on grass compensated and had a greater average daily gain than hand-fed steers. Hand-fed supplemented steers tended to have a more backfat at harvest and subsequently higher (but still acceptable) yield grade. Steers that were supplemented with MIX30 tended to have a greater average daily gain (ADG) in the feedlot than hand-fed steers, with block supplemented steers being intermediate. Additionally, MIX30 steers had a heavier final weight prior to harvest than block supplemented steers, with hand-fed being intermediate. There was no difference in ADG or total gain for the entire system (grazing and feedlot period).

Introduction

Supplementation is important in cattle production because it could (1) fill the gap in 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

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geographic location, access to labor, distance to cattle from feed source, forage types, and economic goals. A variety of supplements for grass cattle have been developed to meet operational objectives. Determining which supplement best fits an operation can be daunting.

The purpose of this study was to evaluate the effect of cattle gain of stocker steers grazing brome grass during the summer (1) based on method of supplementation (hand-fed versus self-fed); (2) form of self-fed supplement; (3) addition of ionophore into the supplement; and (4) how supplementation strategy impacts performance in the feedlot and carcass characteristics.

Experimental Procedures

Eighteen brome pastures were used in a $2 \times 2 + 2$ factorial research project at the Southeast Research and Extension Center in Parsons, KS. The 2×2 factorial was evaluating supplement type and the addition of ionophore. The additional two treatments include MIX30 (liquid feed) and a negative control (no supplement except free choice mineral). Pastures were fertilized on March 4 and 5, 2020, based on recommendations from soil test for phosphorus and potassium and all pastures had 100 lb of nitrogen applied in 46-0-0 form.

Supplement Specifics

The hand-fed supplement (HAND) is a 50:50 blend of cracked corn:dried distillers grains (DDG) with or without Rumensin (138 g/ton; HANDRU) fed at 0.25% of body weight daily, offered 3 times a week on Monday, Wednesday, and Friday. The liquid feed supplement is a product called MIX30 (Agridyne, LLC; MIX30) fed in an open-topped tub. The block treatments were Mintrate 40 Red Block (ADM Alliance Nutrition; BLOCK) and the Mintrate Red RU (BLOCKRU). Blocks were fed free-choice to the steers and placed in bunks to contain all pieces of the block. The control (CON) treatment were steers that were fed a free-choice mineral (Farney, 2021).

The blocks and liquid tubs were weighed weekly to estimate intake. A new block was added when less than $\frac{1}{4}$ of the old block was remaining in the feed tub. New liquid was added weekly after agitation in storage tote and agitation in feeding tubs was done with a paint stirrer.

Cattle Specifics

Weaned and vaccinated steers (540 ± 14.7 lb) were used and stocked at 4 head per pasture on 5-acre pastures. There were three pastures of each treatment. To manage for rumen fill effects, four days before turnout steers were fed a 50:50 diet of wheat middlings and DDG at 2% of body weight for three full days. On days -1 and 0 (day of turnout) steers were weighed on two consecutive days and placed on brome pastures (April 2, 2020). Steers were wormed prior to turnout with a white wormer (Valbazen, Zoetis Inc.). During May, insecticide ear tags were inserted.

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 (August 31, 2020; 151 days on grass). After scanning, steers were placed on a rumen

fill equivalence diet for three days (50:50 blend of wheat middlings and DDG at 2% of body weight on DM basis) and weighed on two consecutive days before being placed in feedlot. Steers were placed in a feedlot at Mound Valley, KS; implanted with a terminal implant (Revalor XS), then placed on a step-up diet to reach a finishing diet. Steers were penned in feedlot by contemporary pasture group. The finishing diet (on DM basis) was 85% whole shelled corn, 10% corn silage, and 5% supplement (contains minerals, vitamins, urea, Tylan, and Rumensin). Steers were weighed every 28 days until ~0.4 inch of backfat then taken to commercial packing facility. Steers were harvested on January 7, 2021 (124 days on feed). Final weight was calculated from carcass weight divided by dressing percentage.

Results and Discussion

Grazing Period

Results are for year 1 of 3. During the study there was above average rainfall for the area through May, then much lower precipitation than usual. Due to weather, cattle were removed from the pasture nearly 2 months earlier than has traditionally been done with those pastures. There was no difference in grazing ADG when comparing all the treatments ($P = 0.36$; Table 1). However, grazing ADG was impacted by category of supplementation where hand-fed steers had a greater ADG than steers fed free-choice supplements ($P = 0.05$; Table 1). This advantage was observed after cattle had been on trial for 84 d and was maintained until steers reached the feedlot ($P < 0.05$; Table 1) and resulted in heavier final weight off-grass ($P = 0.04$; Table 1).

There was no difference in grazing ADG based on the addition of ionophore ($P = 0.43$), yet by 56 d into the study, calves with ionophore approached a tendency for improved gains as compared to non-ionophore feeds ($P = 0.12$). By d 112 of the study, steers fed ionophore did result in improved ADG ($P = 0.04$; Table 1). During the period of poorest quality forage (period between d 84 and 112) the ionophore did help improve gains over non-ionophore feeds ($P = 0.04$; Table 1).

There was no difference in ADG based on class of supplement up to d 84 on study ($P > 0.10$), yet based on cumulative gains from d 84 to 112, hand-fed steers gained more than steers supplemented with a block, and the liquid feed gains were intermediate ($P < 0.05$; Figure 1). For the entire grazing period there was no difference in gain based on supplement type ($P = 0.16$).

Ultrasound data at the end of the grazing period (d 150) indicated very few differences between the feeding systems. The only differences detected were that there was a tendency ($P = 0.09$) for backfat to be greater in hand-fed steers as compared to free-choice supplements and for marbling to be greater in control steers compared to any that were supplemented ($P = 0.09$; Table 1). Also, there was a tendency ($P = 0.11$) for hand-fed steers to have more backfat than liquid supplemented steers, with block supplemented steers being intermediate.

Feedlot Period

Average daily gain was greater in steers that were self-fed supplement during grazing period as compared to the hand-fed supplemented steers ($P = 0.07$; Table 1). The MIX30

steers had a greater ADG than hand-fed steers fed the supplement, with block being intermediate ($P = 0.06$; Table 2). Final weights were greater for MIX30 than steers fed the supplement block, with hand-fed being intermediate ($P = 0.09$; Table 2). No other gain measures were different during the feedlot period ($P > 0.15$; Table 1).

There were minimal differences in carcass characteristics based on form of supplement during the grazing period ($P > 0.15$; Tables 1 and 2). The only differences were a tendency for hand-fed supplemented steers to have more backfat than self-fed steers, and subsequently yield grade tended to be higher for hand-fed than self-fed ($P < 0.10$; Table 1). Even though hand-fed steers were higher in yield grade, it was still at an acceptable grade value.

System Performance Effects

There were no differences in the whole system (grazing and feedlot phase) for any treatment, addition of ionophore, hand-fed vs. self-fed supplement, nor type of supplement ($P > 0.20$; Tables 1 and 2).

Supplement Intake on Grass

The hand-fed cattle intakes were more consistent than self-fed intakes for the cattle on supplements and intakes increased through the feeding period, as the calves were increasing in weight. The most variable intake was found with the MIX30 supplement (Figure 2A). The steers had a higher intake of MIX30 early in the grazing period and then a much lower intake towards the end. Average daily protein and energy intakes were fairly similar across the feeding period for HAND and HANDRU. BLOCK and BLOCKRU also had similar protein and energy intakes that were nearly the same throughout the entire grazing period (Figure 2B and Figure 2C). Forage crude protein decreased through the grazing period (Figure 2D). Average pasture protein values were similar between pastures for each respective month (1.3% to 2.4% difference in treatments), even though in July (corresponds to period between d 84 and 112) the control pastures had a higher crude protein and that was the time when CON steers gained quite a bit more than supplemented steers (Table 1). Since supplement intakes were not different when the forage was lower quality, overall protein and energy supplied to steers resulted in the low to negative gains from d 112 to the end of grazing period.

References

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Table 1. Steer gain and carcass measures during the grazing, feedlot, and entire system

| Item | Treatment | | | | | | P-value | | | | |
|--|--------------------|---------------------|---------------------|-----------------------|---------------------|----------------------|------------------|------------------|----------------------------|-----------------------------|-------------------|
| | CON ¹ | MIX30 | Block ² | Block-RU ² | Hand ³ | Hand-RU ³ | SEM ⁴ | Trt ⁵ | Hand vs. self ⁶ | Supple. vs. no ⁷ | Ion. ⁸ |
| Start weight, lb | 540 | 540 | 540 | 540 | 540 | 540 | 14.9 | 1.00 | 0.99 | 0.99 | 0.99 |
| Final grazing weight, lb | 810 | 793 | 792 | 794 | 825 | 834 | 19.2 | 0.50 | 0.04 | 0.92 | 0.77 |
| Grazing ADG, lb/d | 2.04 | 1.87 | 1.83 | 1.97 | 2.07 | 2.09 | 0.10 | 0.36 | 0.05 | 0.48 | 0.43 |
| Final feedlot weight, lb | 1341 | 1375 | 1321 | 1320 | 1350 | 1323 | 21.1 | 0.41 | 0.92 | 0.87 | 0.50 |
| Feedlot ADG, lb/d | 4.29 | 4.52 | 4.14 | 4.24 | 4.11 | 3.94 | 0.15 | 0.21 | 0.07 | 0.56 | 0.81 |
| System ADG, lb/d | 2.91 | 2.97 | 2.81 | 2.83 | 2.88 | 2.85 | 0.07 | 0.66 | 0.88 | 0.55 | 0.95 |
| System gain, lb | 801 | 816 | 774 | 780 | 791 | 783 | 18.5 | 0.66 | 0.88 | 0.55 | 0.95 |
| Cumulative average daily gain (ADG) grazing period, lb/d | | | | | | | | | | | |
| d 28 | 4.34 | 4.10 | 3.74 | 4.33 | 3.97 | 3.99 | 0.22 | 0.40 | 0.69 | 0.21 | 0.19 |
| d 56 | 3.57 | 3.75 | 3.27 | 3.66 | 3.53 | 3.74 | 0.18 | 0.48 | 0.66 | 0.90 | 0.12 |
| d 84 | 2.85 | 2.93 | 2.55 | 2.77 | 3.06 | 3.09 | 0.17 | 0.28 | 0.05 | 0.89 | 0.47 |
| d 112 | 2.35 ^{ab} | 2.13 ^{bc} | 1.95 ^c | 2.16 ^{abc} | 2.21 ^{abc} | 2.42 ^a | 0.10 | 0.05 | 0.02 | 0.10 | 0.04 |
| d 140 | 1.99 | 1.83 | 1.79 | 1.91 | 2.06 | 2.06 | 0.11 | 0.36 | 0.05 | 0.60 | 0.57 |
| Period ADG grazing period, lb/d | | | | | | | | | | | |
| d 56 | 2.79 | 3.41 | 2.80 | 3.00 | 3.09 | 3.50 | 0.28 | 0.39 | 0.39 | 0.25 | 0.29 |
| d 84 | 1.43 | 1.28 | 1.11 | 1.00 | 2.12 | 1.78 | 0.35 | 0.26 | 0.02 | 0.95 | 0.53 |
| d 112 | 0.84 ^a | -0.24 ^{cd} | 0.16 ^{bcd} | 0.32 ^{abc} | -0.36 ^d | 0.41 ^{ab} | 0.21 | 0.01 | 0.79 | 0.01 | 0.04 |
| d 140 | 0.55 | 0.59 | 1.15 | 0.94 | 1.47 | 0.60 | 0.33 | 0.34 | 0.65 | 0.29 | 0.13 |
| Ultrasound carcass measures: grazing phase | | | | | | | | | | | |
| Back fat, in | 0.19 | 0.16 | 0.18 | 0.18 | 0.18 | 0.21 | 0.01 | 0.31 | 0.09 | 0.49 | 0.54 |
| Marbling ⁹ | 5.72 | 5.42 | 5.41 | 5.26 | 5.29 | 4.88 | 0.25 | 0.31 | 0.23 | 0.09 | 0.27 |
| Loin depth, mm | 50.0 | 50.1 | 49.1 | 51.0 | 52.0 | 47.2 | 1.67 | 0.44 | 0.75 | 0.98 | 0.38 |
| Carcass measures | | | | | | | | | | | |
| Hot carcass wt, lb | 793 | 805 | 787 | 779 | 809 | 789 | 12.9 | 0.62 | 0.48 | 0.98 | 0.30 |
| Dressing, % | 59.2 | 58.6 | 59.7 | 59.1 | 59.9 | 59.7 | 0.48 | 0.45 | 0.15 | 0.69 | 0.37 |
| Marbling score ¹⁰ | 473 | 466 | 448 | 467 | 461 | 487 | 30.1 | 0.96 | 0.63 | 0.81 | 0.47 |
| Ribeye area, sq in. | 12.9 | 13.0 | 12.8 | 13.3 | 12.9 | 12.6 | 0.35 | 0.84 | 0.45 | 0.95 | 0.91 |
| Backfat, in. | 0.42 | 0.40 | 0.44 | 0.42 | 0.52 | 0.47 | 0.05 | 0.52 | 0.09 | 0.60 | 0.49 |
| Yield grade | 2.85 | 2.84 | 2.89 | 2.66 | 3.16 | 3.10 | 0.20 | 0.56 | 0.10 | 0.69 | 0.49 |

^{abcd}Values indicate treatment differences within row with $P < 0.05$.

¹CON: control treatment received free choice mineral (Wildcat Feed, LLC).

²Block: Mintrate40 block (ADM Alliance Nutrition) and BlockRU: Mintrate RedRU block includes Rumensin at 300 g/ton (ADM Alliance Nutrition).

³Hand: 50:50 blend of dried distillers grains (DDG) and cracked corn offered at 0.25% of body weight, 3 times per week (Monday, Wednesday, and Friday) and HandRU: 50:50 blend of DDG and cracked corn with Rumensin as 139 g/ton offered at 0.25% of body weight, 3 times per week (Monday, Wednesday, and Friday).

⁴SEM: standard error of means.

⁵Trt: P -value comparison between all 6 treatments.

⁶Hand vs. Self: P -value comparison between free-choice treatments (MIX30, Block, BlockRU) and hand-fed treatments (Hand and HandRU).

⁷Supple. vs. No: P -value comparison non-supplemented (CON) and supplemented (MIX30, Block, BlockRU, Hand, and HandRU).

⁸Ion.: P -value comparison between treatments with ionophore (BlockRU and HandRU) or without ionophore (Block and Hand).

⁹Ultrasound 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>).

¹⁰U.S. Department of Agriculture marbling scores: 300-399: Slight 0-90; 400-499: Small 0-90; and 500-599: Modest 0-90.

Table 2. Carcass measures based on category of supplementation (average \pm standard error of means)

| Item | Block ¹ | Liquid ² | Hand ³ | P-value |
|-------------------------------|-------------------------------|------------------------------|-------------------------------|---------|
| Gain measures | | | | |
| Grass period ADG, lb/d | 1.90 \pm 0.1 | 1.87 \pm 0.1 | 2.08 \pm 0.1 | 0.16 |
| Grass period final wt, lb | 793 \pm 13.3 | 793 \pm 18.8 | 830 \pm 13.3 | 0.11 |
| Feedlot period ADG, lb/d | 4.19 \pm 0.1 ^{ab} | 4.52 \pm 0.2 ^a | 4.02 \pm 0.1 ^b | 0.06 |
| Feedlot period final wt, lb | 1320 \pm 13.6 ^b | 1375 \pm 20.6 ^a | 1335 \pm 13.9 ^{ab} | 0.09 |
| System ADG, lb/d | 2.83 \pm 0.04 | 2.97 \pm 0.07 | 2.86 \pm 0.04 | 0.21 |
| Total system gain, lb | 777 \pm 12.2 | 816 \pm 18.5 | 787 \pm 12.5 | 0.21 |
| Ultrasound measures off-grass | | | | |
| Marbling score ⁴ | 5.34 \pm 0.15 | 5.41 \pm 0.22 | 5.08 \pm 0.15 | 0.36 |
| Back fat, mm | 4.52 \pm 0.25 ^{ab} | 4.03 \pm 0.37 ^b | 4.95 \pm 0.25 ^a | 0.11 |
| Loin depth, mm | 50.1 \pm 1.1 | 50.1 \pm 1.6 | 49.6 \pm 1.1 | 0.95 |
| Carcass data | | | | |
| Hot carcass wt, lb | 783.4 \pm 8.7 | 805.4 \pm 13.2 | 798.5 \pm 8.9 | 0.30 |
| Dressing, % | 59.4 \pm 0.3 | 58.6 \pm 0.5 | 59.8 \pm 0.3 | 0.15 |
| Marbling score ⁵ | 457.4 \pm 20.0 | 466.1 \pm 29.4 | 474.5 \pm 20.2 | 0.84 |
| Ribeye area, sq in. | 13.0 \pm 0.2 | 13.0 \pm 0.4 | 12.8 \pm 0.2 | 0.67 |
| Backfat, in. | 0.43 \pm 0.03 | 0.40 \pm 0.05 | 0.50 \pm 0.03 | 0.17 |
| Yield grade | 2.77 \pm 0.14 | 2.84 \pm 0.21 | 3.13 \pm 0.14 | 0.23 |

¹Block: averages from Mintrate40 block and MintrateRU block (ADM Alliance Nutrition) treatments.

²Liquid: Mix 30 (Agridyne, LLC).

³Hand: Average gains from hand feeding (without and with Rumensin) 50:50 blend of dried distillers grains and cracked corn at 0.25% of body weight, 3 times per week.

⁴Ultrasound 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>).

⁵U.S. Department of Agriculture marbling scores: USDA – 300-399: Slight 0-90; 400-499: Small 0-90; and 500-599: Modest 0-90.

ADG = average daily gain.

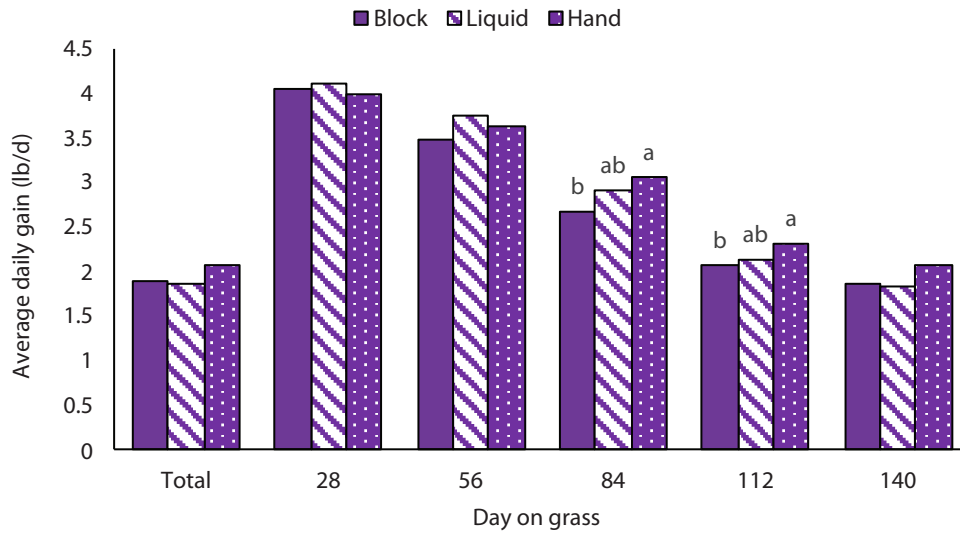


Figure 1. Cumulative average daily gains measured every 28 days, based on supplement category.

Block: Average gains of Mintrate Red40 and Mintrate RedRU blocks.

Liquid: Average daily gains on MIX30 liquid supplement.

Hand: Average gains from hand feeding (without and with Rumensin) 50:50 blend of dried distillers grains and cracked corn at 0.25% of body weight, 3 times per week.

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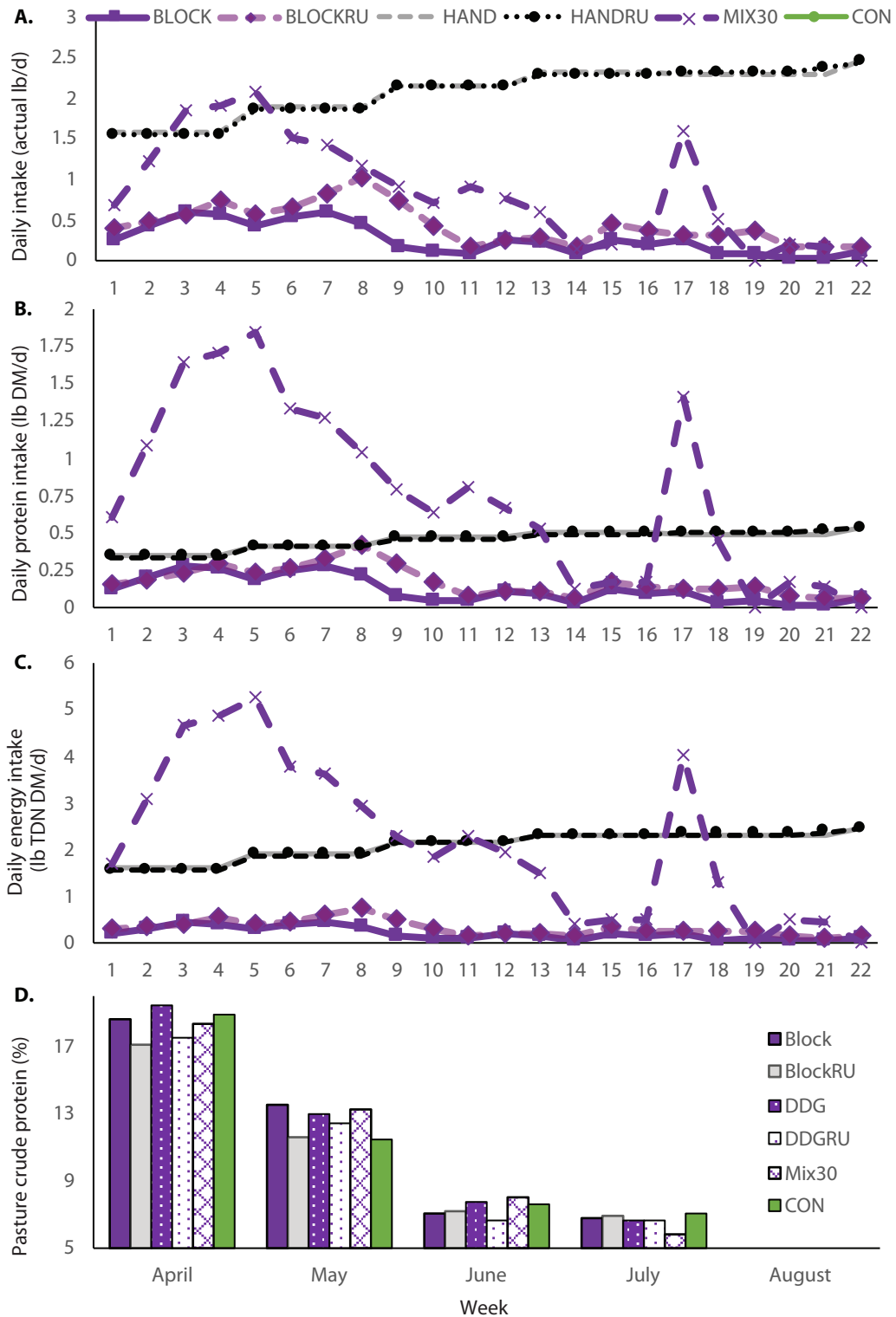


Figure 2. Daily intake of supplements (as-is), protein and energy (DM basis), and average pasture crude protein over grazing period. See Table 1 for the treatment definitions listed in this figure.

DM = dry matter. TDN = total digestible nutrients.