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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 180 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, and 2018. Supplementation treatments evaluated were: no supplement, a supplement with starch as the primary source of energy, and a supplement with fat as the primary source of energy. 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 five years. In 2014, 2016, 2017, and 2018, 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 live weight, 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 live weight, 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.

### **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 steers 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) and March 27, 2018 (443 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, and 224 days in 2014, 2015, 2016, 2017, and 2018, 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, and 2018, 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, and 2018) and energy (3.3 lb of TDN in 2014 and 2015 and 3.4 lb of TDN in 2016, 2017, and 2018) 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; and February 13, 2018. 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); and November 6, 2018 (224 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 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, and 91 days in 2014, 2015, 2016, and 2017 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 2018 were being finished for slaughter at the time that this report was written.

## Results and Discussion

Average available forage for the smooth bromegrass pastures during the grazing phase, and grazing and subsequent finishing performance of grazing steers are presented by supplementation treatment for 2014, 2015, 2016, and 2017 in Tables 1, 2, 3, and 4,

respectively. Grazing performance only is presented for 2018 in Table 5. Supplementation treatment had no effect ( $P > 0.05$ ) on the quantity of forage available for grazing in any year. Pastures grazed by supplemented steers might be expected to have greater available forage dry matter 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 they did not affect forage consumption.

Supplemented steers had greater ( $P < 0.05$ ) weight gain, daily gain, and steer gain/a than those that received no supplement in all five years. In 2014, 2016, 2017, and 2018, 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 2014, steers fed the starch-based supplement had greater ( $P < 0.05$ ) final finishing live weight, 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 greater ( $P < 0.05$ ) grazing gains than those that received the starch-based supplement. 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, 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, and had greater ( $P < 0.05$ ) hot carcass weight 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. 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 and greater ( $P < 0.05$ ) overall gains 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 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, and had greater ( $P < 0.05$ ) hot carcass weight than those that received no supplement. 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. Steers that were supplemented during the grazing phase had greater ( $P < 0.05$ ) overall gains than those that received no supplement.

Under the conditions of this study, supplementation of stocker cattle grazing smooth brome grass 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.

**Table 1. Effect of supplemental energy source on grazing and subsequent finishing performance of steers grazing smooth brome grass pastures, Southeast Research and Extension Center, 2014**

| Item   | Supplemental energy source |        |        |
|--|----------------------------|--------|--------|
|  | 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 <sup>1</sup>                            | 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 |

<sup>1</sup>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, Southeast Research and Extension Center, 2015**

| Item   | Supplemental energy source |        |       |
|--|----------------------------|--------|-------|
|  | 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 <sup>1</sup>                            | 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 |

<sup>1</sup>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 brome grass pastures, Southeast Research and Extension Center, 2016**

| Item   | Supplemental energy source |        |       |
|--|----------------------------|--------|-------|
|  | 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 <sup>1</sup>                            | 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 |

<sup>1</sup>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 brome grass pastures, Southeast Research and Extension Center, 2017**

| Item   | Supplemental energy source |        |        |
|--|----------------------------|--------|--------|
|  | 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 <sup>1</sup>                            | 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  |

<sup>1</sup>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 performance of steers grazing smooth bromegrass pastures, Southeast Research and Extension Center, 2018**

| Item                                    | Supplemental energy source |        |       |
|---|----------------------------|--------|-------|
|   | 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   |

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