2018

Effect of Backgrounding System on Performance and Profitability of Yearling Beef Steers

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Summary with Implications

Five summer management strategies were compared following grazing corn residue through winter. Cattle were assigned to be 1) summer finished, 2) graze bromegrass, 3) graze bromegrass and fed distillers grains at 0.6% of BW, 4) backgrounded in a drylot pen to gain 1.70 lb/d, or 5) backgrounded in a drylot pen to gain 2.35 lb/d. Results differed by year, however, in general as backgrounding ADG increased, days required on feed to reach an equal fat endpoint decreased. In year 1, ADG of cattle grazing bromegrass was less than cattle backgrounded in pens. There was no difference in finishing ADG for summer backgrounded steers. In year 2, steers grazing bromegrass with no supplement had the lowest summer ADG but exhibited compensatory growth in the feedlot. Overall, backgrounding systems increase carcass weights when cattle are finished to an equal fat thickness.

Introduction

Yearlings can be finished in the summer as short yearlings or in the fall as long yearlings coming off grass. Previous research has evaluated optimal supplementation rates during both the winter and summer. Previous research has reported increased gains for yearling calves supplemented with distillers grains while grazing summer range which led to decreased days on feed (2011 Nebraska Beef Report, pp. 31–32). However, research evaluating the effects of winter and subsequent summer supplementation in a yearling system reported that higher levels of supplementation while cattle graze corn residue is beneficial, but supplementation while grazing summer range was not due to compensation of unsupplemented calves during the finishing period (2014 Nebraska Beef Report, pp. 39–42). Effect of supplementation strategies on performance of yearling steers grazing a cool-season grass in the summer following winter supplementation while grazing corn residue has not been conducted.

The objective of this study was to evaluate the effects of differing summer management strategies on subsequent finishing performance and carcass characteristics.

Procedure

A 2-year experiment was conducted utilizing 240 yearling steers (yr 1 initial BW = 548 lb, SD = 20; yr 2 initial BW = 533 lb, SD = 33) each year. Treatments consisted of 5 summer management strategies with 4 replications of each treatment per year (12 steers per replication). Prior to grazing corn stalks, steers were limit fed a diet consisting of 50% alfalfa and 50% Sweet Bran at 2.0% of BW for 5 days to equalize gut fill. Steers were then weighed on 2 consecutive days (d 0 and 1) and the average of those 2 days was used as initial winter BW.

Winter Phase

Steers grazed corn residue for 154 d in year 1 and 161 d in year 2 from November to mid-April. Throughout the winter, steers were supplemented with 5.5 lb DM of modified distillers grains plus solubles (MDGS) daily along with a supplement that supplied monensin at 200 mg/steer daily. Available grazing days for each residue field was calculated using estimates of residue amount and grazing efficiency as reported by previous research (2012 Nebraska Beef Report, pp. 11–12). Estimated available forage was divided by estimated dry matter intake (DMI) (10 lb/steer daily) of steers to determine the number of grazing days the field could support. Steers were implanted with 36 mg of zeranol (Ralgro; Merck Animal Health) on d 1 of the winter phase.

Summer Backgrounding Phase

At the conclusion of corn residue grazing, steers were placed in pens and limit fed for 5 days to equalize gut fill. Steers were weighed on 3 consecutive days and the average of those 3 days was used as initial summer or finishing BW depending on treatment. Steers were blocked by the average of the d-1 and 0 BW (n = 3), stratified by BW within block and assigned to 1 of 5 summer management strategies. There were 4 replications per treatment each year (1 light block, 2 middle block, and 1 heavy block) with 12 steers per replication. Treatments consisted of summer finished steers (SHORT), steers grazing smooth bromegrass and supplemented with dried distillers grains plus solubles (DDGS) at 0.6% of BW (SUPP), steers grazing smooth bromegrass with no supplement (UNSUPP), steers backgrounded in a pen to target average daily gain (ADG) of 2.35 lb/d (HI), and steers backgrounded in a pen to target ADG of 1.70 lb/d (LO). The level of targeted gain in the HI and LO treatments was equal to a 10-yr average of SUPP and UNSUPP gains on brome pastures (2016 Nebraska Beef Report, pp. 61–64).

Steers in the HI and LO treatments were placed in pens by replication and limit fed a common diet which consisted of 30% Sweet Bran, 35% MDGS, 31% wheat straw, and 4% supplement which provided trace minerals and vitamins and monensin at 200 mg/steer daily. Steers on HI were limit fed the common diet at 2.08% of initial summer BW while the LO calves were fed at 1.72% of initial summer BW.

Supplemented and UNSUPP replicates were assigned randomly to smooth bromegrass pastures. Each pasture area was divided into 6 paddocks that were rotationally grazed and the grazing period was

Table 1. Effect of growing system on summer performance

	Treatments[1]						*P*-Value		
Item,	SHORT	HI	LO	SUPP	UNSUPP	SEM	Trt	Year	Int[2]
Winter, year 1[3]									
Initial BW, lb	547	549	547	551	549	3.67	0.78	< 0.01	0.74
ADG, lb	1.86	1.86	1.87	1.85	1.86	0.03	0.95	< 0.01	0.84
Winter, year 2[3]									
Initial BW, lb	535	535	529	530	534	3.67	0.78	< 0.01	0.74
ADG, lb	1.73	1.74	1.76	1.79	1.73	0.03	0.95	< 0.01	0.84
Summer, year 1[4]									
Initial BW, lb	-	844	843	843	842	3.10	0.71	< 0.01	0.71
ADG, lb	-	2.27[a]	1.79[b]	1.61[c]	1.00[d]	0.050	< 0.01	0.73	< 0.01
F:G	-	7.75	7.99	-	-	-	0.18	0.03	0.87
Summer, year 2[4]									
Initial BW, lb	-	820	812	822	818	3.10	0.71	< 0.01	0.71
ADG, lb	-	2.07[a]	1.66[b]	1.98[a]	1.04[c]	0.050	< 0.01	0.73	< 0.01
F:G	-	8.21	8.49	-	-	-	0.18	0.03	0.87

[abcd] Means within a row without common superscript are significantly different ($P < 0.05$).
[1] Treatments = short yearlings (SHORT), high level of backgrounding gain in pen (HI), low level of backgrounding gain in pen (LO), supplemented with DDGS at 0.6% of BW while grazing smooth bromegrass (SUPP), grazed smooth bromegrasss with no supplement (UNSUPP).
[2] Treatment x year interaction.
[3] Winter = corn stalk residue grazing for 154 days in year 1 and 161 days in year 2.
[4] Summer = Respective treatment for 156 days in year 1 and 161 days in year 2.

divided into 5 cycles with BW measured at the beginning of each cycle.

Pastures were stocked at a rate of 4.0 animal unit months (AUM)/ac for SUPP cattle and 2.8 AUM/ha for the UNSUPP cattle. Amount of DDGS delivered to SUPP cattle was 0.6% of BW and updated using interim weights, shrunk 4%.

In both years, SUPP, UNSUPP, HI, and LO calves were implanted with Ralgro (Merck Animal Health) on d 1 of the summer phase and with 200 mg progesterone and 20 mg estradiol (Component E-S, Elanco Animal Health) on d 60 (SUPP and UNSUPP) or d 61 (HI and LO).

Finishing Phase

Summer finished steers (April–September) were fed a finishing ration for 146 d in year 1 and 133 d in year 2 and implanted with Component E-S on d 1 and with 120 mg trenbolone acetate and 24 mg estradiol (Component TE-S, Elanco Animal Health) on d 60 of the finishing phase each year. Summer finished steers were adapted to a finishing diet which consisted of 51% high-moisture corn, 30% Sweet Bran, 10% MDGS, 5% wheat straw, and 4% supplement. Carcass ultrasound was used in order to harvest all cattle at an equal fat endpoint target of 0.55 in of 12th rib fat.

Upon removal from bromegrass in September, SUPP and UNSUPP cattle were placed into pens and limit fed for 5 days to equalize gut fill. All steers were weighed on 3 consecutive days and the average of those 3 days was used as initial finishing BW. Steers on the HI and LO treatments remained in their respective pens and were switched to the limit fed diet the same day the SUPP and UNSUPP steers began limit feeding. Steers were adapted to the same finishing diet fed to SHORT steers. Summer backgrounded treatments were implanted with Component TE-S approximately 90 days from slaughter. On day of harvest HCW was recorded. Final BW was then calculated as HCW divided by a common dressing percent of 63%. Following a 48-hr chill, 12th rib fat, LM area, and marbling score were recorded.

Statistical Analyses

All performance data were analyzed using the GLIMMIX procedure of SAS (SAS Institute Inc., Cary, NC). Summer management strategy, year, block within year, and summer management × year interaction were included in the model as fixed effects. Replicate within year was the experimental unit. Differences were considered significant at $P < 0.05$. Tendencies are discussed at $P < 0.10$. There were significant treatment × year interactions for most performance and economic measures, therefore results are presented by treatment within year.

Results

Winter Phase

Initial winter BW was similar across all treatments ($P = 0.78$; Table 3), however, steers were heavier in year 1 (555 lb) than in year 2 (533 lb; $P < 0.01$). Likewise, by design, ADG of steers when supplemented with 5.5 lb/steer daily of MDGS while grazing corn residue did not differ across treatments ($P = 0.95$) but was greater in year 1 than in year 2 (1.85 vs. 1.76 lb/d; $P < 0.01$).

Summer Backgrounding Phase

By design there was no difference in initial BW for the summer backgrounding

Table 2. Effect of growing system on finishing performance

	Treatments[1]						*P*-Value		
Item,	SHORT	HI	LO	SUPP	UNSUPP	SEM	Trt	Year	Int[2]
Year 1									
Initial BW, lb	842[e]	1204[a]	1129[b]	1101[c]	1005[d]	7.94	< 0.01	0.11	< 0.01
Initial 12[th] Rib fat, in	0.108[c]	0.208[a]	0.118[bc]	0.186[a]	0.141[b]	0.007	< 0.01	0.21	< 0.01
Final BW, lb[3]	1489[b]	1571[a]	1571[a]	1535[ab]	1462[b]	27.3	< 0.01	0.37	< 0.01
DMI, lb/d	27.6[b]	30.6[a]	30.8[a]	31.3[a]	31.7[a]	0.35	< 0.01	< 0.01	0.84
ADG, lb	4.43[a]	3.78[b]	3.75[b]	3.68[b]	3.87[b]	0.11	0.06	0.97	< 0.01
F:G	6.25[a]	8.06[b]	8.26[b]	8.47[b]	8.20[b]	-	< 0.01	< 0.01	< 0.01
DOF[4]	146	97	118	118	118	-	-		-
System ADG, lb[5]	3.06[a]	2.43[b]	2.32[bc]	2.23[c]	2.07[d]	0.04	< 0.01	0.12	< 0.01
Year 2									
Initial BW, lb	819[d]	1162[a]	1089[b]	1151[a]	995[c]	7.94	< 0.01	0.11	< 0.01
Initial 12[th] Rib fat, in	0.077[c]	0.207[a]	0.117[b]	0.209[a]	0.112[b]	0.007	< 0.01	0.21	< 0.01
Final BW, lb[3]	1324[c]	1537[b]	1654[a]	1514[b]	1517[b]	27.3	< 0.01	0.37	< 0.01
DMI, lb/d	25.0[b]	28.0[a]	27.4[a]	27.9[a]	28.4[a]	0.35	< 0.01	< 0.01	0.84
ADG, lb	3.79[b]	3.89[b]	3.97[b]	3.82[b]	4.35[a]	0.11	0.06	0.97	< 0.01
F:G	6.58[a]	7.19[b]	6.90[ab]	7.04[ab]	6.54[a]	-	< 0.01	< 0.01	< 0.01
DOF[4]	133	96	142	96	121	-	-		-
System ADG, lb[5]	2.55[a]	2.31[b]	2.44[a]	2.29[b]	2.16[c]	0.04	< 0.01	0.12	< 0.01

[abcd] Means within a row without common superscript are significantly different ($P < 0.05$).
[1] Treatments = short yearlings (SHORT), high level of backgrounding gain in pen (HI), low level of backgrounding gain in pen (LO), supplemented with DDGS at 0.6% of BW while grazing smooth bromegrass (SUPP), grazed smooth bromegrasss with no supplement (UNSUPP).
[2] Treatment x year interaction.
[3] Final BW = HCW ÷ 0.63.
[4] Treatments were fed to same target 12[th] rib fat thickness.
[5] Total BW gain ÷ total days in system.

phase for the HI, LO, SUPP, and UNSUPP treatments ($P = 0.71$; Table 3), however, steers were lighter in year 2 than in year 1. There was a treatment × year interaction for ADG during the summer backgrounding phase ($P < 0.01$). In year 1, all four treatments had differing rates of gain with HI being the greatest (2.27 lb/d) followed by LO (1.79 lb/d), SUPP (1.61 lb/d), and UNSUPP (1.00 lb/d). In year 2, however, the HI and SUPP treatments had similar rates of ADG (2.07 and 1.98 lb/d, respectively), followed by the LO treatment (1.66 lb/d) and the UNSUPP treatment was lowest (1.04 lb/d). For the HI and LO treatments, feed to gain conversion (F:G) did not differ ($P = 0.18$), but was lower in year 1 (7.87 lb/lb) than in year 2 (8.35 lb/lb; $P = 0.03$). At the end of the summer, SUPP cattle were 97 lb heavier than UNSUPP cattle in year 1 and 156 lb heavier in year 2.

By design, the HI and SUPP, and the LO and UNSUPP were managed to have similar ADG. In year 1, the HI and LO treatments had gains close to predicted levels, however, ADG of the SUPP and UNSUPP were below predictions from previous years.

Finishing Phase

There was a treatment × year interaction for initial feedlot BW ($P < 0.01$; Table 4) due to differing ADG during the summer backgrounding phase. In year 1, HI cattle had the greatest initial feedlot body weight (1204 lb; $P < 0.01$) followed by LO (1129 lb), SUPP (1101 lb), and UNSUPP (1005 lb). The SHORT treatment had the lowest initial feedlot body weight (842 lb), due to the treatment being finished during the summer rather than backgrounded further prior to finishing. In year 2, with similar ADG observed in the summer backgrounding phase, initial feedlot BW for the HI and SUPP treatments did not differ ($P = 0.32$) but were greater than LO (1089 lb) and UNSUPP (995 lb; $P < 0.01$). As observed in year 1, due to being placed on the finishing ration in April, the SHORT treatment had the lowest initial feedlot BW (819 lb). There was no treatment × year interaction for DMI ($P = 0.84$); however, there was a main effect of treatment ($P < 0.01$). In both years the four summer backgrounding treatments had greater DMI than the SHORT treatment ($P < 0.01$) but did not differ from one another ($P \geq 0.14$).

There was a treatment × year interaction for feedlot ADG and F:G ($P < 0.01$). In year 1 there was no difference in ADG between the HI (3.78 lb/d), LO (3.75 lb/d), SUPP (3.68/d), and UNSUPP (3.87/d; $P \geq 0.23$) which were all less than the SHORT treatment (4.43 lb/d; $P < 0.01$). Similarly, in year 1 the SHORT treatment had the lowest F:G during finishing ($P < 0.01$), while the other

Table 3. Effect of growing system on carcass characteristics

	Treatments[1]						*P*-Value		
Item,	SHORT	HI	LO	SUPP	UNSUPP	SEM	Trt	Year	Int[2]
Year 1									
HCW, lb	938^{b}	990^{a}	990^{a}	967^{ab}	921^{b}	17.2	< 0.01	0.31	< 0.01
LM area, in^2	13.8^{a}	13.6^{ab}	13.3^{ab}	13.5^{ab}	13.1^{b}	0.18	0.19	0.08	< 0.01
12th Rib fat, in	0.63^{x}	0.55^{xy}	0.54^{xy}	0.58^{xy}	0.52^{y}	0.02	0.02	0.12	0.18
Marbling Score[3]	481^{z}	484^{yz}	514^{x}	491^{yz}	492^{xy}	10.8	< 0.01	0.94	0.23
Calculated YG[4]	3.74^{y}	3.80^{y}	3.86^{x}	3.84^{xy}	3.60^{y}	0.07	< 0.05	0.60	0.24
EBF, %[5]	31.9	31.5	31.8	31.9	30.8	0.42	0.12	0.31	0.08
Year 2									
HCW, lb	834^{c}	962^{b}	1042^{a}	954^{b}	956^{b}	17.2	< 0.01	0.31	< 0.01
LM area, in^2	12.6^{c}	13.7^{a}	13.6^{ab}	13.2^{ab}	13.1^{b}	0.18	0.19	0.08	< 0.01
12th Rib fat, in	0.56^{x}	0.54^{xy}	0.56^{xy}	0.52^{xy}	0.51^{y}	0.02	0.02	0.12	0.18
Marbling Score[3]	442^{z}	488^{yz}	538^{x}	483^{yz}	511^{xy}	10.8	< 0.01	0.94	0.23
Calculated YG[4]	3.6^{y}	3.6^{y}	4.0^{x}	3.7^{xy}	3.7^{y}	0.07	< 0.05	0.60	0.24
EBF, %[5]	30.4^{b}	31.2^{b}	32.6^{a}	31.0^{b}	31.3^{b}	0.42	0.12	0.31	0.08

[abcd] Means within a row without common superscript are significantly different for treatment × year interaction (*P* < 0.05).
[xyz] Means within a row without common superscript are significantly different for main effect of treatment (*P* < 0.05).
[1] Treatments = short yearlings (SHORT), high level of backgrounding gain in pen (HI), low level of backgrounding gain in pen (LO), supplemented with DDGS at 0.6% of BW while grazing smooth bromegrass (SUPP), grazed smooth bromegrasss with no supplement (UNSUPP).
[2] Treatment x year interaction.
[3] Marbling Score: 400 = Small^{00}, 500 = Modest^{00}.
[4] Calculated as 2.5 + (2.5 x 12th rib fat) + (0.2 x 2.5 (KPH)) + (0.0038 x HCW)–(0.32 x LM area).
[5] Calculated as 17.76207 + (4.68142 x 12th rib fat) + (0.01945 x HCW) + (0.81855 x QG)–(0.06754 x LM area).

treatments did not differ from one another ($P \geq 0.36$). In year 2 however, the UNSUPP treatment had the greatest ADG (4.35 lb/d; $P < 0.01$) with no difference between the other treatments ($P \geq 0.26$). Feed conversion was similar for the SHORT, UNSUPP, LO, and SUPP treatments ($P \geq 0.12$). Feed conversion for the HI treatment was greater than the SHORT and UNSUPP ($P \leq 0.04$) treatment but did not differ from the LO and SUPP treatments ($P \geq 0.36$).

In year 1 there was no compensatory growth as evidenced by similar ADG among summer backgrounded treatments regardless of restriction and/or degree of restriction. Of note, however, the relative difference in finishing ADG between the SUPP and UNSUPP treatments was 0.19 lb/d which lead to a 25% compensation for the UNSUPP compared to the SUPP treatment. Additionally, we hypothesized that the LO treatment would also have increased ADG during the finishing period relative to the HI treatment, but this was not observed.

In year 2, compensatory gain was observed for the UNSUPP treatment. The UNSUPP treatment compensated 103% compared to the SUPP treatment. It is unclear why the UNSUPP treatment exhibited compensatory growth during the finishing phase in year 2 but not year 1.

There was a treatment × year interaction for total system ADG ($P < 0.01$). In year 1 the SHORT treatment had the greatest system ADG followed by the HI and LO. The SUPP treatment was then lower than the HI ($P < 0.01$) but not different from the LO ($P = 17$). The UNSUPP treatment had the lowest system ADG. In year 2, the SHORT and LO treatments had the highest system ADG followed by the HI and SUPP treatments ($P < 0.05$). Once again, the UNSUPP treatment had the lowest system ADG. Differences in system ADG for treatments relative to one another is attributed to differences in the summer backgrounding and/or finishing phases between years.

Carcass Characteristics

There was a treatment × year interaction for HCW ($P < 0.01$). In year 1 the HI, LO, and SUPP treatments had the heaviest HCW followed by the UNSUPP and SHORT treatments which were lighter than the HI and LO ($P < 0.05$). The SHORT treatment was not different from the SUPP treatment ($P = 0.23$) while the UNSUPP treatment tended to be lighter ($P = 0.06$). In year 2 the LO treatment had the greatest HCW ($P < 0.01$) followed by the HI, SUPP, and UNSUPP treatments which were all greater than the SHORT treatment ($P < 0.01$).

In year 1 of the current study, HCW of the SHORT treatment did not differ from every one of the summer backgrounded treatments, however, those cattle were fatter. In year 2, when cattle were fed to more similar fat endpoint, HCW of the SHORT cattle was lowest. Within the summer backgrounded treatments, when fed to equal endpoints, HCW was similar with the exception being the LO treatment in year 2. Increased HCW was a result of increased days on feed (DOF) needed to reach the target fat endpoint. The increased days required to reach a similar 12th rib fat as other treatments combined with the increase in marbling score relative to other treatments may suggest that the LO cattle deposited more fat intramuscularly than subcutaneously

There was a treatment × year interaction

($P < 0.01$) for LM area and a main effect of treatment on marbling score ($P < 0.01$) and calculated YG ($P < 0.05$). The LO treatment had the highest YG which tended to be greater than the SUPP treatment ($P = 0.08$) and was greater than the YG of the SHORT, HI, and UNSUPP ($P \leq 0.04$) treatments which were all similar to the SUPP ($P \geq 0.27$). Increased occurrence of yield grade 4 and above was above 20% for all treatments in both years except for the SHORT treatment in year 2. Additionally, occurrence of overweight carcasses (> 1000 lb) was 8.3% and 0% for the SHORT treatment in years 1 and 2, respectively. For the summer backgrounded treatments in year 1, overweight carcasses occurred at a rate of 41.7, 50.0, 27.1, and 6.3% for the HI, LO, SUPP, and UNSUPP treatments, respectively. In year 2, occurrence rate was 31.9, 66.7, 27.3, and 22.7% for the same treatments.

Conclusions

Steers backgrounded through the summer and finished in the fall had increased HCW and typically required fewer days in the feedlot to reach a similar fat endpoint as summer finished steers. Backgrounding yearlings in drylot pens during the summer resulted in more consistent performance across the 2 years than grazing steers on grass. When fed at either a high or low rate of gain in the drylot pens, steers had similar ADG and F:G when finished, although steers backgrounded at a higher rate of gain required fewer DOF. Steers supplemented with DDGS at 0.6% of BW while grazing bromegrass had greater ADG than unsupplemented steers during the summer. Differences in compensatory growth of the unsupplemented steers between years is supported by variability in previous research evaluating compensatory growth. Growing systems targeting compensatory growth then, may not yield consistent results across years.

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