Timing of Implant Use in the Backgrounding System

Kelton C. Adair
Kylie M. Butterfield
Zach E. Carlson
Braden C. Troyer
Jiehua Xiong
Mitchell M. Norman
Galen E. Erickson
Mary E. Drewnoski
Brandon L. Nuttelman
James C. MacDonald

Summary with Implications

A two-year study utilized 240 weaned steers each year in a 3-phase yearling production system: winter backgrounding, summer grazing, and finishing. The objective of the study was to determine the effects of winter rate of gain (LOW or HIGH) and implant strategy during the winter backgrounding and summer grazing periods on compensatory gain, animal performance, and carcass characteristics. Calves received 1 of 3 implant strategies: NONE, SINGLE (Revalor-G during summer grazing), and MULTIPLE (Ralgro during winter backgrounding and Revalor-G during summer grazing). All cattle received a Revalor-XS during the finishing phase. Implant strategy and rate of gain during the winter backgrounding phase had additive effects to increase animal performance through all phases. When cattle were backgrounded at a LOW rate of gain, an additional 28 lb of hot carcass weight was attributed to Revalor-G. When cattle were backgrounded at a high rate of gain, an additional 32 lb of hot carcass weight was attributed to Ralgro. Combining the MULTIPLE implant strategy and HIGH rate of gain during winter backgrounding resulted in 75 lb of additional hot carcass weight.

Introduction

Backgrounding strategies can impact animal performance in subsequent phases of production as well as carcass characteristics at harvest. Implanting techniques and targeting a specific rate of gain are key tools used in backgrounding systems to influence gains and economic returns. Calves winter backgrounded at a LOW rate of gain are often observed to have a greater average daily gain (ADG) during the summer grazing phase than calves winter backgrounded at a HIGH rate of gain; thus, demonstrating that the cattle supplemented LOW in the winter compensated in body weight (BW) during the summer phase to cattle supplemented at HIGH during the winter phase (Gillespie-Lewis, 2014 pages 36–38). However, cattle supplemented at a HIGH rate of gain enter the summer grazing phase with a greater BW and often have greater EBW at the end of grazing compared to calves backgrounded during the winter at a LOW rate of gain. This compensatory gain can be economically advantageous by reducing supplementation costs; however, it does not yield the greatest BW so it is important to consider the trade off between compensatory gain and maximizing yield as well as economics when determining a winter supplementation program. Implants are known to increase ADG and BW within each phase of production, but the interactions of implant use during backgrounded phases for calves developed at different rates of gain have not been elucidated. Additionally, it is important to evaluate these potential interactions within the context of an entire production system as opposed to evaluating each phase independently because of the potential for compensatory effects in the subsequent production phase. Therefore, the objective of this research was to evaluate the effects of winter rate of gain and implant use during the winter and summer backgrounding phases on animal performance and carcass characteristics.

Procedure

A backgrounding systems study was conducted at the University of Nebraska-Lincoln Eastern Nebraska Research Extension and Education Center (ENREEC) near Mead, Nebraska. For two consecutive years, 240 weaned crossbred steer calves (Initial BW = 553 lb; SD = 0.36 lb) were used in a 2 x 3 factorial arrangement with factors consisting of two rates of gain (LOW targeted at 1 lb/d or HIGH targeted at 2 lb/d) and three implant strategies: NONE, SINGLE(Revalor-G [40mg trenbolone acetate and 8mg estradiol] during summer grazing), and MULTIPLE (Ralgro [36 mg zeranol] during both winter backgrounding and Revalor-G during summer grazing). Upon arrival, steers were weighed, individually identified, and backgrounded for a 30-day period before starting the experiment. Steers were limit fed for five days prior to trial initiation at 2% of BW with a diet of 50% alfalfa hay and 50% Sweet Bran (Cargill Corn Milling, Blair, NE). Steers were weighed for two consecutive days to account for gut fill variation on 0 d and 1 d of winter phase. Calves were stratified by BW and assigned at random to a treatment on day 1 with 10 head/pen and 4 pens/treatment each year. Calves remained within treatment groups throughout all production phases.

Winter backgrounding

Calves were winter backgrounded in a dry lot system for 148 days with a diet consisting of smooth bromegrass hay, modified distillers grains (MDGS), and supplement. Steers targeted at a HIGH rate of gain consumed a diet of 66% smooth bromegrass hay, 30% MDGS, 3.5% supplement which provided vitamins, minerals, and 200 mg/hd monensin daily. Urea was included at 0.50% of diet DM to ensure RDP was not limiting, and the diet was 13.3% CP. Steers targeted at a low rate of gain were fed a diet consisting of 86% smooth bromegrass hay, 10% MDGS, 3% supplement to provide vitamins, minerals, and 200 mg/hd monensin daily. Urea was included at 1% of diet DM and the dietary CP was 11.4%. All steers were fed ad libitum with diets fed twice daily to ensure all the feed would fit in the

Table 1. Effects of winter rate of gain and implant strategy on winter backgrounding performance

	Treatments[1]									
Winter ROG	LOW Gain			HIGH Gain			SED	*P*-value[2]		
Implant Strategy	NONE	SINGLE	MULTI	NONE	SINGLE	MULTI		Winter ROG	Implant	Winter ROG* Implant
DOF[3]	148	148	148	148	148	148				
Initial BW, lb	552	552	553	553	552	552	1	1.00	0.47	0.35
Ending BW, lb	728[d]	741[c]	751[c]	840[b]	841[b]	878[a]	10	<0.01	<0.01	0.15
ADG, lb	1.19[d]	1.28[c]	1.34[c]	1.94[b]	1.95[b]	2.20[a]	0.07	<0.01	<0.01	0.16
DMI, lb	18.0	17.5	18.3	19.5	19.5	20.5	0.49	<0.01	0.11	0.76
F:G[4]	15.12[d]	13.58[c]	13.67[c]	10.05[b]	10.03[b]	9.15[a]		<0.01	<0.01	0.15

[1]Low Gain targeted 1 lb ADG during the winter phase by feeding smooth bromegrass hay with 10% modified distillers grains. High Gain targeted 2 lb ADG during the winter phase by feeding smooth bromegrass hay with 30% modified distillers grains. NONE = No implant during winter and summer phases. SINGLE = No implant during winter phase and Revalor-G during summer phase (40mg TBA and 8mg estradiol). MULTI (MULTIPLE) = Ralgro during winter phase and Revalor-G during summer phase.

[2]*P*-value: Winter ADG = effect of supplementing LOW gain versus HIGH gain over 2 years during the winter phase. Implant = effect of implant strategy during the winter and summer phases. Winter ADG * Implant = Interaction of Winter ADG and implant strategy during winter and summer phases. Significance declared at $P < 0.10$.

[3]Days on feed

[4]Analyzed as G:F.

[abcd]Different superscripts differ ($P < 0.10$) when the supplement by implant interaction is significant ($P < 0.10$).

Table 2. Effects of winter rate of gain and implant strategy on summer grazing performance

	Treatments[1]									
Winter ROG	LOW Gain			HIGH Gain			SED	*P*-value[2]		
Implant Strategy	NONE	SINGLE	MULTI	NONE	SINGLE	MULTI		Winter ADG	Implant	Winter ADG* Implant
DOF[3]	56	56	56	56	56	56				
Initial BW, lb	738[d]	751[c]	760[c]	850[b]	850[b]	888[a]	10	<0.01	<0.01	0.15
Ending BW, lb	816[d]	842[c]	845[c]	904[b]	918[b]	962[a]	13	<0.01	<0.01	0.10
ADG[4], lb	1.42	1.62	1.53	0.98	1.23	1.30	0.09	<0.01	0.02	0.48
Compensation[5], %	21	23	9	-	-	-				

[1]LOW gain targeted 1 lb ADG during the winter phase by feeding smooth bromegrass hay with 10% modified distillers grains. HIGH gain targeted 2 lb ADG during the winter phase by feeding smooth bromegrass hay with 30% modified distillers grains. NONE = No implant during winter and summer phases. SINGLE (SINGLE) = No implant during winter phase and Revalor-G during summer phase (40mg TBA and 8mg estradiol). MULTI (MULTIPLE) = Ralgro (36 mg zeranol) during winter phase and Revalor-G during summer phase.

[2]*P*-value: Winter ADG = effect of supplementing LOW gain versus HIGH gain over 2 years during the winter phase. Implant = effect of implant strategy during the winter and summer phases. Winter ADG * Implant = Interaction of Winter ADG and implant strategy during winter and summer phases. Significance declared at $P < 0.10$.

[3]Days on feed

[4]SINGLE and MULTI implant strategies are greater than NONE within the same rate of gain.

[5]Calculated as difference in BW at the end of the winter phase minus difference in BW at the end of the summer phase divided by the difference in BW at the end of the winter phase for HIGH gain and LOW gain treatments within implant treatment.

[abcd]Different superscripts differ ($P < 0.10$) when the supplement by implant interaction is significant ($P < 0.10$).

bunk. Cattle within pens assigned to the NONE and SINGLE implant strategies did not receive an implant during the winter backgrounding phase; cattle within pens assigned to MULTIPLE implant strategy received a Ralgro on day 1.

Summer Grazing

The summer grazing phase was 56 days. Each pen (10 head) was allotted to 6 acres of smooth bromegrass pasture which was divided into three 2-acre paddocks that were rotationally grazed. Each paddock was grazed three times in year 1 and four times in year 2. Pastures were fertilized with 100 lb per acre of nitrogen in both years. In YR 1, steers were limit fed for 14 days to give pastures adequate time for growth after fertilization due to cool temperatures. In YR 2, the steers were limit fed for six days. In both years, the limit-fed diet consisted of 50% Sweet Bran (Cargill Corn Milling, Blair, NE) and 50% alfalfa hay fed at 2% of BW. The steers were weighed for two consecutive days: on day 0 and day 1 of summer phase. A one pound per day ADG was assumed for all steers during the limit feeding period to calculate EBW for the winter phase. Cattle assigned to the NONE implant strategy did not receive any implants during the summer backgrounding phase. Steers assigned to SINGLE and MULTIPLE implant strategies were implanted with Revalor-G (Merck Animal Health) on day 1 of the summer phase.

Finishing

Steers entered the feedlot and were limit-fed for five days at 2% of BW with a diet of 50% alfalfa hay and 50% Sweet Bran.

Table 3. Effects of winter rate of gain and implant strategy on finishing performance

	Treatments[1]									
	LOW Gain			HIGH Gain			SED	*P*-value[2]		
Implant Strategy	NONE	SINGLE	MULTI	NONE	SINGLE	MULTI		Winter ADG	Implant	Winter ADG* Implant
DOF[3]	126	129	129	126	119	119				
Initial BW, lb	820[d]	844[c]	848[c]	907[b]	921[b]	965[a]	8	<0.01	<0.01	0.05
Final BW, lb	1395[d]	1440[c]	1450[bc]	1477[b]	1462[bc]	1514[a]	13	<0.01	<0.01	0.06
HCW, lb	879[d]	907[c]	915[bc]	930[b]	921[bc]	954[a]	8	<0.01	<0.01	0.06
ADG, lb	4.55	4.62	4.65	4.49	4.54	4.61	0.05	0.18	0.13	0.93
DMI[4], lb	28.8	29.1	29.7	28.3	29.4	30.2	0.4	0.80	<0.01	0.33
F:G	6.33	6.30	6.39	6.30	6.48	6.55	0.002	0.15	0.16	0.42
REA, in	13.7	13.7	14.0	14.0	13.8	14.6	0.2	0.04	<0.01	0.35
Fat, in	0.60[b]	0.65[ab]	0.64[ab]	0.66[a]	0.60[b]	0.61[ab]	0.02	0.80	0.97	0.07
Marbling	514	505	516	560	520	506	17	0.22	0.23	0.30

[1]LOW gain targeted 1 lb ADG during the winter phase by feeding smooth bromegrass hay with 10% modified distillers grains. HIGH gain targeted 2 lb ADG during the winter phase by feeding smooth bromegrass hay with 30% modified distillers grains. NONE = No implant during winter and summer phases. SINGLE = No implant during winter phase and Revalor-G during summer phase (40mg TBA and 8mg estradiol). MULTI (MULTIPLE) = Ralgro (36 mg zeranol) during winter phase and Revalor-G during summer phase.

[2]*P*-value: Winter ADG = effect of supplementing LOW gain versus HIGH gain over 2 years during the winter phase. Implant = effect of implant strategy during the winter and summer phases. Winter ADG * Implant = Interaction of Winter ADG and implant strategy during winter and summer phases. Significance declared at $P < 0.10$.

[3]Days on feed

[4]Within each rate of gain, NONE and SINGLE cattle had a lower DMI than MULTI with NONE having the lowest.

[abcd]Different superscripts differ ($P < 0.10$) when the supplement by implant interaction is significant ($P < 0.10$).

Steers were consecutively weighed for two days on 0 d and 1 d of the finishing phase. A one pound per day ADG was assumed for all steers during the limit feeding period to calculate EBW for the summer phase. In the finishing phase, all steers were given the same implant strategy of 40 mg of estradiol and 200 mg of TBA (Revalor-XS; Merck Animal Health, De Soto, KS). Steers were stepped up over a 21-d period using 4 step-up diets in which corn stalks were reduced from 16% to 5% of diet DM, Sweet Bran was reduced from 50% to 40% of diet DM, and high-moisture corn increased from 30 to 51% of diet DM. The final finishing diet consisted of 51% high-moisture corn, 40% Sweet Bran, 5% corn stalks, and 4% supplement which provided vitamins, minerals, monensin and tylosin. Steers were fed ad libitum once daily. Cattle were fed during the finishing phase for 119, 126, or 129 days. Shipping dates were determined by estimating backfat thickness at 0.60 inch. Backfat measurements were collected via ultrasound between the 12th and 13th rib on day 1, 57, and 89. Steers were harvested at a commercial abattoir where hot carcass weight (HCW) was recorded on the day of harvest and marbling score, longissimus muscle area, 12th rib fat thickness, and yield grade were measured after a 48-hour chill. Final BW was calculated by dividing HCW by a common dressing percentage of 63%.

Statistics

Data were analyzed using MIXED procedure of SAS as a 2 x 3 factorial design with main effects of winter rate of gain (HIGH or LOW) and implant strategy (NONE, SINGLE (Revalor—G only), and MULTIPLE (Ralgro + Revalor G). The model consisted of the main effects and interaction of winter rate of gain and implant strategy. Year was treated as a random effect. The variance estimate was provided as the standard error of the difference (SED) for the simple effects of treatment because random terms are known to inflate estimates of the standard error of the mean. Significance was declared at a $P < 0.10$.

Results

There were no two-way interactions observed during the winter backgrounding phase ($P > 0.15$). The HIGH ADG steers without implants (NONE and SINGLE) gained 1.95 lb/d, which was close to the targeted 2.0 lb/d. The LOW ADG steers without an implant (NONE and SINGLE) gained 1.24 lb/d, which was slightly greater than the target of 1.0 lb/d. As expected, steers receiving the HIGH ADG diet had a greater ADG, EBW, dry matter intake (DMI), and feed conversion (F:G) over steers fed LOW ADG diet. Overall, the use of Ralgro increased ADG of steers by 11.4% during the winter phase. Additionally, Ralgro improved feed conversion and resulted in an additional 26 lb of BW at the end of the winter backgrounding phase compared to steers not implanted.

When cattle were turned out for summer grazing, the steers fed at a HIGH ADG had greater initial BW and maintained heavier EBW than steers fed at a LOW rate of gain. However, the LOW ADG steers had a greater ADG during the grazing period due to compensatory gain. Steers backgrounded at a LOW winter ADG and did not receive a Ralgro (NONE and SINGLE treatments) compensated by 21 to 23% during the summer grazing phase compared to steers wintered at a HIGH ADG with the same implant strategies. Steers wintered at a LOW ADG and received a Ralgro during the winter phase (MULTIPLE) compensated only 9% during the summer grazing phase when compared to

steers in the MULTIPLE HIGH treatment. However, steers that were implanted with a Ralgro during the winter backgrounding phase (MULTIPLE) had greater initial BW when entering the summer grazing phase and maintained BW resulting in greater EBW at the end of the summer grazing phase than cattle not implanted (NONE and SINGLE) within the same level of gain (LOW or HIGH). The use of Revalor-G improved ADG by 17% during the summer backgrounding phase, regardless of winter rate of gain.

Within the finishing phase, cattle fed a HIGH rate of gain during winter backgrounding had greater initial BW, final BW, and HCW. Steers fed HIGH ADG during winter backgrounding and administered an implant at both growing phases (MULTIPLE) resulted in the greatest HCW with no differences in finishing ADG or F:G. Both implant strategy and winter rate of gain had a large impact on HCW. For steers backgrounded at a LOW ADG, both the SINGLE and MULTIPLE implant strategies had improved HCW when compared to the NONE but did not differ from one another. This suggests that the HCW response observed at a LOW rate of gain (28 lb) was due to the Revalor-G. For steers backgrounded at HIGH rate of gain, only the MULTIPLE implant strategy improved HCW, suggesting that the additional 32 lb of HCW is attributed to the Ralgro. These observations suggest that steers respond significantly to a SINGLE implant strategy at a LOW rate of gain and respond to a MULTIPLE implant strategy at both LOW and HIGH rates of gain. This study suggests that cattle in a 3 phase yearling system gaining 1.19 lb (LOW) ADG during the winter phase would benefit from either implant strategy (SINGLE or MULTIPLE) and cattle targeted to gain 1.94 lb ADG (HIGH) during the winter phase would benefit from an implant at each phase (MULTIPLE). The combination of a winter backgrounding program, targeting a HIGH rate of gain, and a MULTIPLE implant strategy during the backgrounding phases increased HCW by 75 lb. Overall, the data from this study align with previous conclusions that implants improve performance within each phase of production and higher rates of gain during the winter backgrounding phase result in greater ending body weight and HCW.

Conclusion

Implant strategy and rate of gain during the winter backgrounding phase had additive effects increasing animal performance throughout all phases. Furthermore, combining a MULTIPLE implant strategy and HIGH rate of gain during winter backgrounding resulted in 75 lb of additional HCW.

Kelton C. Adair, graduate student, University of Nebraska–Lincoln

Kylie M. Butterfield, former graduate student, University of Nebraska–Lincoln

Zach E. Carlson, former research technician, University of Nebraska–Lincoln

Braden C. Troyer, research technician, University of Nebraska–Lincoln

Jiehua Xiong, former graduate student, University of Nebraska–Lincoln

Mitchell M. Norman, research technician, University of Nebraska–Lincoln

James C. MacDonald, professor, animal science, University of Nebraska–Lincoln

Galen E. Erickson, professor, animal science, University of Nebraska–Lincoln

Mary E. Drewnoski, professor, animal science, University of Nebraska–Lincoln

Brandon L. Nuttelman, Merck Animal Health, DeSoto, Kansas