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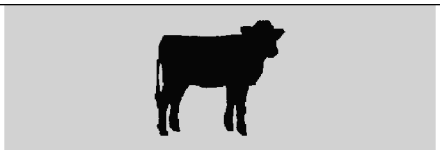

Comparison of Low-Input Pasture to High-Input Drylot Backgrounding on Performance and Profitability of Beef Calves Through Harvest

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ABSTRACT

Over 3 yr, 250 calves (236 kg initial BW; 133 steers and 117 heifers) were used to compare a low-input pasture backgrounding system (PAST) to a high-input drylot system (DLOT) to evaluate performance and profit during the backgrounding (BACKGRD; weaning to 42 to 45 d) and finishing (FINISH; end BACKGRD to slaughter) phases. Calves were randomly assigned to PAST or DLOT treatments during BACKGRD. The DLOT calves were fed a corn-wheat midds-based pellet plus alfalfa hay (0.68 to 1.13 kg/d), and PAST calves were supplemented with a 32% CP range cube (0.57 kg/d; 3 times/wk). During BACKGRD, DLOT calves gained more BW ($P < 0.01$) and had a greater final value ($P = 0.03$), but feed and total costs were more than 4-fold greater ($P < 0.01$). Net income during BACKGRD was $45 greater ($P < 0.01$) for PAST than DLOT. After BACKGRD, only steers were finished at a commercial feedlot where they were managed as a single group. During FINISH, PAST steers had greater ADG ($P < 0.01$; 1.27 vs. 1.07 kg/d) through interim weight (74 to 94 d on feed), but subsequent ADG was similar ($P = 0.68$). There were no differences ($P \geq 0.13$) in interim BW, days on feed, total ADG, carcass characteristics, or proportion of steers treated for sickness. However, DLOT steers had greater death loss ($P = 0.02$; 7.6 vs. 0.0%). During FINISH, PAST steers garnered $111 more gross income ($P < 0.01$; $946 vs. $833 per carcass) and had a net return advantage ($P < 0.01$) of $103 per head.

Key words: backgrounding, beef calf, feedlot, profit, health

INTRODUCTION

The Texas A&M University Value Added Calf (**VAC**) guidelines (Anonymous, 2005) originally established weaning duration recommendations based upon Texas Ranch to Rail calf health records that indicated a decline in medicine cost and morbidity among calves weaned 45 d or more prior to transportation to a feedyard. Industry acceptance of the 45-d duration as a component of a backgrounding system is evident in current price premiums. From 2000 to 2004, price premiums for "VAC-45" calves marketed through Superior Livestock Auction video sales increased every year, with annual average premiums ranging from $3.66 to $7.91/45.4 kg (King and Seeger, 2005). Justification for such premiums are supported by the analysis of New Mexico Ranch to Rail data (Waggoner et al., 2005), which showed that steers weaned 41 d or more before feedlot entry generated $22 and $44 per head more net income during finishing than steers backgrounded 21 to 40 d or less than 20 d, respectively. Those findings further support the premise that backgrounding programs of 45 d or more on the ranch of origin improve finishing profit potential.

Even though backgrounding calves for 45 d or more is commonly prac-

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ticed, studies evaluating backgrounding have typically focused on programs less than 40 d (Pritchard and Mendez, 1990; Roeber et al., 2001; St. Louis et al., 2003), and controlled experiments evaluating the impact of divergent backgrounding systems on performance and profit through harvest are limited. Therefore, this study compared a low-input pasture backgrounding system to a high-input drylot system of the same duration to evaluate performance and profit during the backgrounding and finishing phases.

MATERIALS AND METHODS

Over 3 yr, 250 calves (236 kg average initial BW; 133 steers and 117 heifers) were used to compare 2 backgrounding systems at the New Mexico State University Corona Range Livestock Research Center (**CRLRC**) located 13 km east of Corona, NM (average elevation = 2,000 m; average annual precipitation = 380 mm). All animal handling and experimental procedures were in accordance with guidelines established by the New Mexico State University Animal Care and Use Committee. Calves originated from the CRLRC spring-calving British-crossbred cow herd and were born in February, March, or April of 2003, 2004, and 2005.

Steer calves were castrated at branding (early May). At branding and 16 to 21 d prior to weaning, all calves were vaccinated against bovine respiratory syncytial virus, infectious bovine rhinotracheitis, bovine viral diarrhea, and parainfluenza 3 (yr 1 with Bovi-Shield 4; yr 2 and 3 with Bovi-Shield Gold 5; Pfizer Animal Health, Exton, PA), and were administered a 7-way clostridial vaccine (Ultrabac-7, Pfizer Animal Health).

Backgrounding Phase

All BW were measured unshrunk at the same time of day, and a 4% pencil shrink was applied. At weaning (d 0), calves were weighed, assigned a market price, and randomly assigned to 1 of 2 treatments: 1) high-input drylot backgrounding system (**DLOT**) or 2) low-input pasture backgrounding system (**PAST**). Each treatment was replicated within year. Following vaccination and measurement of weaning BW, calves were transported to their respective pen or pasture. Prior to weaning, calves were not all in the same pasture; therefore, calves from different pastures were commingled when sorted into treatment pen or pasture. The same 2 native range pastures (minimum 4.1 ha/head) and drylot pens (minimum 17.8 m^2/head) were used each year. During yr 1, water sprinklers were utilized to minimize dust in drylot pens; however, dust control was not necessary during yr 2 and 3. Free choice access to water and a loose mineral mix (38% NaCl, 12% Ca, 8% P, 2% K, 2% Mg, 2,500 ppm Mn, 1,000 ppm Cu, 1,000 ppm Zn, 13 ppm Se, and 125,000 IU/kg vitamin A; Hi-Pro Feeds, Friona, TX) was provided.

Table 1. Nutrient composition of hand-plucked forage samples collected at the end of the backgrounding phase

	Year		
Nutrient	1	2	3
	% of DM		
CP	9.2	7.6	8.0
NDF	63.7	67.3	70.5
ADF	39.0	42.0	46.5

Native range pastures were not grazed during the spring and summer growing season prior to stocking during backgrounding. Predominant grass species include blue grama (*Bouteloua gracilis*), threeawn (*Aristida spp.*), and wolftail (*Lycurus phleoides*; Forbes and Allred, 2001). Average annual forage production at the study site is 1,000 kg/ha (G. B. Donart, New Mexico State University, Las Cruces, personal communication). Forage availability exceeded cattle needs during all 3 yr. To estimate forage quality, grass samples were annually hand-plucked (Wallace de Vries, 1995) from pastures at the end of the backgrounding period, and analyzed for CP, NDF, and ADF at a commercial laboratory (Table 1; SDK Laboratories Inc., Hutchinson, KS).

On d 0 to 6 following weaning, PAST calves were trained to hand-delivery of protein supplement by enticement with alfalfa hay (maximum 0.75 kg/head; 92.4% DM: 17.3% CP,

Table 2. Drylot backgrounding pellet composition[1]

Ingredient	% of diet (as-fed)
Corn, ground	34.7
Wheat middlings	32.0
Soybean hulls	15.0
Cottonseed meal	5.8
Cottonseed hulls	5.0
Molasses	5.0
Calcium carbonate	1.5
Potassium chloride	0.5
Salt, vitamins, trace minerals[2]	0.5
Chemical analysis	
CP, %	15.8
NE_m, Mcal/kg	1.83
NE_g, Mcal/kg	1.10

[1]Pellet formulation was consistent across years.

[2]Includes Rumensin-80 at 0.0125%.

45.8% NDF, and 38.1% ADF) plus protein supplementation with a 32% CP range cube (Hi-Pro #32, Hi-Pro Feeds) fed at 0.57 kg/d. Beginning d 7, protein supplement delivery frequency was reduced to 3 times/wk. Calves were fed between 1000 and 1200 h each day that feed was delivered.

On d 0, DLOT calves were fed 4.54 kg/head alfalfa hay (92.4% DM: 17.3% CP, 45.8% NDF, and 38.1% ADF). Beginning d 1 each year, DLOT calves were offered 2.25 kg/head of a corn-wheat middlings-based backgrounding pellet (Table 2; Hi-Pro Feeds) plus alfalfa hay. Pellets and hay were offered in troughs (300 × 60 cm) with access from both sides. Linear trough space exceeded 30 cm/head. Daily pellet offered was increased by 0.68 kg/head when all troughs in a pen were completely empty at 0700 h, and pellet offering was restricted to 3.0% BW/d. Pellets were increased to 4.54 kg/head by d 7. Hay was reduced to 0.68 to 1.13 kg/d per head by d 13, and was maintained at that amount throughout the backgrounding phase.

All calves were weighed on a single day each year near the midpoint (d 19 or 21) and at the end of the backgrounding phase (d 42 to 45). The day final backgrounding BW was measured marked the end of the backgrounding phase. The backgrounding treatment period was 45 d in yr 1, 44 d in yr 2, and 42 d in yr 3. All steers were place in a common drylot pen and fed alfalfa hay to appetite for 5 to 9 d prior to shipping. Therefore, steers remained at the CRLRC for 46 to 54 d postweaning and conformed to guidelines for VAC-45 preweaning option (Anonymous, 2005).

Each year, weaning price and final backgrounding price were individually applied to each calf based upon prices in the New Mexico Weekly Weighted Average Feeder Cattle Report (USDA CV LS795) for the week of the beginning and end of the backgrounding phase. The price reporting category utilized to best represent calves used in this study, within gender, was medium to large frame score with muscle score 1 to 2. Prices were reported in 23-kg BW categories. Prices for consecutive BW categories were averaged to create 11 kg price blocks, and then were applied to calves based upon shrunk BW. No premium for backgrounding was applied. Purchased feed cost varied by year, with delivered price per ton ranging from $204 to $213 for backgrounding pellets, $244 to $262 for range cubes, and $130 to $165 for alfalfa hay. Feed costs were applied as weight of feed delivered to each pasture per pen times unit feed cost. A grazing fee was charged to PAST calves at $0.132/d per head. Time spent delivering feed to calves was recorded for each pasture or pen to calculate labor cost, which was charged at $6.00/h. There was no backgrounding medicine cost because no calves exhibited symptoms of sickness during the backgrounding phase.

Finishing Phase

Heifers were not included in the finishing phase. Steers were fed at a commercial feedlot (Double A Feeders, Clayton, NM) where they were entered into the New Mexico Ranch to Rail Program. Final BW and price of steers from the backgrounding phase were used as the initial BW and price of steers for the finishing phase.

Steers were received at the feedlot on a single day in mid-November

Table 3. Backgrounding performance and profitability of mixed steers and heifers backgrounded in a drylot or on pasture (PAST)

	Backgrounding system			
Item	**Drylot**	**PAST**	**SE**	***P***
Number of head	125	125	—	—
Performance[1]				
Weaning BW, kg	235	236	1.1	0.56
Interim BW,[2] kg	244	251	1.3	<0.01
Final BW,[3] kg	263	257	1.3	0.03
ADG, d 0 to interim, kg/d	0.43	0.71	0.03	<0.01
ADG, interim to final, kg/d	0.84	0.30	0.04	<0.01
Total ADG, kg/d	0.64	0.50	0.02	<0.01
Financial				
Weaning price, $/45.4 kg	109.31	109.08	0.34	0.65
Weaning value, $	564.88	566.16	1.96	0.66
Final price, $/45.4 kg	104.39	105.35	0.27	0.04
Final value, $	602.79	595.89	1.72	0.03
Feed cost, $	60.84	11.91	0.09	<0.01
Drylot pellet	54.52	0	—	—
Hay[4]	6.31	0.61	—	—
Range cube[5]	0	5.55	—	—
Grazing fee[6]	0	5.70	—	—
Labor[7]	5.93	2.10	0.04	<0.01
Total cost, $	66.77	14.01	0.10	<0.01
Net income, $	(28.87)	15.72	1.71	<0.01

[1]A 4% pencil shrink was applied to all BW.

[2]Interim BW collected d 21 in yr 1 and 3, and d 19 in yr 2.

[3]Final BW collected on d 45, 44, and 42 during yr 1, 2, and 3, respectively.

[4]Hay fed to PAST steers during initial week to train steers to range cubes.

[5]Range cubes (32% CP) provided to PAST steers at 0.57 kg/d; delivered 3 times/wk.

[6]Grazing fee charged to PAST steers $0.13/d per head.

[7]Labor cost based on $6.00/h.

each year, and were managed according to standard procedures in place at the feedlot at the time of finishing. Steers were diagnosed as morbid based on subjective visual appraisal by experienced feedlot staff. Upon arrival, all steers were administered a growth-promoting implant (Synovex Choice; Fort Dodge Animal Health, Fort Dodge, IA). Additionally, each year the feedlot management observed steers at arrival, considered the previous health and management protocol, and subjectively decided the receiving preventive pharmaceutical protocol for all steers. Steers were housed in pens of varying sizes, but all pens allowed more than 9.3 m^2/head and 40 cm/head linear bunk space.

Steers were processed for secondary application of growth-promoting implants (Synovex Plus; Fort Dodge Animal Health) in late January or early February; thus, days on feed (**DOF**) to secondary processing date ranged from 74 to 94. At that time, steers were weighed (interim BW) and individually assigned to marketing groups using the ultrasound technology and computer software of the Cattle Performance Enhancement Co. (CPEC, Oakley, KS). Once the optimum market date for each steer was estimated, steers were assigned to marketing groups that were harvested between March and early July. Cattle were harvested at a commercial facility (National Packing Co., Liberal, KS). Hot carcass weight was collected at slaughter, and LM area, fat thickness, calculated YG, and marbling score were evaluated by an independent data collection service (Cattle Trail LLC, Johnson, KS) following chilling.

At the completion of finishing, steers were sold on an individual carcass basis through the National Beef Grid. Premiums and discounts were applied using hot carcass weight and USDA QG and YG.

Statistical Analysis

The effect of backgrounding treatment on performance, carcass, and financial data was evaluated using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC) with pen or pasture as the experimental unit. The model included replicate, year, and treatment. The χ^2 in the FREQ procedure of SAS was utilized to evaluate the categorical distribution of USDA QG, USDA YG, morbidity, and death loss.

RESULTS AND DISCUSSION

Backgrounding Phase

There were no differences ($P \geq 0.56$) in weaning BW, price, or value between PAST and DLOT (Table 3). Between d 0 and interim backgrounding BW, PAST calves had an ADG advantage ($P < 0.01$). This likely occurred because DLOT calves experienced greater environmental and nutritional change following weaning. From interim BW to the end of backgrounding, rank in ADG reversed such that DLOT calves had greater ADG ($P < 0.01$) after the first 19 to 21 d of backgrounding. More specifically, ADG among PAST calves during the latter half of backgrounding was only 42% of the ADG that PAST

Table 4. Feedlot performance, carcass characteristics, and profitability of steers backgrounded in a drylot or on pasture

	Backgrounding system			
Item	**Drylot**	**Pasture**	**SE**	***P***
Number of steers	66	67	—	—
Performance				
Initial BW,[1] kg	274	270	1.7	0.27
Interim BW,[2] kg	361	363	3.1	0.78
Final BW,[3] kg	493	502	6.2	0.34
Days on feed	168	173	2.9	0.26
ADG, d 0 to interim, kg/d	1.08	1.27	0.03	<0.01
ADG, interim to harvest, kg/d	1.50	1.51	0.02	0.68
Total ADG, kg/d	1.33	1.35	0.01	0.32
% treated for sickness[4]	47.6	34.3	—	0.14
% death loss[4]	7.6	0.0	—	0.02
Carcass				
Hot carcass weight, kg	309.9	316.6	4.1	0.29
Fat thickness, cm	1.35	1.39	0.04	0.59
LM area, cm^2	80.8	79.6	1.3	0.54
Marbling score[5]	472	481	6.5	0.35
Calculated YG	2.90	3.06	0.06	0.12
Financial				
Initial price,[1] $/45.4 kg	105.94	106.65	0.53	0.38
Initial value, $	636.36	631.78	3.02	0.32
Medicine cost, $	28.32	23.01	3.54	0.33
Feed cost, $	220.53	238.18	4.68	0.04
Total cost, $	932.60	941.40	7.90	0.46
Carcass price, $/45.4 kg	133.48	135.67	0.82	0.11
Gross income, $	834.27	945.64	15.54	<0.01
Net income, $	(98.33)	4.68	10.64	<0.01

[1]Initial BW and price = final backgrounding BW and price of steers; 4% pencil shrink applied to BW.

[2]Interim BW occurred at 74, 77, and 94 days on feed during yr 1, 2, and 3, respectively; 4% pencil shrink applied.

[3]Final BW is an estimate calculated as carcass weight average dressing % of marketing group.

[4]Chi-square analysis.

[5]Marbling score: $Small^{00}$ = 500.

calves achieved during the initial 19 to 20 d after weaning. This pattern was expected because of the normal decline in native range forage quality and digestibility from late September to November (Pieper et al., 1978). Conversely, ADG among DLOT calves increased almost 2-fold after d 19 to 21 compared with earlier. This increase is attributed to greater energy intake among DLOT calves in the latter half of the backgrounding phase. Overall, DLOT calves had greater ADG ($P < 0.01$) during backgrounding, resulting in heavier final backgrounding BW ($P = 0.03$) for DLOT calves.

Final backgrounding price per unit BW was greater for the PAST calves ($P = 0.04$) because they were lighter, but the final value was $6.90/head less ($P = 0.03$) for PAST than DLOT calves. The greater value of DLOT calves was offset by a $52.76 difference ($P < 0.01$) in total costs. Feed and labor cost were 5- and 2-fold greater ($P < 0.01$), respectively, for DLOT than PAST. Consequently, net income during the backgrounding phase was $44.59 greater ($P < 0.01$) for PAST calves. These results support the findings of St. Louis et al. (2003) that showed lower feed cost and greater net return ($43.17/head) for a 30-d ryegrass pasture backgrounding program compared with a 30-d drylot backgrounding program. A final price premium of $5.00/45.4 kg would have been required for the DLOT system to be profitable; however, the PAST backgrounding system was profitable without a price premium.

Table 5. Distribution of USDA quality grades and yield grades by backgrounding system

	Backgrounding System		
Item	Drylot	Pasture	*P*
Number of steers	61	67	—
	%		
USDA QG			0.24
Choice	31.2	38.8	—
Select	65.6	61.2	—
Dark cutter	3.3	0.0	—
USDA YG			0.30
1	1.6	0.0	—
2	49.2	41.8	—
3	47.5	49.3	—
4	1.6	6.0	—

Finishing Phase

Initial BW, price, and value of DLOT and PAST steers were similar ($P \geq 0.37$; Table 4), even though BW of steers and heifers combined collected at the end of backgrounding was different. The PAST steers had greater ADG ($P < 0.01$) through interim BW, but subsequent ADG was similar ($P = 0.68$). The improved ADG to interim BW among PAST steers supports the findings of Choat et al. (2003), who reported greater feedlot ADG from 15 to 70 DOF among steers previously wintered on native range with supplement compared with contemporary steers wintered on irrigated wheat pasture that entered the feedlot heavier. However, there were no differences ($P \geq 0.12$) in interim BW, total ADG, estimated final BW, DOF, calculated YG, or any measured carcass characteristics in this study. Additionally, the distributions of USDA QG and YG were similar ($P \geq 0.24$; Table 5).

The proportion of steers treated for sickness and medicine cost per head were similar ($P \geq 0.14$); however, DLOT steers had greater death loss ($P = 0.02$). Even though morbidity was not different, there was a 7.6 percentage unit difference in death loss. All death losses occurred between 32 and 128 DOF. It is likely that the DLOT calves experienced additional stressors during the backgrounding phase compared with PAST calves because DLOT calves were not only weaned and socially mixed with calves from different pastures, but the DLOT calves also experienced more distinct environmental (confinement) and dietary changes. Carroll and Forsberg (2007) stated that among other factors, weaning, transportation, social mixing, and dietary change can impose significant stress on cattle, causing reduced performance, increased morbidity, and death. Although treatments were applied during the backgrounding phase at the ranch of origin in the current study and not at a feedlot, the magnitude of mortality difference between the PAST and DLOT treatments were similar to the 6 percentage unit difference in mortality reported by Lofgreen (1983) for calves consuming a millet hay diet during receiving (2.5% mortality) compared with calves fed a 75 percent concentrate diet plus millet hay (8.5% mortality). Possibly the additional stressors of greater dietary and environmental change experienced by DLOT calves during backgrounding yielded a long-term susceptibility that rendered DLOT steers less competent than PAST steers to withstand immune challenge during the finishing phase.

The DLOT steers had lower feed cost ($P = 0.04$), but average price received for carcasses sold was not different ($P = 0.11$). Gross income during the finishing phase was $111 greater ($P < 0.01$) for PAST steers because they had no mortalities and numerically greater carcass weight and carcass price. Consequently, PAST steers garnered $103/head more net income ($P < 0.01$) than DLOT steers. To achieve the same finishing phase net income for DLOT and PAST steers, price of DLOT steers at the be-

ginning of the finishing phase would need to be reduced by $17/45.4 kg.

IMPLICATIONS

Backgrounding programs that conform to VAC-45 marketing requirements can vary in intensity and cost. However, the additional gain achieved with higher-input systems may not offset increased costs; and stress associated with dietary change and confinement immediately following weaning may impact subsequent death losses. Low-input pasture backgrounding systems can be more profitable than drylot systems of the same duration during the backgrounding and finishing phases.

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