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Effects of Body Condition, Initial Weight, and Implant on Feedlot and Carcass Characteristics of Cull Cows[1]

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Abstract

Feeding cull cows an energy-dense diet can increase amount and quality of marketable product. Furthermore, implanting cull cows with steroid implants may improve BW gain, feed efficiency, carcass traits, and overall eating quality. Therefore, objectives of this study were to determine effects of implant, initial BW, and body condition score **(BCS)** *at the beginning of the study, on feedlot performance and final live animal and carcass weights, and carcass characteristics of cull cows fed a high-concentrate diet for approximately 90 d. One-half (68) of the cows were allotted to implant treatment (Synovex-Plus®) by initial BW and BCS. Cows were fed a warm-up diet (50 to 60% concentrate, DM basis) for 14 d and then fed a finishing (80 to 85% concentrate, DM basis) diet for the remainder of the study. Variations in initial BW of cows were associated positively ($P<0.10$) with final BW, hot carcass weight, longissimus area, and yield grade. Initial BCS had a positive affect ($P<0.10$) on fat thickness but did not influence ($P>0.10$) ADG, final BW, or other carcass traits. Implant influenced ($P<0.05$) both feedlot and carcass characteristics; implanted cattle had 18 kg greater final BW, 0.22 kg greater ADG, 18 kg greater carcass weight, 8.6 cm^2 larger longissimus area, 27 units (100 units per marbling score) less marbling and 0.24 units less yield grade. Initial BW, BCS, and implanting influence feedlot performance and carcass characteristics of cull cows.*

(Key Words: Cull Cows, Feedlot, Implant, Body Condition)

Introduction

Sale of cull beef cows accounts for 15 to 25% of yearly gross revenues of cow-calf operations in the United States (Apple, 1999). Total quality losses determined by the 1999 National Market Cow and Bull Quality Audit (Roeber et al., 2001) were \$68.82/head compared to \$69.90/head in 1994. The top three losses were excess external fat, inadequate muscling, and trim loss from arthritic joints. The audit concluded that much of this loss could be recaptured through improved management, monitoring, and marketing. Many beef and dairy producers view market cows as culls rather than an important source of beef for the food industry. Beef from market cows is widely used in the retail and food service sectors in a variety of product forms, not all of which is ground. Producers should identify opportunities to add value to market cows, as it may be possible to feed cows for a period of time before marketing to increase BW, improve body condition, and increase carcass quality and yield. Smith et al. (1994) reported that producers lose an average of \$69.90 of potential revenues per non-fed animal slaughtered in the United States, but \$20 per animal could be recovered by feeding cull cows an energy-dense diet before slaughter. Feeding cull cows an energy-dense diet has been shown to increase carcass fat content, increase lean meat yield, increase marbling, produce whiter external fat, and improve cooked meat palatability (Apple, 1999; Boleman et al., 1996; Schnell et al., 1997). Limited research has indicated that BW gain, feed efficiency, carcass traits, and overall eating quality can be improved by implanting cull cows with steroid

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implants (Cranwell et al., 1996a; Cranwell et al., 1996b). In many of the previous studies, cows were fed for 56 d or less. Pritchard and Burg (Pritchard and Burg, 1993) indicated that for most cows to improve one USDA slaughter grade they would need to be fed from 60 to 100 d. Therefore, objectives of this study were to determine effects of implant, initial BW, and body condition score (**BCS**) on feedlot performance and final live animal and carcass characteristics of cull cows fed a high-concentrate diet for approximately 90 d.

TABLE 1. Cow diets and calculated nutrient analysis for Experiment 1 and 2.

Ingredient (DM, %)	Experiment 1 Billings	Experiment 1 Fort Keogh	Experiment 1 Purchased cows	Experiment 2
Corn silage	12.26	4.52	4.01	11.15
Grass hay	1.74	9.76	12.07	3.68
Wheat straw				4.49
Wheat grain		39.32	38.22	29.28
Corn grain	79.85	44.03	43.34	47.64
Protein supplement	6.15	2.38	2.37	3.76
Calculated analysis				
DM, %	71.0	81.1	81.9	72.1
Crude protein, %	11.5	12.8	12.8	12.3
NE_m, Mcal/kg	2.02	2.05	2.03	1.98
NE_g, Mcal/kg	1.36	1.39	1.37	1.32

Materials and Methods

Experiment 1. Cows from three sources were fed at two locations, Miles City and Billings, MT. Cattle were fed approximately 90 d from mid-July through mid-October (2001) in Miles City and early August through early November (2001) in Billings. Forty-nine cull cows (BCS = 6.0 ± 0.81; BW = 524 ± 66 kg; mean ± standard deviation; mostly crossbred containing British and Continental) from Fort Keogh Livestock and Range Research Laboratory and 37 purchased cows (BCS = 4.7 ± 0.60 ; BW = 526 ± 40 kg; mean ± standard deviation) of unknown genetics, but appeared to have some Continental influence, were fed at a commercial feedlot near Miles City. Cows (n = 50; primarily black Angus) fed at Billings were from one ranch (BCS = 5.4 ± 0.63; BW = 551 ± 69 kg; mean ± standard deviation). At the beginning of the study, cows were weighed (initial BW), visually appraised for BCS (1 to 9 scale), valued by a commercial cattle buyer (initial value), and treated with Ivomec® (Ivermectin; Merck and Co., Whitehouse Station, NJ) pour-on for external and internal parasites. One-half of cows at each location were allotted to implant treatment (Synovex-Plus®; Fort Dodge Animal Health, Overland Park, KS) by initial BW and BCS. Cows were initially fed a warm-up diet (50 to 60% concentrate, DM basis) for 14 d and then fed a finishing (80 to 85% concentrate, DM basis) feedlot diet consisting of corn silage, chopped hay, whole corn, cracked wheat, and supplement for the remainder of the study (Table 1). At the end of the feeding period cows were sent to a packing plant in Rapid City, SD, where carcass data were collected. Data collected included fat thickness, longissimus area, hot carcass weight, percentage KPH (kidney, pelvic, and heart fat), and marbling score (scale of 100 to 999: 300 = Slight^{00} degree of marbling; 400 = Small^{00} degree of marbling).

Effects of implant, initial BW, and BCS on feedlot performance and final live animal and carcass characteristics were analyzed using SAS GLM procedures (SAS, 1990). The model included initial BW and BCS as covariate terms (continuous variables) and source of cattle and implant status (yes or no) as fixed effects. Estimates of covariates and effect of implant were obtained by the "solution" option of the SAS procedure. Pearson correlation coefficients among initial BW, BCS, ADG, and final BW were obtained using the SAS correlation procedure (SAS, 1990).

Experiment 2. A cull cow feeding project was conducted with local ranchers to determine the feasibility of feeding cull cows from a tradition-

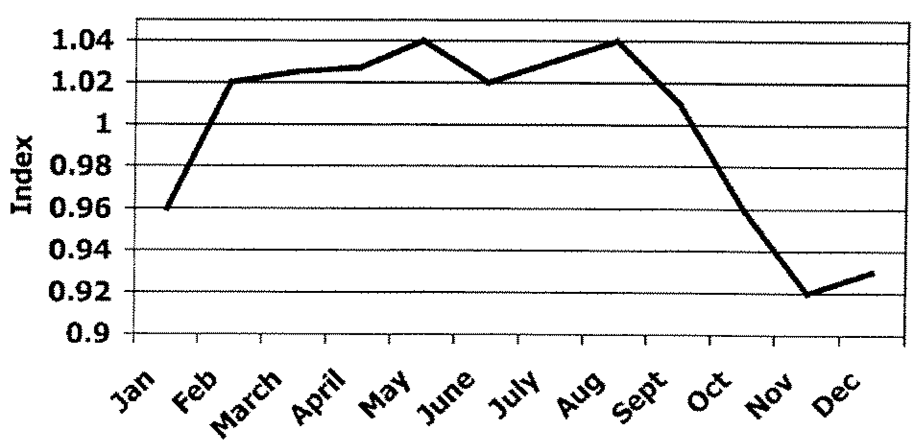

Figure 1. Seasonal price patterns for utility cows, Northern Plains.

TABLE 2. Cow performance for Experiment 1 and 2.

	Experiment 1			
Item	Billings	Ft. Keogh	Purchased	Experiment 2
No cows	49	47	34	78
Initial BW, kg	551	524	526	471
Final BW, kg	740	668	670	708
ADG, kg	2.10	1.61	1.57	2.12
DMI, kg	16.99	13.44	13.45	15.46
Feed/gain ratio	8.09	8.35	8.57	7.29

ally low cow market (November) through a period of generally increasing prices [March; Figure 1; adapted from Hughes (2001)].

A total of 80 cull cows from four ranches were received at a commercial feedlot near Miles City, MI, in mid-November (2001). All cows were weighed, body condition scored, assigned an initial value by a commercial cattle buyer, and processed at the beginning of the study in which they all received Ivomec® (Ivermectin; Merck and Co., Whitehouse Station, NJ) pour-on for external and internal parasites and implanted with Synovex-Plus® (Fort Dodge Animal Health, Overland Park, KS). Mean initial BW of cull cows was 471 kg and average BCS was 4.42. Cows ranged in age from 2 to 10 yr old (age was not known on all cows). Average value at beginning of the study (i.e., in value) was \$0.87/kg live BW, as calculated from estimates of individual animal values predicted by a cattle buyer. Cows were fed a warm-up diet (50 to 60% concentrate, DM basis) for 14 d and then switched to a finishing (80 to 85% concentrate, DM basis) diet for the remainder of the period (approximately 96 d). The finishing diet consisted of corn silage, chopped hay, whole corn, cracked wheat, and supplement (Table 1).

Results and Discussion

Experiment 1. Genetics, body condition score, and initial BW were confounded by location, including source in the statistical analysis accounted for significant variation in all response variables. Feedlot performance for each location is presented in Table 2. Effects of initial BW, BCS, and implant on final BW, ADG, hot carcass weight, fat thickness, longissimus area, marbling score, and yield grade are shown in Table 3. For every kilogram in initial BW, final BW increased ($P<0.01$) by 1.06 kg; hot carcass weight, longissimus area, and yield grade were also positively affected ($P<0.10$) by initial BW (Table 3). A change in one unit of initial BCS resulted in an increase ($P<0.10$) of 0.12-cm fat thickness but did not effect (P>0.10) any other feedlot or carcass measurements taken. Implant influenced ($P<0.05$) both feedlot and carcass characteristics. Implanted cattle had 18.4 kg heavier final BW, 0.22 kg greater ADG, 17.7 kg heavier carcass weight, 8.6 cm^2 larger longissimus, 26.5 units less marbling, and 0.24 units less yield grade. Initial BCS was correlated ($P<0.01$) with initial BW and final BW but not ($P>0.10$) ADG (Table 4). Final BW was also correlated ($P<0.01$) with initial BW and ADG.

TABLE 3. Final feedlot and carcass characteristics for cull cows and estimated effects (*P*-value) of initial BW, body condition score, and implant on these characteristics[a].

Item	Average	Initial BW	Body condition	Implant
Final BW, kg	696	1.06 (0.01)	NS	18.4 (0.02)
ADG, kg	1.72	NS	NS	0.22 (0.01)
HCWT, kg	398	0.57 (0.01)	NS	17.7 (0.01)
Backfat, cm	1.3	NS	0.12 (0.06)	NS
Longissimus area, cm^2	88.3	0.06 (0.01)	NS	8.6 (0.01)
Marbling score[b]	449	0.16 (0.12)	NS	–26.5 (0.02)
Yield grade	3.20	0.002 (0.06)	NS	–0.24 (0.05)

[a]Values under each effect are estimates obtained from the covariate analysis.
[b]HCWT = Hot carcass weight; Scale of 100 to 999: 300 = Slight^{00} degree of marbling; 400 = Small^{00} degree of marbling.

Experiment 2. Overall, average final BW was 708 kg and ADG was 2.12 kg/d (Table 2). Cattle were fed an average of 110 d and marketed in three different groups. Older cows were sent in two groups to a cow processing plant in Minnesota. Younger cows (2 to 3 yr old) were sold on a fed cattle grid (Figure 2) to a cattle-processing plant in Colorado.

Pearson correlation coefficients for feedlot characteristics of cull cows in Experiment 2 are presented in Table 5 [obtained using the SAS correlation procedure (SAS, 1990)]. Initial BCS was positively correlated ($P<0.01$) with initial and final BW and ADG. Initial BW was negatively correlated ($P<0.01$) with initial value and days on feed, which was probably a function of younger animals weighing less on arrival, valued higher, and fed longer. Initial and final BW were positively correlated ($P<0.01$), as were final BW and ADG. Initial value was positively ($P<0.01$) correlated with days on feed and negatively ($P<0.05$) with final BW; again, this was

Grid Pricing	Price/kg
Carcass Start Price	$ 2.49
Out Cattle Allowance	$ -
Freight Allowance	$ -
Choice/Select Spread	$ .07
Select/No Roll Spread	$ .22
Prime/Choice Spread	$ .13
Certified Angus Prem.	$ .02
Out Cattle Discount	$ .44
Commercial Price	$ 1.54
Utility Price	$ 1.15

Yield Grade Prices	
Grade	Price/kg
1	.09
2	.03
3	.00
4	-.44
5	-.55
Grade Base	70.34%

Quality Grade Prices		
Grade	Code	Prem/Dis
Prime	1	.15
Choice	2	.02
Select	3	-.05
Standard	4	-.27
Commercial	5	-.95
Utility	6	-1.35
Canner	7	-1.35
Dark Cutter	8	-.51
Stag	9	-.95
Bull	10	-.95
B-Maturity Stand	11	-.27

Figure 2. Pricing grid on which 2- and 3-yr-old cows were sold.

TABLE 4. Pearson correlation coefficients for feedlot characteristics of cull cows.

	BCS[a]	Initial BW	ADG	Final BW
BCS	1.0	0.40**	–0.09	0.27**
Initial BW		1.00	0.04	0.79**
ADG			1.0	0.62**
Final BW				1.0

[a]BCS = body condition score.
**P<0.01.

TABLE 5. Pearson correlation coefficients for feedlot characteristics of cull cows in demonstration project.[a]

Item	BCS	Initial BW	Initial value	DOF	ADG	Final BW
BCS	1.0	0.34**	0.07	–0.006	0.30**	0.50**
Initial BW		1.00	–0.53**	–0.51**	0.02	0.78**
Initial value[b]			1.0	0.57**	0.03	–0.28*
DOF				1.0	–0.28*	–0.30**
ADG					1.0	0.57**
Final BW						1.0

[a]BCS = body condition score; DOF = days on feed.
[b]Value at the beginning of the feeding period as estimated by a cattle buyer.
*P<0.05.
**P<0.01.

probably a function of age, with younger animals valued higher, fed longer, and finishing at a lighter BW. Days on feed were negatively correlated with final BW (P<0.01) and ADG (P<0.05), which also is probably a function of younger animals being lighter even though they were fed longer.

One cow died during the feeding period, and three were sold at a local auction market before the end of the feeding period because of structural problems. The first two groups of cows sold received $1.65 and $1.69/kg carcass weight, respectively. The 2- and 3-yr-old cows (24 head) were sent with another group (18 head; 2 and 3 yr old) of cows on a similar project near Billings, MT. Complete carcass data were collected on these cattle. These younger cows averaged $1.91/kg carcass weight (range = $1.14/kg for Utility to $2.53/kg for Choice). These cattle had an average carcass weight of 399 kg, 1.42-cm fat thickness, 84.4-cm^2 longissimus area, 3.46 calculated USDA yield grade, and Small^{80} marbling score. Final profitability was determined by subtracting all costs (feed, yardage, trucking, and pharmaceuticals) and the initial value of the cows in the feedlot from the final value received. Overall, cattle in this project returned ap-

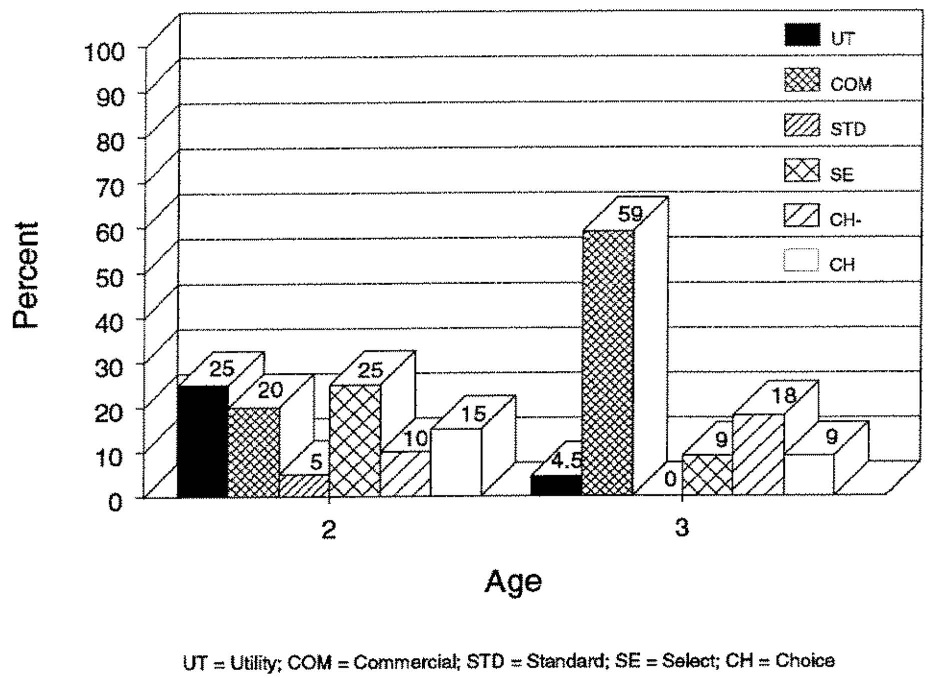

Figure 3. Distribution of USDA quality grade by cow age.

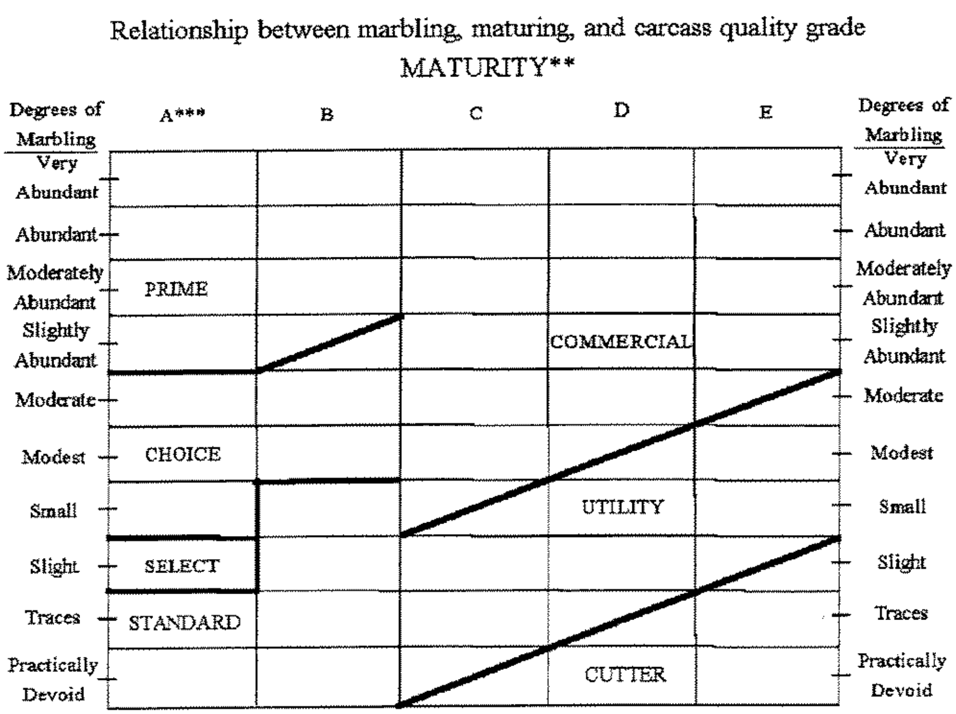

Figure 4. USDA quality grading system.

proximately $30/head over what they would have been worth if sold at the beginning of the feeding period. This value included the loss of the cow that died.

USDA quality grade distribution by cow age is shown in Figure 3. According to USDA quality grading system (Figure 4), cattle of B maturity (30 to 42 mo of age) should not be graded any lower than Standard; unfortunately, this was not the case. Based on actual age, all younger cows (2 to 3 yr old) should have been A or B maturity; however, several were called C (42 to 72 mo of age) and D (72 to 96 mo of age) maturity and discounted severely (Figure 2). It is interesting to note that the opposite was also true as some 3-yr-old cows graded Select or low Choice, indicating they were classified as A maturity; however, this was not nearly to the extent that cattle were discounted for Utility and Commercial. Carcass maturity classification did not accurately correspond to chronological age. The quality grading system is based on skeletal maturity and marbling in an attempt to classify animals of similar eating quality. Lawrence et al. (2001) recently reported no difference in Warner-Bratzler shear force or sensory panel tenderness evaluation in cattle varying in age (based on dental classification) from less than 24 mo (A maturity) to greater than 45 mo (C or greater maturity).

A common recommendation being made for feeding cull cows is to start with animals that are thin and lesser BW to take advantage of compensatory gain and the possibility of upgrading cows into a better slaughter grade. Initial BW did not affect ($P>0.10$) ADG in Experiment 1 and was not correlated ($P>0.10$) with ADG in either study; BCS had no affect ($P>0.10$) on ADG in Experiment 1 but was positively correlated ($P<0.10$) with ADG in Experiment 2, suggesting that cattle in greater BCS at beginning of the feeding period performed better during the feeding period. In addition, greater BCS at the start of feeding resulted in increased fat thickness, longissimus area, and marbling (Table 3). Individual feed efficiency was not measured in the present studies so it was not possible to determine effects of initial weight and BCS on overall profitability; however, feedlot performance was not greater in animals of lower initial BW or BCS.

Implications

Sale of cull cows is a significant source of income for ranchers. Properly managing and marketing cull cows may mean the difference between a profit and a loss for a year. Feeding cull cows a feedlot diet for a period of time before selling may improve quality of animals and overall profitability. Often the cost of gain for cows will be greater than the sale price of cows at harvest; however, cow feeding may increase returns if price increases during the feeding period. Thus, it is important to consider seasonality of cull cow prices and price differences between cull cow slaughter grades when considering feeding cull cows. Neither initial BW or body condition affected performance (ADG) of cull cows in the feedlot in this research project. Implanting, however, improved feedlot performance and increased hot carcass weight and longissimus area.

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