December 1999

Consideration of Weaning Time, Implanting Strategies and Carcass Data on Cow-Calf Decisions

Doug L. Hixon
University of Wyoming, Laramie, WY

Proceedings, The Range Beef Cow Symposium XVI
December 14, 15 and 16, 1999 Greeley, Colorado

CONSIDERATION OF WEANING TIME, IMPLANTING STRATEGIES AND CARCASS DATA ON COW-CALF DECISIONS

Doug L. Hixon
University of Wyoming
Laramie, WY

Introduction

As the beef industry becomes more focused on the consumer, various management practices must be evaluated to determine what lasting effects they might have on final consumer product. In the past, we have evaluated the effects of management decisions on performance and measured differences in pounds produced. However, the dynamic nature of the beef industry and the necessity for sustainability requires that we measure performance in dollars rather than pounds. I often ask students to describe their ideal beef animal in eleven words or less. I believe the answer to that question is "the one that makes the most money while producing a product that enhances consumer demand." That description allows for animal uniqueness in differing environments while considering profitability, sustainability and consumer acceptability whether selling weaner calves, bred heifers or finished market cattle.

Time of Weaning

As cow-calf producers evaluate costs associated with annual production, we know a large portion of that annual cost of maintaining a cow-calf unit is associated with nutrition. Standardized Performance Analysis (SPA) data suggests that expenditure may be as high as 70% in some production units depending on the associated environments. Two management decisions that have major effects on these nutritional expenditures are first, when calves are born and secondly, when they are weaned. Obviously, this is due to increased nutritional requirements associated with lactation. Systems research such as that being conducted by Drs. Don Adams and Richard Clark at the University of Nebraska's Gudmunden Sandhills Laboratory, suggests that the closer this lactation expenditure is matched to grazed forage quality, the lower the cost of production. By moving back to a June calving session, they have essentially eliminated the feeding of harvested forage (reduced by 94% although protein expenditures were higher) to mature cows (Clark et al., 1999). These associated costs may vary in magnitude from one environment to another, but the more we can allow the cow to utilize her ability to graze and meet her nutritional requirements for production with the least amount of supplementation, the lower her break-even price of pounds of calf produced. However, due to extenuating circumstances, not everyone can move to a later calving season. Producers who depend on public land forage where they possibly run in common with other producers, may need to calve earlier in order to have a high percentage of their cows bred prior to when they lose control of them in early to mid-June. Therefore, they may calve during a more traditional March and April time frame. Another factor that plays a role in this decision is what is done with the offspring at weaning. If the producer sells weaner calves, later calving may mean fewer pounds to sell. However, there may be an opportunity for dollar savings on the weaning end of these expenditures that have associated savings in cow weight and body condition. We traditionally wean spring-born calves somewhere from 200 to 250 days of age. However, how do these decisions affect profitability and consumer product?

With these considerations in mind, a research project was developed at the University of Wyoming (Thielen et al., 1999) with the objectives to determine the effects of calf age and nutritional regimen on feedlot performance, carcass characteristics and tenderness of product at similar external fat endpoints. To help answer these questions, 112 steer calves produced by our Angus/Gelbvieh rotational crossbred teaching and research herd were assigned to either an early wean (EW; average age = 170 d) or late wean (LW; average age = 250 d) group. After a 28 d adjustment period following weaning, steers were blocked by sire breed and weight and randomly assigned to either a finishing diet (F; NE_g = 3.04 Mcal/lb) or a grow diet (G; NE_g = 1.92 Mcal/lb) for 84 days before being similarly stepped up onto the aforementioned finishing diet. Steers were targeted for slaughter at approximately .4 in external fat. Analysis of variance was performed on performance and carcass characteristics.

Steers were spring-born calves, born primarily in February and March. After the AI breeding season that ended on June 10, cow-calf pairs were moved to native shortgrass range approximately 34 miles northeast of Laramie, WY, where they grazed until the calves respective weaning date. EW calves were weaned on August 13 while late weaned calves were weaned on October 31 when they averaged 170 and 250 d of age, respectively. After a 21-d adjustment period, F-treatment steers were placed on an 85% concentrate finishing diet following a 3-week step-up period. The G-treatment steers received the first step ration (35% concentrate) for the 84-d period prior to being stepped up to the 85% concentrate F diet. The EWG and LWF treatments went through the step-up rations and onto the finishing rations at the same time.

Because the objectives of this study involved determining the effects of calf age and nutrition on carcass characteristics and tenderness, growth-promoting implants were not used. Implants are documented to enhance gains but under some conditions, aggressive implanting may have a negative influence on maturity, marbling and possibly tenderness (Duckett et al., 1999). This topic will be further discussed later in this paper.

Ultrasound technology, was used to determine when treatment groups approached an average of .4 inch external fat over the 12th rib and a slaughter date was established. Cattle were marketed through a commercial packing plant. Carcasses were in the cooler for approximately 24 h before being ribbed and graded. The same USDA grader evaluated the carcasses for marbling, USDA quality and yield grade and % KPH over the three harvest periods (EWG and LWF steers were harvested at the same time).

A wholesale rib was removed from the left side of each carcass, individually vacuum packaged and transported back to the UW meats facility in Laramie. They were maintained at 4 C for 14 days from harvest date. A 1.25 in thick steak was removed from the region of the 12th rib. Steaks were identified, individually wrapped and frozen in a -30 C freezer until thawed and cooked and evaluated for tenderness via the Warner-Bratzler Shear test. The thaw and cooking procedures followed were as outlined by American Meat Science Association AMSA protocols (1995).

Steers from EWF, EWG, LWF and LWG did not differ ($P > .05$) in mean weight (503, 500, 505 and 500 lb, respectively) nor age (168, 171, 173 and 169 d, respectively) at time of early weaning. EWF and EWG calves were heavier ($P < .05$) at time of late weaning. EWF, EWG, LWF and LWG calves weighed 767.4, 695.8, 649.5 and 644.2 lb, respectively, after the second weaning date following the post-weaning adjustment period.

Early wean grow calves gained 2.18 lb/d during the "grow" period while the LWG calves gained 2.58 lb/d during the similar period. EWG steers consumed 16.5 lb DM/hd/d while LWG consumed 19.8 lb DM/hd/d. However, when compared as a percent body weight, EWG and LWG steers' daily consumption was 2.71 and 2.64% of their average body weight, respectively. This would suggest that the higher rate of gain for the LWG was probably due to their heavier weights over their respective grow periods.

EWF and LWF steers average dry matter intake was 20.7 and 22.3 lb/hd/d, respectively. As with the "grow" steers, this difference appeared to be mainly a function in differences in body weight.

Total gain from time of early weaning until slaughter was greatest ($P < .05$) for LWG (835 vs. 701, 772 and 750 lb, respectively, for EWF, EWG and LWF). These differences existed since each treatment was fed to a similar fat endpoint. The LWG cattle were older and therefore heavier at time of slaughter. The EWF group did, however, have the highest ($P < .05$) ADG over the entire period (from time of EW until slaughter), 2.87 lb/d vs. 2.62, 2.56 and 2.49 lb/d for EWG, LWF and LWG, respectively).

Gain performance during the finishing phase was 3.37 lb/d for both the LWF and LWG calves as compared to 3.20 and 3.15 lb/d for EWF and EWG calves, respectively. It is possible this difference could be attributed to a lower plane of grazed nutrition between the two weaning dates and the late weaned calves therefore had more compensatory gains after going to the feedlot.

A concern with cattle that excel in growth genetics is that as the "grow" period is extended using high forage diets whether it be in the feedlot or under grazing conditions possibly even as yearlings, heavy carcasses may become a problem by the time the cattle are finished. The management schemes employed in this study did affect the growth curve of the cattle being evaluated (Table 2). Cattle were targeted to similar endpoints of .4 inch external fat. EWF calves were on the F-diet the longest (196 d) and had the lightest final weights averaging 1206 lb. LWF and EWG calves were on the finishing diet the same number of days (168 d) and had finished weights of 1255 and 1272 lb, respectively. The LWG were on the F-diet for the shortest period of time (131 d) and produced the heaviest final weights (1336 lb). There was some concern about heavy carcasses with the latter group and marketing was moved slightly forward resulting in a .36 inch external fat cover. However, external fat cover was not significantly different among treatments. The EWF calves were most efficient with a feed:gain ratio of 6.5:1 which was similar to LWF calves at 6.7:1 but different ($P < .01$) from EWG (7.4:1) and LWG (7.7:1).

Treatment effects on carcass characteristics are presented in Table 3. Marbling scores did not differ significantly (P > .05) nor did quality grades. However, LWF and EWG had the greatest percentage of carcasses grading low choice or higher at 96 and 93%, respectively. This compared to 82 and 79% for the EWF and LWG at 413 and 505 d of age.

Shear values for the older, LWG steers were 6.15 lbs (P < .05) as compared to 7.1, 7.12 and 6.77 lb for EWF, EWG and LWF, respectively. Theoretically, the younger the chronological age, the less connective tissue and more tender you would expect carcasses. However, in this case, the older LWG cattle produced heavier carcasses (P < .05) and it is possible that a slower cooling rate resulted in less cold shortening and therefore a more tender product. It should be noted, however, that all treatments produced shear values that would be considered acceptable to consumers.

Correlations between parameters of interest were generally low. There was a -.332 correlation between marbling and shear force. This suggests that as marbling increases, shear force decreases, indicating a more tender product. However, marbling accounted for only 11.02% of the variation in tenderness. As would be expected, a similar negative correlation (-.322) existed between quality grade and shear force. The correlation between age and marbling was small but positive (+.163). In addition, the relationship of shear force and age was small but negative ® = -.205).

When the costs of feed, yardage and interest (on value of calves and feed) were considered, the LWF calves had the lowest cost of production followed by the EWF (+8.6%), LWG (+27.4%) and EWG (+34.7%). However, the dams of the EW calves gained 84 pounds between the two weaning dates while the dams of the LW calves lost 32 pounds. This 116 lb difference would generally be a thought to represent a difference of 1 to 1 ½ BCS units. This could be extremely important to young 2 and 3-year-old cows going into the winter months.

This project suggests that young beef steer calves with adequate growth genetics can efficiently utilize an energy-dense ration and produce high cutability carcasses of acceptable tenderness as young as 13.5 months of age. Although accounting for only 11.02% of the variation in tenderness, marbling was still the most highly related unit of the parameters evaluated.

Another concern associated with early weaning is that fewer pounds would be available to sell if selling calves at weaning was required. Half of the heifer mates to these EW steers were also EW and grazed over this 84-d period on high quality meadow regrowth forage. Their gains were very similar to the gains of those heifers remaining suckling the cows on range forage over this period.

Growth Promoting Implants in Suckling Calves

At an Oklahoma State sponsored symposium on the Impact of Implants on Performance and Carcass Value of Beef Cattle in May of 1997, Dr. Glenn Selk reviewed a multitude of research trials comparing the effect of a single implant dose administered to suckling calves at branding time (approximately 45 to 60 days of age), to non-implanted controls. His review concluded that approximately .1 lb/d could be expected from steer calves receiving either zeranol or estradiol-progesterone implants. This would translate into 14 to 16 additional pounds (2.5 to 3% in a 550 lb steer calf) from time of administration until weaning. He concluded that the decision to implant was more important than the decision of which implant to use. Furthermore, gain response in heifer calf trials included in this review were slightly greater at .12 to .14 lb/d or from 17 to 22 lb from time of administration until weaning at 205 d of age. This would translate into a 3 to 4% response in a 525 lb heifer calf. Typically, suckling calf response to growth promoting implants is highly correlated to genetics for growth and the level of nutrition (milk and forage) available to the calves during this suckling phase.

In a summary of 20 studies evaluating re-implanting steer calves prior to weaning, average daily gain response over the entire nursing period was only slightly greater (.11 to .13 lb/d) when compared to those receiving a single implant administration (.097 to .11 lb/d).

The effect of growth promoting implants on reproductive performance of potential replacement heifers when implants are administered once at branding time (from approximately 40 to 60 days of age), has generally been inconsequential. A summary of 13 studies using zeranol showed a pregnancy rate reduction of .8% in implanted heifers while 9 studies using the estradiol-progesterone combination showed a reduction of 3.2%. Selk reported a summary of 10 trials where heifers were implanted 2 X with zeranol (36 mg) and saw an average reduction in pregnancy rate of 7.3%. However, three studies involving a single implant administration at birth averaged a 39% reduction in subsequent pregnancy rates.

Researchers (Hargrove, 1994; Deutscher, 1994) have reported that a single implant administration during the suckling phase has resulted in a significant increase in pelvic area at approximately one year of age but that the advantage was essentially lost by the time the heifers calved at two years of age. Therefore, there was no effect on calving difficulty when compared to non-implanted controls.

In summary, a thorough review of the literature would suggest that the administration of one implant dose of a product cleared for use in potential replacement heifers would have little or no effect on future reproductive performance. However, the effect of such implants administered at birth or the effect of the administration of multiple implants between approximately two months of age and weaning time can have significant reductions in reproductive performance.

Various Weaning Ages with the Use of Growth Promoting Implants

Research at the University of Illinois (Myers et al., 1999) evaluated weaning 168 crossbred (½ Simmental, ¼ Angus and ¼ Hereford) steer calves at either 90, 152 or 215 d of age and placing them in a feedlot where they were fed to a constant compositional endpoint. All steers received 36 mg of zeranol at their respective time of weaning and were reimplanted with 120 mg of trenbolone acetate and 24 mg of estradiol (Revalor -S), 146, 132 and 104 d prior to slaughter for the 90, 152 and 215-d weaning groups, respectively.

After weaning calves were stepped up onto a finishing diet within 44 days. The number of days to finish decreased by 55 and 38 d (P = .001) as weaning age increased when slaughtered at a constant fat endpoint of .32 inch.

Weaning at 90 and 152 d of age enhanced overall daily gain by .33 and .15 lb/d, respectively, over weaning at 215 d. Over the finishing period, intake increased (P = .004) as weaning age increased. Because of number of days on feed and intake, total concentrate consumed increased (P = .03) as weaning age decreased.

Carcass traits of the three treatment groups were similar as there were no differences (P > .21) in carcass weight, ribeye area (REA) or yield grade. Likewise, no differences were observed in average marbling scores (P > .19) as 90, 152 and 214 d weaned calves had marbling scores of modest^{40} (Mt^{40}), Mt^{12} and Mt^{15}, respectively. Over 90% of the steers in each treatment group quality graded low choice or higher.

Dams of 90 d weaned calves increased 2/3 of a body condition score over the 125 d period until 215 d calves were weaned (represented a weight change of approximately 106 pounds) while the 152 d dams gained .39 units of BCS over the 63 d period until 215 d calves were weaned (approximately a 77 lb weight change).

Pregnancy rates were improved by 12% (P = .15) in the 90 d weaning treatment compared to the 152 and 215 d treatments. The latter two treatments were similar (67%) but would not have been affected by time of weaning since the breeding season was concluded prior to weaning.

These researchers concluded that early weaning enhanced gain and feed efficiency but increased total concentrate consumed in the feedlot phase.

Feedlot Implant Strategies

The cow-calf producer who retains ownership to finish, along with the feedyard operator, has decisions to make on growth promoting implant strategies during the finishing period. Table 4 summarizes the results of an excellent review of information from 37 research trials by Duckett et al., 1996. Implanting steers increased (P > .05) gain by 18%, feed intake by 6%, feed efficiency by 8%, carcass weight by 5% and ribeye area (REA) by 4% relative to steers that did not receive implants. However, when REA was adjusted for carcass weight, there was no difference from non-implanted control steers. Although some trends appeared to exist, marbling score, quality grade, percent grading choice and shear force did not differ statistically.

This data includes various combinations of implant types. Aggressive implant strategies using combinations of estrogenic and androgenic implants must be properly managed from a timing standpoint prior to slaughter in order to get the economic benefits while producing a consumer acceptable beef product.

Using Carcass Data in Cow-calf Management Decisions

The more information a producer has, the more accurate the decision-making process can be. It can reduce risk if you have the information or may in some cases increase risk if you don't have the information. However, one must ask to whom do you market your product? Remember, no matter how great the carcass genetics, you still have to produce a live calf that grows at an acceptable rate to weaning. If one sells calves at weaning, he may have different priorities than one who retains ownership from the finished product and sells on a grid pricing system. Even then, selection priorities may be different if your grid is based on quality grade versus one that offers the greatest premiums for superior cutability.

The most progress can probably be made by selecting sires that are within acceptable ranges for the traits that are important to your customers whether you are selling weaner calves, finished market cattle or replacement heifers. Use your within herd records to monitor those traits of importance to your sustainability. Then use the EPDs for those traits of importance to your operation, to make directional change as needed. Carcass information is just one part of the puzzle that should be within acceptable ranges. The use of carcass data in cow culling decisions should probably be limited to those that consistently produce outliers. Carcasses that are either too small or too large, or dark cutters might be cause for concern although the previously discussed research would suggest that management decisions may be able to accommodate the size differences. The greatest benefit of carcass information should be to give direction to sire selection programs.

Summary

Beef producers continually face challenges to the sustainability of their production systems. They must consider the use of available technology and make management decisions (i.e., time of calving and weaning) that will reduce their costs of production while producing a product that will maintain or hopefully enhance consumer demand. Producers must utilize the best information available to make management decisions. It is critical to make those decisions that will enhance the flexibility of your production system to allow one to better cope with the dynamic nature of the industry.

Literature Cited

Clark, R. T., D. C. Adams, G. Earriker, R. E. Sandberg, T. Milton, J. Musgrave, T. J. Klopfenstein, and G. P. Lardy. 1999. March vs. June calving systems: production and economic considerations. Proceedings. University of Nebraska, Gudmundsen Sandhills Laboratory Field Day. p. 1-10.

Duckett, S. K., D. G. Wagner, F. N. Owens, H. G. Dolezal, and D. R. Gill. 1996. Effects of estrogenic and androgenic implants on performance, carcass traits, and meat tenderness in feedlot steers: A review. The Professional Animal Scientist 12:205-214.

Deutscher, G. H. 1994. Growth promoting on replacement heifers – A research review. Proc. Society for Theriogenology Annual Meeting, Kansas City, MO. p. 76-85.

Hargrove, D. D. 1994. Use of growth promotants in replacement heifers. In: Factors Affecting Calf Crop, ed. M. J. Fields and R. S. Sands. CRC Press, Boca Raton, FL. p. 91-194.

Myers, S. E., D. B. Faulkner, F. A. Ireland, and D. F. Parrot. 1999. Comparison of three weaning ages on cow-calf performance and steer carcass traits. J. Anim. Sci. 77:323-329.

Selk, Glenn. 1997. Implants for suckling steer and heifer calves and potential replacement heifers. Proceedings: Symposium on Impact of Implants on Performance and Carcass Value of Beef

Cattle. Oklahoma State University. p. 40-50.

Thielen, J. A. 1998. Effects of calf age and post-weaning nutritional regime on performance, carcass characteristics and economic return. Masters Thesis, University of Wyoming, Laramie.

Thielen, J. A., D. L. Hixon, B. W. Hess, R. A. Field and M. L. Riley. 1999. Effects of calf age and nutritional regime on feedlot performance and carcass characteristics. University of Wyoming, Animal Science Department Annual Report. p. 61-68.

Table 1. Ration composition (DM basis).

	% Concentrate			
Item	35 (G)[1]	52	69	85 (F)[2]
	%			
Cracked corn	30.9	47.9	64.9	81.3
Dehydrated alfalfa	12.1	11.4	10.5	9.5
Oat hay	52.9	36.6	20.5	5.1
Pre-mix[a]	4.1	4.1	4.1	4.1

[a]Contained protein, minerals, and ionophore to balance diet and meet nutritional requirements.
[1]Grow (G) diet contained 12.9% crude protein.
[2]Finish (F) diet contained 12.7% crude protein.

Table 2. Feedlot performance measures.

Item	Days on F-diet	F-diet ADG (lb/d)	Final end weight (lb)	Age at harvest (d)
EWF	196	3.20	1206	413
EWG	168	3.15	1272	464
LWF	168	3.37	1255	466
LWG	131	3.37	1336	505

Table 3. Treatment effects on carcass characteristics.

Item	EWF	EWG	LWF	LWG
HWC, lb[1]	742.7[a]	781.1[b]	772.1[b]	825.4[c]
Dressing %[2]	64.1	64.0	64.1	64.3
Backfat, in	.37	.38	.39	.36
REA, in^2	13.3	13.4	13.6	14.2
YG[3]	2.09	2.16	2.14	2.08
Marbling[4]	1366	1398	1410	1391
QG[5]	3.29	3.57	3.71	3.31
Shear force, lbs	7.10[a]	7.12[a]	6.77[a]	6.13[b]

[1]HCW = Hot carcass weight.
[2]Dressing % = Dressing percentage based on 4% shrink of average two-day full weights prior to shipping to packer.
[3]YG = USDA yield grade.
[4]Marbling score: 1200 = slight; 1300 = small; 1400 = modest; 1500 = moderate.
[5]Quality grade: 2 = select; 3 = low choice; 4 = average choice.
[a,b,c]Means in same row with different superscripts differ (P < .05).

Table 4. Mean of each trait for non-implanted and implanted steers, and the change by implanting (Duckett et al., 1996).

Variable	Non-implanted mean	Implanted mean	Change by implanting
Performance			
Average daily gain, lb/d	2.78	3.28	.50[**]
Feed intake, lb/d	19.2	20.4	1.26[**]
Feed efficiency, lb feed: lb gain	6.96	6.40	-5.6[*]
Carcass traits			
Dressing percentage, %	62.00	61.94	-0.06
Carcass weight, lb	679.00	716.00	37.00[**]
Ribeye area, in^2	11.80	12.24	.44[**]
Fat thickness, cm	.47	.48	0.01
Kidney, pelvic, heart fat, %	2.20	2.07	-0.13
Marbling score[a]	5.40	5.16	-0.24
Quality grade[b]	4.90	4.60	-0.30
Percentage choice, %	74.00	59.50	-14.50
Yield grade	2.80	2.77	-0.03
Tenderness			
Warner-Bratzler Shear force, lb	7.91	8.51	0.60

[a]Marbling score numerical systems: 4-4.9 = slight; 5-5.9 = small.
[b]Quality grade numerical system: 4 = select; 5 = low choice; 6 = average choice.
[*]Change by implanting was unequal to zero (P < .05).
[**]Change by implanting was unequal to zero (P < 0.01).