December 2005

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Proceedings, The Range Beef Cow Symposium XIX
December 6, 7 and 8, 2005, Rapid City, South Dakota

HEIFER DEVELOPMENT: REVISITING TARGET WEIGHTS AND MANAGEMENT APPROACHES

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INTRODUCTION

Developing heifers can be among the most expensive practices in many beef production businesses (Sprinkle, 2000). We have heard time and again about the importance of getting heifers bred at high rates. The logic used is that it is expensive to develop heifers, so you can reduce the cost of a pregnant heifer by improving pregnancy rates. This tends to lead into a cycle of adding more costs to further increase pregnancy rates. A production driven approach to developing heifers may have negative impacts on ranch profitability.

It is generally recommended that heifers need to be developed to 60-65% of mature weight by the start of the breeding season (Patterson et al., 1992). Many producers will develop heifers to an average 70% of mature weight to make sure that near all heifers in the group are in the target range. Indeed, studies have shown that heifers developed to lower weights can have longer post-partum intervals (Patterson et al., 1991). In addition, some research has shown a clear relationship between dietary energy levels during development and heifer pregnancy rates (Lemenager et al., 1980).

We will discuss current research and production practices that challenge some of these recommendations and also take a look at different approaches to developing heifers. The degree and timing of inputs into heifer development systems can have marked effects on net returns. It is crucial that heifer development be considered from an economic standpoint, not simply a production-based perspective.

ECONOMICS OF HEIFER DEVELOPMENT

At the Range Beef Cow Symposium in 2003, Rick Funston shared data from Nebraska that challenged the 65% of mature weight recommendations (Funston and Deutscher, 2003). Eighty crossbred heifers in each of three years were developed to either 53 or 58% of mature body weight (low and high-gain). Heifers were developed on meadow hay, wheat middlings, cracked corn, and a supplement pellet. Corn was adjusted in rations so that each group would reach the desired target weight. Heifer pregnancy rates were not statistically different between treatments (88 and 92% for the low and high-gain, respectively). In addition, there were no differences between treatments in pregnancy rates of these heifers with there second (average of 91%), third (93%) or fourth calves (96%).

Creighton (2004) used 261 heifers across three years to compare two heifer development systems: 1) heifers developed to 50% of mature weight prior to breeding with a 60-day breeding period (low-gain) or 2) heifers developed to 55% of mature weight with a 45-day breeding season (high-gain). Heifers were developed during the winter on meadow hay, protein supplement, and whole corn. Corn was adjusted so that heifers would reach desired target weights. Similar to that described above, there were no differences in heifer pregnancy rates (87 and 90% for low and high-gain, respectively). There were also no differences in pregnancy with the second calf (average 91%).

Using data from these two studies, Clark et al. (2005) evaluated the economics of the heifer development systems described by Funston and Deutscher (2003) and Creighton (2004). The approach we used was to calculate the cost of producing a bred heifer and a heifer pregnant with her second calf using the actual inputs and pregnancy data from these studies. Feed costs and cattle prices were estimated for an eleven-year period (1992 to 2002) using actual data. The heifer development costs included the opportunity cost of the heifer at weaning and feed and other costs from weaning to pregnancy. All costs were then expressed back to the bred heifer (value of opens and culls was subtracted from costs), as the total cost was divided by the number of heifers actually bred. Calculations of the cost of developing a heifer to her second calf followed the same procedure and included a subtraction of the value of the first calf (assumed calves sold at weaning) and the value of culls and opens. Nominal prices for cattle and inputs were used in the calculations.

When averaged over the eleven year period, the low-gain treatment in the work of Funston and Deutscher (2003) resulted in $27 less cost per bred heifer than did the high-gain treatment (Table 1). Also, the average cost of developing a heifer in the work of Creighton (2004) was $23 less for the low-gain than the high-gain heifers (Table 1). The low-input systems resulted in similar performance and lower costs than the systems that developed heifers to a higher percentage of body weight.

Table 1. Total Development Costs from weaning to pregnancy of Low and High-Gain heifer development system (across two studies) averaged using cattle and commodity prices from 1992-2002[a,b].

	Heifer Development Study	
Item	Funston and Deutscher, 2003[c]	Creighton, 2004[d]
Low-Gain	$608	$580
High-Gain	$635	$603

[a]Adapted from Clark et al., 2005

[b]Data are average costs of developing heifers over 11 years of prices for cattle and inputs; quantities of feed and other inputs held constant for each of the two studies which were three years each.

[c]Study included 240 heifer calves across three years. Low-Gain heifers at 53% of mature weight at breeding and had a 92% pregnancy rate in 45 days; High-gain heifers were at 57% of mature weight at breeding and had an 88% pregnancy in 45 days.

[d]Study included 261 heifer calves across three years. Low-gain heifers developed to 50% of mature weight at breeding and had a pregnancy rate of 87.2% in a 60 day breeding season; High-gain heifers developed to 55% of mature weight and had a pregnancy rage of 89.2% in a 45 day breeding season.

A sensitivity analysis showed that if pregnancy rates would have been 50% in the low-gain system, the cost of developing a bred heifer would have actually been lower. Lowering the pregnancy rate did increase the variation in the cost of developing a bred heifer between years, however. The variation in development cost is increased when there are more opens due to variation in the value of opens and culls. If the high-gain system had a pregnancy rate of 50%, the development cost would have been about the same with more variation between years. This means that in the low-gain system, selling an open heifer in the fall was actually profitable (in the short-term). Costs were simply low enough that selling the yearling made money, whereas in the high-gain system it was a break-even. Both of these systems were not high-cost systems, though. When costs were arbitrarily increased (assumed same pregnancy rate), the relationship was different. If costs would have been $41 higher for the low input system (using the data of Creighton, 2004), lower pregnancy rates would have resulted in higher costs for a bred heifer.

Another interesting aspect of this analysis was in the cost of a second calf heifer. Using the data from Creighton, 2004, the cost of developing a two-year-old bred heifer actually went down, due to the price received for the first calf (on average across the eleven years). However, if pregnancy rate of the second breeding was arbitrarily reduced, then the cost of developing a second calf heifer went up. Therefore, pregnancy rate from the second breeding was important, as selling open two-year-olds was not profitable.

These data are consistent with that of Meek et al. (1999) which looked at the net present value of cows of different ages in a commercial herd in Nebraska. In this analysis, to achieve a 10% increase in two-year-old pregnancy, you could afford to pay $27/head before the first breeding (during replacement heifer development) or $57 after she was bred (as a bred heifer). Do you think you would be more likely to increase two-year-old pregnancy by spending $27 prior to first breeding or $57 dollars on the bred heifer. I believe the latter would be more achievable. All this is telling us is that you have more leverage to influence production without increasing costs with the bred heifer than with the replacement. The bred heifer may be a place that more management attention needs to be focused.

Patterson (2001) reported at the Range Beef Cow Symposium that they improved two-year old pregnancy from 86% to 91% on over 1000 bred heifers by spending an extra $1.80/ heifer in supplement. Heifers were developed to about 53% of mature weight at first breeding. They balanced a winter supplement to meet metabolizable protein requirements and achieved the improved pregnancy.

There are some considerations to developing heifers to weights that are less than 60% of mature weight at breeding. The data presented here showed similar pregnancy rates of "underdeveloped" heifers, however there is likely more risk of lower pregnancy rates with decreasing levels of development. That may not be too much of a problem if you have enough heifers to keep replacements. A system that exposes more heifers with lower input, with the intent on selling yearlings in the fall, may be profitable in some situations.
There will be some years when open heifer prices are low compared to feed costs and it may not be profitable to sell opens. A second concern is calving difficulty in lighter heifers. Patterson et al. (1991) reported that heifers that were developed to 55% of mature weight at

breeding had more dystocia than did heifers developed to 65%. If birth weights in your herd are not too high and proper bulls are selected for breeding heifers, you can likely manage this. No increase in dystocia was reported in the studies discussed above. Another consideration is heterosis. The heifers in the work describe above were crossbred heifers. It is not clear that pure-bred animals or other biological types would have the exact same results. Also, developing heifers that are lighter at breeding may result in cows that are smaller at maturity. This could be very positive in reducing maintenance requirements of the cows.

The data described above do show that heifer development systems need to be based on economic decisions, not just production-based outcomes.

ALTERNATIVE HEIFER DEVELOPMENT SYSTEMS

Recent work in South Dakota showed that heifers can be effectively developed without spending a lot of money on feed (Salverson et al., 2005). This project stemmed from a time of weaning study that we were working on (August versus November weaning). One of the things with early-weaned heifers is that you have a long time to feed her before breeding. Therefore, we developed a trial to evaluate developing August-weaned heifers on native range versus November-weaned heifers in a drylot (conventional system). The study took place at South Dakota State University's Antelope Research Station, near Buffalo, South Dakota. Heifers were all weaned on grass hay and a wheat middling/soybean hull based weaning pellet for 30-45 days. August-weaned heifers were turned out onto ample winter range in September and remained on pasture all winter. November weaned heifers remained in the drylot after weaning and were fed grass hay and a wheat middling-based range pellet. Both groups of heifers were managed to achieve 65% of mature weight at breeding in June (about 860 lbs). We assumed they would gain 2.0 lbs/day between turnout in mid-May and breeding in mid-June. Since the Range developed heifers were early weaned, they needed to gain 1.5 lb/day during the winter, compared to 1.3 lbs/day for the November weaned group.

To achieve the desired average daily gain for the heifers on range, dried distillers grains were fed daily in feed bunks at a rate of 2-7 lbs per heifer each day. The rate of feeding was initially at 2 lbs and then gradually increased to 7 lbs by February. The rate then declined back down in the spring (we based this on estimates of forage quality and intake). Hay was only fed on two days during the winter when snow cover prevented grazing.

All heifers were turned out to summer pasture on May 18 and were exposed to bulls on June 14 (as one group). On June 18, heifers were given an injection of Lutalyse (Pfizer Animal Health, New York, NY) to synchronize estrus. Bulls were removed 5 days later for a 14-day period so that synchronized conception could be determined. Bulls were then returned for a 24-d period. Two blood samples were taken prior to synchronization to determine if heifers were cycling.

Performance results are shown in Table 2. By design, heifers on the Range system were lighter at trial initiation because they were younger (early-weaned). Also by design, they gained more during the experiment than the drylot heifers. However, they gained 1.68 lbs per day, rather than the target 1.5. This increase in gain was a result of the heifers performing better in the spring than expected. November-weaned/drylot heifers gained at the target rate of gain. There were no differences in the percentage of heifers cycling prior to breeding, synchronized conception, or overall pregnancy rages. Pregnancy rates were good, averaging about 90%.

Interestingly, there was a difference in average daily gain between the two groups of heifers from May 18 to June 14, even though they were managed together on native range and no supplements were fed. During this period of time, the early-weaned heifers that had been on range all winter gained 2.1 lbs/day, compared to only 0.32 lb/day in the heifers that were developed on grass hay and a supplement. Due to the higher than expected gains in the range group during the spring and early summer, we could have fed them less distillers grains and still reached target weights.

Hay was charged at $72/ton; supplement (drylot group) at $160/ton; dried distillers grains at $114/ton, and native range at $7.50 per heifer each month. The daily cost of the drylot group was $0.74 compared to $0.52 for the range developed group. We were able to feed the early-weaned calves an extra 78 days for about the same total cost as the normal-weaned calves.

Table 2. Performance of heifers that were weaned in August and developed on range (Range) compared to November-weaned heifers developed in a drylot (Drylot).

Item	Range	Drylot
Number of Heifers	33	32
Initial Weight, lb[a]	460[f]	605[g]
Final Weight., lb[b]	859	830
Average Daily Gain, lb/d[c]	1.68[f]	1.34[g]
Cycling at breeding, %	94	100
Synchronized Conception, %[d]	58	50
Final Pregnancy Rage, %[e]	91	88

[a]Weight at the beginning of heifer development treatments (weaning dates were different)
Range: 9-25-03
Normal: 12-2-03.
[b]Weight at the time both groups were moved to summer pasture together and no longer supplemented (5-18-04).
[c]Average daily gain from initial to final weight.
[e]Pregnancy during a 10-d synchronization period to natural service.
[e]34-day breeding season.
[f,g]Within a row, means with unlike superscripts differ ($P<0.05$).

A similar study was conducted at SDSU's Antelope Station in 2004 and 2005. In this study, approximately 117 crossbred heifers were weaned at similar times (Aug-Sept). Heifers were weaned in the drylot. On December 2, one-half of the heifers were turned out on native range and fed 5 lbs of a distillers grains-based range cube (fed daily). The other half remained in the drylot and were fed grass hay and a wheat middling-based supplement. All heifers were moved to summer grass on May 12. All of the analyses were not complete at the time this paper was prepared, but some results had been summarized. Although both heifer systems in this study were designed to achieve similar gains during the winter, the range developed heifers gained 1.5 lbs/day compared to 1.3 for the drylot developed group. There was no difference in pregnancy rate between the two treatments.

At the Padlock Ranch, we are combining both of the major concepts discussed in this paper: 1) developing heifers to a lower percentage of body weight; 2) developing heifers on range. If heifers will breed at 50% of mature weight, we believe we can take advantage of available native range to develop heifers. Since the development costs will be low, we believe we can sell heifers off of grass for a profit in many years. Having the yearlings on grass gives some management alternatives during drought as well. In 2003, 402 head of heifers, weighing 439 lbs, were fence-lined weaned on native range in October. A wheat middling based range cube (18% crude protein; contained Deccox {Alpharma. Fort Lee, New Jersey}) was fed for 30 days at rate of 3 lbs/day. Heifers were then fed a range block (30% crude protein) at a rate of 2.0 lbs/day for the remainder of the winter. No hay was fed all winter. There was very little sickness in the calves (13 heifers were doctored) and the feed costs were less than $0.25/day. Due to drought conditions, we had to sell the heifers in June and thus do not have pregnancy data. The calves weighted about 724 lbs in June, putting there gain at over 1.0 lb/day since weaning. Approximately 1500 heifers will be developed similarly in 2005-2006.

Certainly there will be winters when weather will require more hay feeding or when winter grass is not available. Do you manage every year for that one in ten year storm? I think you have to plan for severe weather, but you do not have to manage for the worst. In addition, there will be some situations where grass is worth enough that it might be cheaper to feed the heifers than to graze them. You need to make that calculation. Would you rather have cows that had to dig through a little snow when they were calves or cows fed in the feedlot until they were 15 months old?

CONCLUSIONS

Crossbred heifers can reach puberty and breed if developed at 55% of mature weight at breeding, but there is likely more risk of reproductive failure. Selling open heifers can be a paying proposition if development costs are low. Range development systems may offer a low-cost way to develop heifers in for some operators. There is significant management leverage in the young cow. Heifer development is usually approached from the standpoint of achieving maximum reproduction. Since it is such a large expense to cattle operations, heifer development systems should be based on economics.

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