Compensatory Gain

by Brian M. Freking, Will Lathrop,
Elise Mitchell and David Redhage

2000 Beef Progress Report-2

Compensatory Gain

Topics **Page No.**

Figures **Page No.**

Tables **Page No.**

Evaluation of Reproduction and Calf Performance of Beef Heifers Under Management With and Without Compensatory Gain

Brian M. Freking, Will Lathrop, Elise Mitchell and David Redhage
The Kerr Center
for Sustainable Agriculture, Inc.
Poteau, Oklahoma

Abstract

A multiple year study was conducted using crossbred heifers produced on the Kerr Center Ranch including breeds consisting of Angus (AN), Senepol (SE), Gelbvieh (GV), Brahman (BR), and Brangus (BN). Each year, heifers were allotted at random to management treatments blocked within breed composition and weight. The first treatment supplements heifers to gain enough weight during the winter period to reach a breeding target weight and minimize or eliminate compensatory growth during the spring green up period. All groups were bred to calve first as two-year-olds with non-pregnant animals culled after pregnancy check. The second treatment group will take advantage of compensatory growth utilizing the spring green-up period and supplementation. This group was fed an energy supplement for only 60 days prior to the breeding date to reach their target weight. The third treatment group consisted of heifers managed to take advantage of compensatory growth during the spring and summer period and primarily rely only on grass as their source of nutrition. Some supplementation of hay was required for all groups for maintenance growth during the dormant season. The breeding period began on May 1 each year utilizing A.I. for one heat period after which a clean-up bull was used. The breeding season terminated on July 1 equating to a 60 day breeding season.

Reproductive performance measures were evaluated on:

- % Cycling
- Calving difficulty score
- Dystocia
- Pregnancy rate
- Calving interval
- % Weaned/cow exposed

Growth performance of the heifer/cow and their calves were evaluated on:

- Average daily gain (ADG)
- 205 day weight
- 205 day weight/cow exposed
- Heifer weight over time
- Cow weight at breeding, calving and weaning

Economics were evaluated on:

- Heifer development cost (feed, vet, medicine, etc.)
- Income (market calves, replacements, and culls)

Experimental Procedures

Introduction

It has been estimated that up to 75% of the feed energy needed for beef production is required by the cow-calf segment of the industry. Of that, 70 to 75% is used to cover cow maintenance requirements. As a result, factors affecting cow maintenance requirements can be expected to affect overall beef production efficiency. The compensatory growth of cattle on pasture following nutritional restriction has been widely studied (O'Donovan, 1984; Ryan, 1990). In addition to increased efficiency, related to lower maintenance requirements and lower energy content of live-weight gain than in normal growing cattle, increases in voluntary herbage intake is the main explanatory mechanism. Management utilizing compensatory growth to reduce inputs may have a significant impact on a producer's bottom line.

This study was conducted at the Cannon Multi Species Grazing Project Area. Upon fall weaning heifers were treated as normal in our system as reported previously in the Kerr Center progress reports. This included vaccinations for five-way leptospirosis and respiratory IBR, PI_3, BRSV, blackleg and clostridials. Heifers were also treated for internal and external parasites in the fall. Upon arrival they received a 12-14% protein supplement for at least a week to ease their transition from weaning pens to pasture and to train animals to be coaxed when moved for rotational grazing. Newly weaned heifers enter the grazing program with the primary objective to have them gaining 1 lb./hd/d on grass with a minimum of supplemented feed to maintain body condition (i.e., B.C.S.= 5). Heifers were rotated every two to four days between pastures. Heifers were rotationally grazed from weaning until the first part of December and had access to fescue/bermuda grass hay using temporary wire hay traps.

Initially, cattle in the first treatment (Feed Group) received free access to hay and were supplemented with a 14% creep pellet and cottonseed meal daily at a level predicted to reach their target weight outlined in the feeding time line. Feeding began on 12 December and completed on 2 April. Cattle in the second treatment (Flush Group) received free choice hay and were supplemented with cottonseed meal. Sixty days prior to the breeding date this group received a 14% creep pellet as an energy source for compensation. Feeding began on 1 March and completed on 1 May. Cattle in the third treatment (Grass Group) also received supplementation of cottonseed meal and hay. This group had to rely on the spring green-up period to compensate for a limited winter nutrition period.

Initial weights were taken and heifers were sorted prior to being put on feed treatments. Cattle were also weighed periodically to evaluate compensatory growth and target weights during critical periods of the production cycle.

Cost of production and income were kept separately for each treatment group. Labor costs were only applied to normal production practices.

Data was analyzed using Least Squares Means procedures of SAS. The model includes continuous effects of management treatment and breed composition. At the present time, results are preliminary, and further statistical analysis is needed.

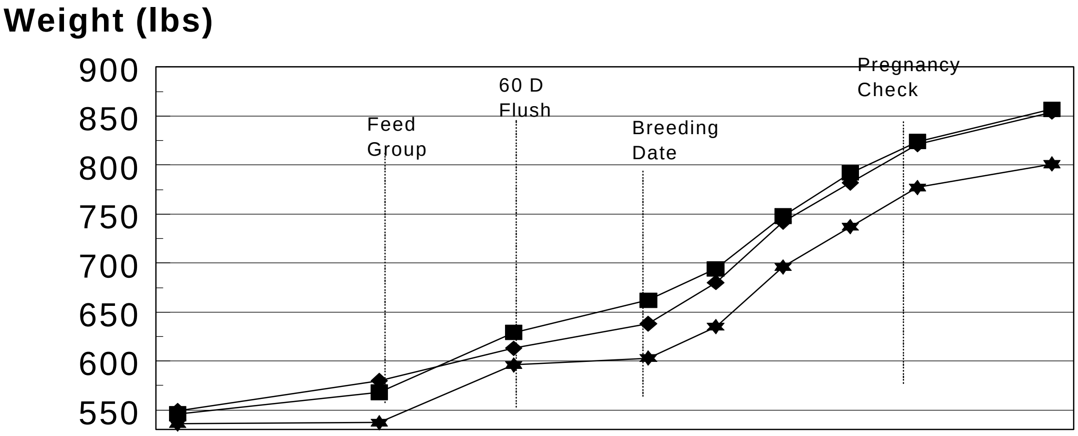
Results and Discussion

The objective of the study is to evaluate reproduction, economics and calf performance in heifers developed with and without compensatory growth. Compensatory growth is the greater than expected weight gain sometimes seen in animals following an extended period of slow growth or weight loss due to restricted nutrition. Compensatory growth is a complex metabolic function and a number of mechanisms are involved (Carstens, 1995). This paper does not attempt to find out how compensatory growth occurs but rather, find out how to optimize its function to the producer's advantage.

Growth rate (Fig. 1) differences over time among the feed treatments help graphically illustrate cattle's adaptation to feed resources. In September heifers were weaned and weights collected. These weights and their genotype determined which feed treatment animals were randomly assigned. Weight at weaning was designed to be similar initially between treatments. Although the groups were managed the same from weaning until December, only the grass group maintained their weight in the first year. This is somewhat of a mystery and may just be random error within the year.

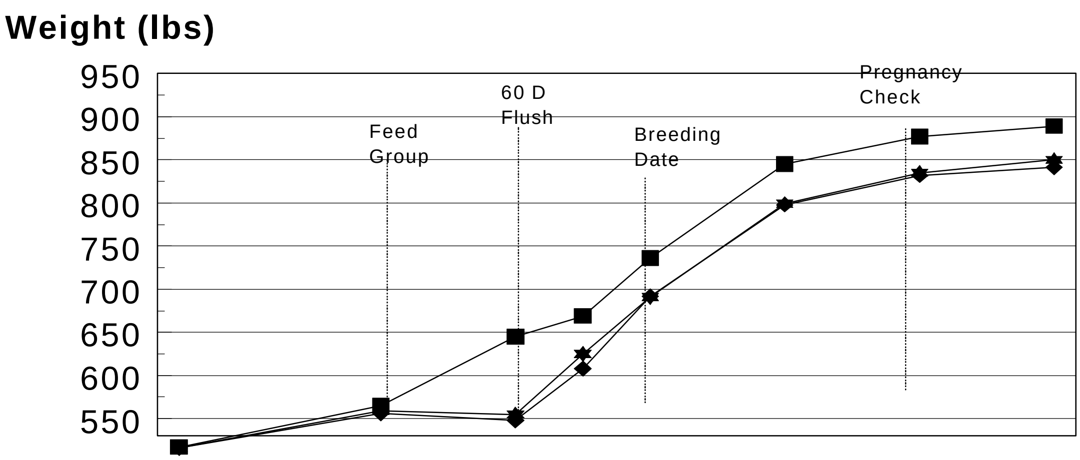
The second year followed a more predicted growth curve (Fig. 2). The grass group also showed examples of compensatory growth during their development. It is illustrated by a flat slope on the growth curve followed by a sharp rise. A key point to emphasize is the timing of this compensatory growth. It is important that heifers weigh enough to reach puberty and be gaining weight going into breeding season. Weight has been shown to be positively correlated with reproductive traits such as pregnancy rate and percent bred artificially (Taylor, 1984).

Figure 1.Heifer Weights over Time- Year 1



Weigh Dates	9/16/96	10/15	11/15	12/12	1/15	2/27	3/15	4/2	5/1	6/5	7/9	8/12	9/9	10/1
Feed Group ■	546			568		629		662	694	748	792	824		857
Flush Group ◆	549			580		613		638	680	742	782	821		854
Grass Group ✱	536			537		596		603	635	696	737	777		801

Figure 2.Heifer Weights over Time- Year 2



Weigh Dates	9/16/97	10/15	11/15	12/04	1/15/98	2/27	3/26	4/27	5/30	6/30	7/9	8/6	9/03	10/2
Feed Group ■	517			565		645	669	736		845		877		889
Flush Group ◆	516			556		548	608	692		798		832		841
Grass Group ✱	516			559		555	625	691		799		835		850

Research has shown that heifers need to weigh 60-65% of their mature weight at the time of breeding and 80-85% at calving time for optimum reproductive efficiency. Our cows usually weigh 1150 lbs. at 4 years of age. Therefore replacing those cows using the target weight system we need our heifers to weigh 690-745 lbs. at breeding and 920-978 lbs. at calving. On average all heifers met their target weight at breeding the second year but only the feed group attained their target weight at breeding in year one. Weight at calving (Fig. 3) was collected at branding which is 60 days past the average calving date. Only the grass group didn't reach the second target weight of 920 lbs. at calving. This group had an average weight of 900 lbs. at calving. Cow weights were also recorded at weaning to calculate an efficiency index. The index (Table 1) is calculated as the adjusted 205 day weight of calf divided by cow weight to the ¾ power (metabolic body size). Nutritionists use metabolic body size to determine an animal's daily nutrient requirements. Using this index makes an attempt to consider maintenance requirements that should favor selection of the most efficient animals regardless of cow size.

Figure 3. Heifer Weights over Time

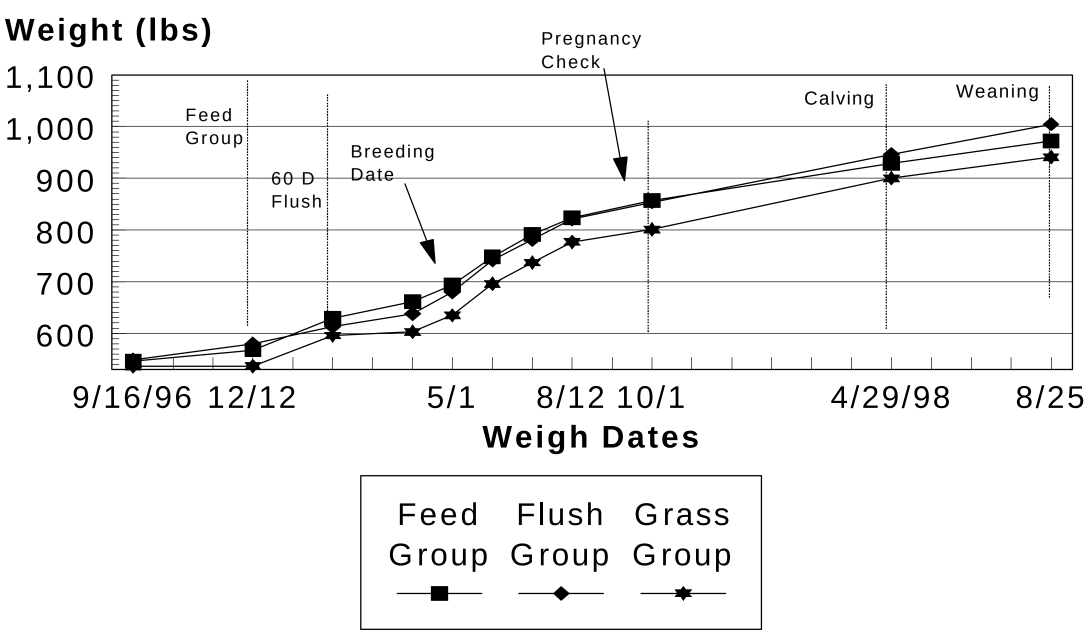
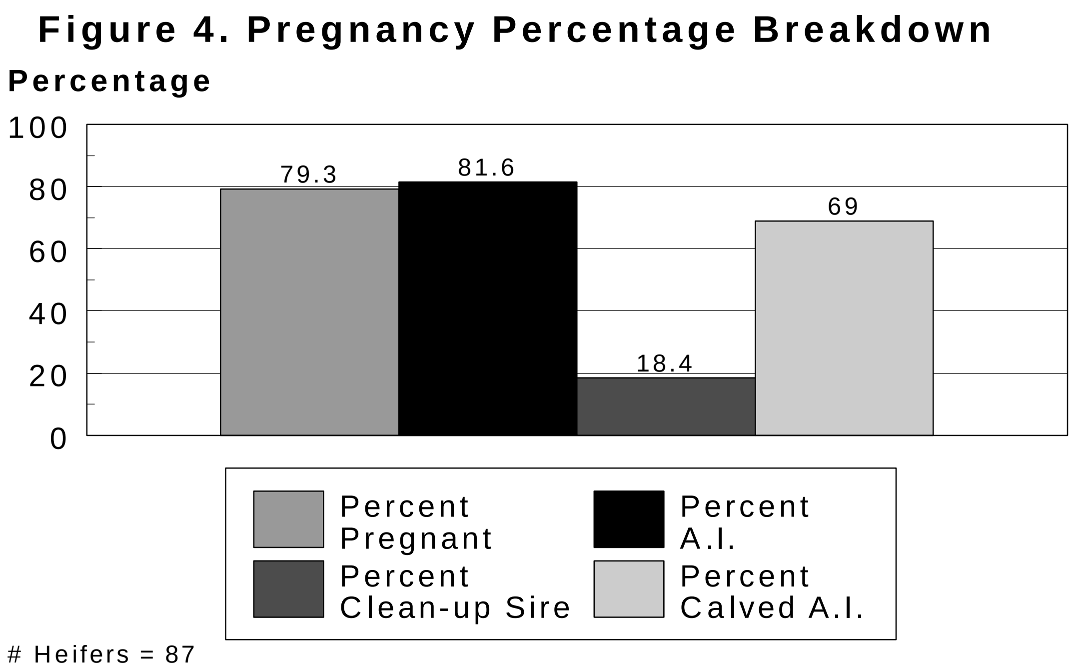


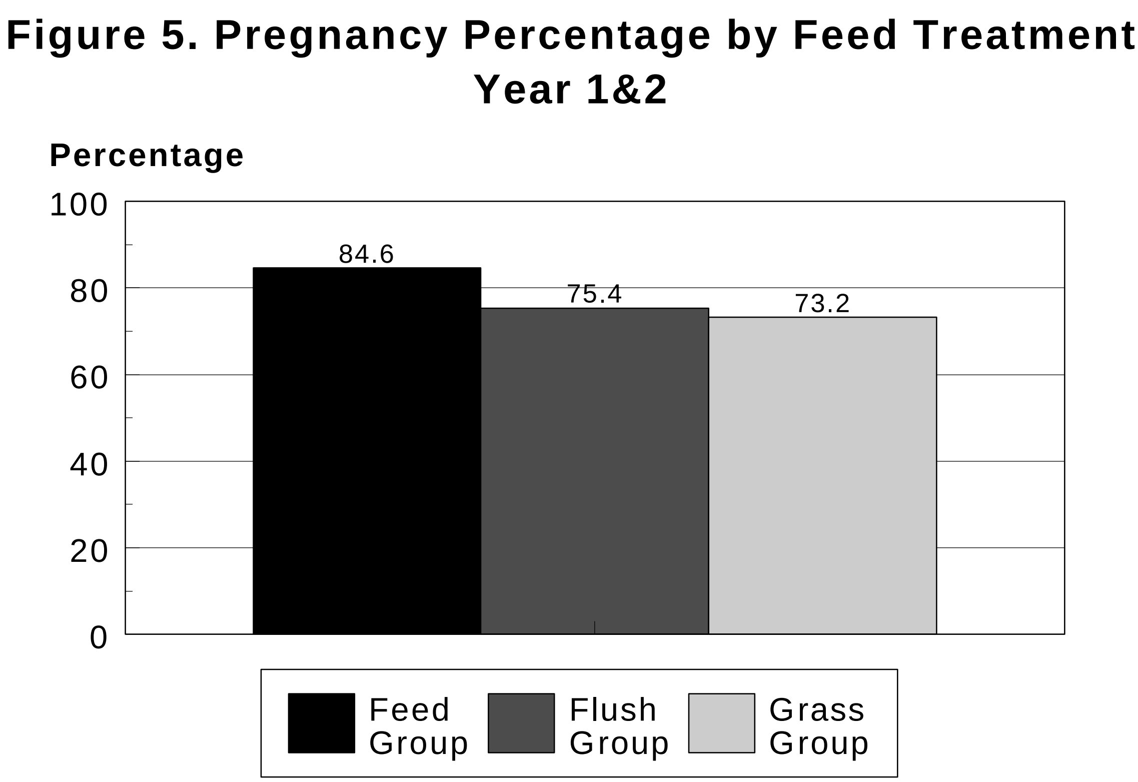
Table 1. Efficiency Index of Heifers by Management Treatments				
	Feed Group n=29	Flush Group n=29	Grass Group n=29	Overall n=87
$\bar{X}$ Birth date	2/22	3/2	2/28	2/27
BW (lb)	73	70	71	72
Calving Ease Score	16.9	12.9	13.1	14.7
Actual WW (lb)	460	423	422	436
Adj 205 d Wt (lb)	551	526	526	535
Cow Wt @ WW (lb)	997	1020	966	994
Efficiency Index	312	254	305	290

The feed group had the earliest average birth date which could also help explain the heavier weaning weights. This group also had the highest numerical calving ease score. The lowest score possible is 11 (most desirable) and the highest score is 55. Heritability has been estimated to be 0.30 for this trait (Taylor, 1984). If producers recorded this information they could make substantial improvements. This scoring system is based on the National Cattlemen's Beef Association red book standards. The efficiency index shows the feed group being 7.6% more efficient than average followed by the grass group at 5.2% above average. The flush group had the lightest calves at weaning. This is primarily due to the fact that average birth date is later resulting in more calves sired by the clean-up bull. They were also 12% less efficient than average because of the weaning weights and cow weights at weaning. Breed of sire explains over 80% of this decrease in efficiency (A.I. vs natural).

Reproduction has been emphasized as a critical component of profitability in beef operations. One objective of the study is to evaluate differences in reproductive components between feed treatments. In year one the overall pregnancy rate was 85.3 % and in year two, 70%. Our local veterinarian determined pregnancy status by rectal palpation. He also attempted to determine pregnancy status in days. Pregnancy diagnosis was completed in early September equating to a potential gestation length of 100-120 days after bull turn-out. Based on the veterinarian's call it was calculated that the percent bred A.I. was 81.6

percent (Fig.4). Final determination of conception to A.I. bulls was determined by calculating gestation length from calving date and A.I. date.



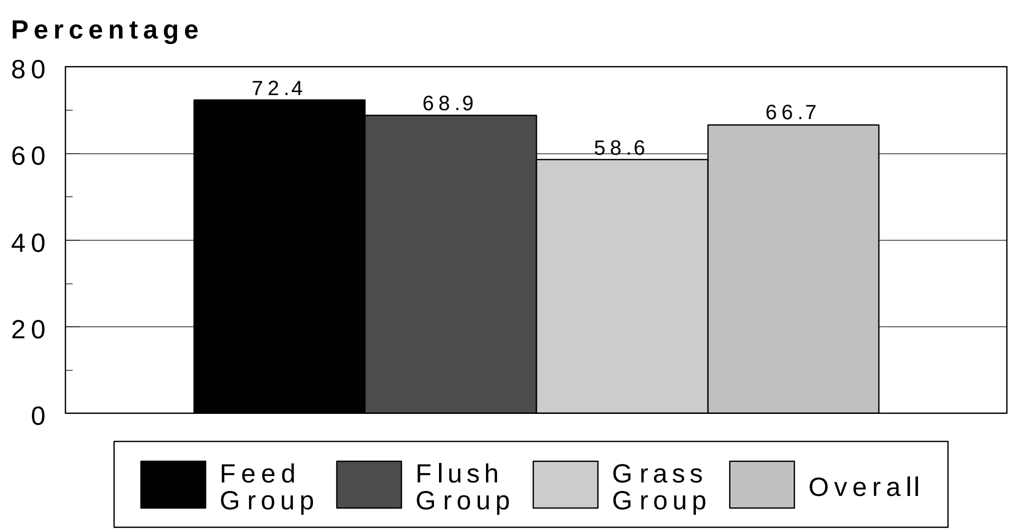


Pregnancy rates between treatments was highest for the feed group followed by the flush group (Fig.5). The grass group had the lowest percent of pregnant heifers in a sixty day breeding season. This is combined data over two breeding seasons. Pregnancy rates on average were very acceptable among all treatments. However, variation between years does exist between treatments.

Most producers agree that the difficult task of heifer management is getting them rebred following calving (Fig.6). We were particularly interested in how previous management affected rebreeding. A recommended management practice is to separate heifers from the mature cow herd and feed accordingly. Another recommendation is to have heifers calve about 30 days prior to the rest of the cow herd. The reason for this is that 1st calf heifers are still growing and need a higher plane of nutrition. It also gives heifers more time to rebreed. We felt we could make more intense selections if all groups were put under the stress of their natural environment and select those animals that were the most efficient. Therefore heifer management was similar between treatments following the first breeding season. All heifers were commingled with the mature cows once they had calved. They were rotationally grazed every two to three days. One potential difference not accounted for is calving date. This can be analyzed as a covariate variable.

The overall rebreeding rate was 66.7 percent. This information is critical if a

Figure 6. Rebreeding Percentage by Feed Treatment



producer wants to maintain a set number of cows. These rates determine how many replacements need to be kept each year to maintain herd size. If a producer wants a herd size of 100 cows he must keep back enough heifers to replace those that are culled for various reasons and those that don't rebreed. Using our overall data of 79.7% pregnancy rate, 66.7% rebreeding rate and a herd size of 100 cows with a 15% replacement rate, we would need to keep a minimum of 28 heifers each year (15 head ÷ 0.797 ÷ 0.667 = 28). Among treatments the highest rebreeding rate was in the 60 day feed group followed by the flush group. It was somewhat expected that the grass group would be last considering their plane of nutrition. Using these numbers and the same goal of a 15% replacement rate on 100 head of cows we would need 24, 29, and 35 replacement heifers for the feed, flush, and grass groups respectively to maintain herd size. Preliminary information suggests an advantage to the feed and flush groups as a replacement heifer development strategy.

A final study objective is to evaluate the economics of each treatment. Development costs were recorded for each treatment. Individual cost items are listed in tables two and three. The main differences to be gleaned from the tables is the feed, A.I., and interest cost. A calf cost was assigned to each treatment based on a standardized performance analysis (SPA) cost to raise a calf to weaning that needs to be recovered. This data can also be interpreted that we need to sell heifers for around $529 to break-even. Looking at it another way, if we could buy similar genetics for less than $529 we should not raise our own replacements.

Looking at the overall cost for each treatment probably doesn't tell the whole story. We should be interested in what it cost per pregnant animal since that is our goal economically and biologically. Using the pregnancy rates in figure 5 we can determine the cost/pregnancy. The feed group has a development cost of $652.15 per head when cost is divided by percent pregnant. The cost of the flush group and grass group is $704.17 and $692.65, respectively.

Table 2. Heifer Development Cost/ Head- Year 1			
	Feed Group	Flush Group	Grass Group
# head	35	35	41
Calf Cost	316.92	316.92	316.92
Vet. & Medicine	10.58	10.58	10.58
Feed, hay, minerals	69.45	62.26	41.77
Pasture rent	28.25	28.25	28.25
Labor	6.08	6.08	6.08
Miscellaneous	34.41	34.41	34.41
A.I.	22.63	17.49	18.44
Clean-up bull	5.94	5.94	5.94
Interest (8% annual)	39.54	38.55	36.99
Total Cost	$533.80	$520.45	$499.38

Table 3. Heifer Development Cost/ Head- Year 2			
	Feed Group	Flush Group	Grass Group
# head	30	30	30
Calf Cost	316.92	316.92	316.92
Vet. & Medicine	10.58	10.58	10.58
Feed, hay, minerals	75.15	62.24	36.25
Pasture rent	34.84	34.84	34.84
Labor	6.08	6.08	6.08
Miscellaneous	34.41	34.41	34.41
A.I.	34.80	21.60	22.80
Clean-up bull	14.67	14.67	14.67
Interest (8% annual)	42.20	40.11	38.12
Total Cost	$569.65	$541.45	$514.67

Implications

A multitude of options exist for developing heifers. Based on these preliminary numbers it pays us to feed the heifers for reproductive efficiency. Using our current information producers could sort off the top 30% of their heifers at weaning and feed them like the feed treatment group to maintain herd size. The rest of the replacements could take advantage of the efficiencies of compensatory growth to save economically. Another option might be to sort the lightest heifers to be fed as the first treatment group, and utilize advantages of compensatory growth in the larger heifers since they would not need to gain as much to reach their target weight. One additional opportunity might be to improve our forages and grazing efficiencies to supply a better year-round nutrition program. Our data also shows the importance of good nutrition when utilizing artificial insemination. Another aspect not covered in the study is the opportunity for improvement by selection. Heritability for reproductive traits generally are low in magnitude, but tremendous progress can be made if selection is emphasized in this area.

Literature Cited

Carstens, G.E. 1995. Symposium: Intake by feedlot cattle. Oklahoma State University. P-942: 70-84.

O'Donovan, P.B. 1984. Compensatory gain in cattle and sheep. Nutrition Abstracts and Reviews, Series B, 54: 389-410.

Ryan, W.J. 1990. Compensatory growth in cattle and sheep. Nutrition Abstracts and Reviews, Series B, 60:653-664.

Taylor, R.E. 1984. Beef Production and the Beef Industry: A Beef Producer's Perspective. Macmillen, pp.107-119.