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# PRODUCTION AND ASSOCIATED COSTS OF HEIFER DEVELOPMENT -THE BENCHMARK VALUES -

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## RESEARCH SUMMARY

Producers involved with the Cow Herd Appraisal of Performance Software (CHAPS) consigned a combined total of 549 heifers from 1993, 1994, 1995 and 1996 to be developed from a weaned heifer calf to a bred replacement heifer. The heifers were spring born, with a typical birth date of mid March, represented a variety of breeds and crosses and were managed to reach 70% of their projected mature weight at breeding. Mature weight was estimated utilizing frame scores taken shortly after delivery. Heifers were synchronized to facilitate artificial insemination (AI) during May. Following AI, heifers were exposed to cleanup bulls for a minimum of 45 days. Angus and Red Angus sires selected for calving ease, based on birth weight ENDS, were used for cleanup bulls. Production and cost benchmarks were documented.

The heifers averaged 84.4 lbs. at birth, 567 lbs. at 205 days of age, 5.6 frame score, with an estimated mature weight of 1220 lbs. As designed by the project, these heifers reached 72.1 percent of their estimated mature weight prior to breeding. This was achieved with an average daily gain of 1.67 pounds from the weight on test (599 lbs.) to the pre breeding weight (884 lbs.). Heifers averaged 1 lb. average daily gain on summer pasture with a project ending weight of 1034 lbs. Respiratory distress was the primary health problem requiring treatment, with foot root the second most common health-related problem. Project mortality was 0.73% with morbidity at 6.2% across all four years

The genetics and management of these heifers resulted in 92.6 percent of the heifers returning home pregnant. Although not all heifers were bred to artificial insemination, 77.8% of the heifers expressed estrus following exposure

to a synchronization program and 54.3% conceived to AI service. Overall, 42.9% were bred to AI service, 49.7% were bred to natural service and 7.4% were open.

Total development costs excluding interest and death loss for the 365-day period averaged $270.71. Costs included were: feed $165.30; yardage $53.67; breeding $36.64; health $9.24; and miscellaneous $5.81. Potential cost savings (high value minus low value over the four years) were: feed $54.76; yardage $6.48; breeding $8.49; health $1.42; and miscellaneous $6.39. If all least cost scenarios were to occur simultaneously, then heifers could have been developed for $77.54 less than what the actual costs were. This however is hypothetical, and the winter of 1996-1997 ($4^{th}$ year) also would suggest that environmental factors must always be accounted for.

In conclusion, development of a heifer should be achievable for a 365-day cash cost of $270. These costs do not reflect the value of the heifer, interest charges or the value of producer demand for the service.

**INTRODUCTION**

In today's cost controlled agricultural environment, a frequent asked question is "What does it cost to develop a replacement heifer?". The answer significantly impacts the North Dakota cattle business since herd production records indicate about one-third of heifer calves raised are developed for herd replacements. Not only must heifers be economically developed, but the management of replacement heifers can significantly affect lifetime productivity. Subsequent production costs must be monitored within the beef operation, but failure to adequately or properly develop the replacement heifer could impact long term output in terms of pounds of calf produced per cow exposed. Least cost management procedures may actually inhibit potential output. Unfortunately, many of the answers to these questions are only assumed but not really known. Since the foundation of North Dakota's beef industry is a profitable cow herd, the replacement of that herd is critical.

In recognition of the importance of heifer selection and development, the North Dakota Beef Cattle Improvement Association in conjunction with the NDSU Extension Service and Dickinson Research Extension Center initiated a Heifer Development Project in the fall of 1993. The project involved developing producer consigned heifer calves for a 365-day period. The central test format involves, receiving heifers post weaning, developing the heifer for breeding, and returning the heifer as a bred heifer to the consignor 365 days later. Benchmark values for production

and economic traits are being developed along with improved recommendations related to the feeding, breeding, health, and management of replacement heifers. This publication focuses on the benchmark values.

## MATERIALS AND METHODS

North Dakota Beef Cattle Improvement Association members utilizing the CHAPS production testing program were invited to enter raised heifers born between February and May into development projects conducted in both 1993-1994, 1994-1995, 1995-1996 and 1996-1997. Consigned heifers were delivered in November to the Dickinson Research Extension Center - Manning Ranch unit accompanied with individual CHAPS information, a $50 entry deposit credited to development costs, and a signed entry form certifying health management and conveying consigned heifers as security against development charges. Consignors retained ownership of heifers entered and were responsible for all incurred development costs over the period of the test, taking back heifers upon test completion the following November and settlement of outstanding charges. Producer cost liability was limited to $250 plus health treatment costs and semen costs for the 1996-1997 project year.

Heifers were required to be dehorned and vaccinated two weeks prior to delivery with I., BVD, BREV., $PI_3$, haemophilus somnus, and 7-way clostridial products. Vaccination for pasteurella haemolytica was optional. Upon delivery, a 4-way viral (IB., BVD, BREV., $PI_3$) and a 7-way clostridial booster vaccination was administered along with a pour-on for ecto parasite (louse) control. Heifers not brucellosis vaccinated prior to arrival were vaccinated, and all heifers received a pre breeding vaccination for 5-way lepto, vibrio, IB., BVD, and $PI_3$. When clinical signs of illness were diagnosed, a veterinary recommended treatment was administered.

Heifers were given an adaptation period in which a receiving ration was fed and health was closely monitored. Once on feed, heifers were weighed on the test, body condition scored, frame scored, disposition scored, and allocated to feeding groups based on weight and target gain. Target gain was determined by calculating the gain needed to achieve 70% of a frame score projected mature weight at the start of breeding. Mature weight was projected by the following formula: estimated mature weight = (frame score*75) + 800. In the first year, heifers were assigned to light, medium and heavy feeding groups. The second year involved assigning heifers to high gain, low gain, and experimental feeding group. In the third and fourth years, heifers were assigned to experimental feeding groups. Regardless of year, body weight and condition were periodically monitored and occasional heifer grouping

adjustments were made to assure that each heifer was achieving the optimum gain needed for breeding.

Heifers were wintered in open dry-lot pens, with wind break protection, and wheat straw for bedding. A total mixed ration was fed in fence line bunks, with the exception of the experimental feeding group in the second year. NRC guidelines and actual feed analysis were used to formulate rations to meet the desired targeted gain levels. Rations were periodically adjusted for heifer performance and condition. High roughage rations consisting of corn silage, chopped hay, limited amounts of rolled corn, oats or barley, along with soybean oil meal when additional protein was required. Rations were supplemented with a commercially prepared mineral-vitamin premix that included the ionophore Bovatec$^{TM}$. Heifers in the experimental group in year two, were fed free-choice high quality long hay in bale rings and supplement blocks containing additional protein, minerals, vitamins, and the ionophore Bovatec$^{TM}$. This group also received a limited amount of oats and commercial feed in the initial week on-test. All heifers were on pastured from the AI breeding to the completion of the project. Heifers were estrus synchronized to facilitate a single AI service followed by a 45-day cleanup service. Breeding dates varied across years depending upon the consignor desired calving date. Three methods of synchronization have been utilized to achieve synchronization within preset management constraints. These included feeding melengestrol acetate (MGA$^{TM}$) plus one injection of prostaglandin, injections of prostaglandin as a two-shot system and the SYNCRO-MATE-B$^{TM}$ system. All systems were utilized following recommended industry practices and were assumed equal in efficacy. Estrus activity was monitored and breeding heat detected with the use of KMAR$^{TM}$ patches, Bovine Beacon$^{TM}$ patches, or the HeatWatch$^{TM}$ system. Breeding services were contracted to Select Sires, ABS Global, and 21$^{st}$ Century Genetics. Consignors were given their choice of sires for the AI service, provided the semen was from the participating breeding companies. Heifers not responding to estrus synchronization were placed with cleanup bulls immediately following the AI breeding period. Cleanup bulls were placed with all heifers for a minimum of 45 days following the AI service. Natural service sires were calving ease selected Angus and Red Angus bulls based on birth weight EPDs. Heifers were measured for pelvic area pre breeding and ultrasound pregnancy diagnosed approximately 70 days post AI breeding.

Consignors were billed on a quarterly basis for heifer development costs. Feed costs were determined by group feed consumption records and the market price or actual cost of purchased feeds. Yardage was accrued on a per head per day basis to cover labor, facilities, equipment, utilities, fuel, and management set at a rate of $.20/day in the dry-lot and $.10/day on pasture. The actual costs of veterinary, breeding and miscellaneous supplies and

services were incurred by consignors. The annual ownership cost for cleanup bulls were shared by all heifers in the project. In the event a heifer died, the loss was borne by the consignor.

## RESULTS AND DISCUSSION

Developmental costs are presented in Table 1. The 365 day developmental costs averaged $270.85 and varied from a low of $249.47 in the 3rd season to a high of $297.19 in the 4th season. The largest cost associated with the development of heifers were feed costs. Approximately 61% of the associated costs were related to feed. Even more striking is the fact that over the four years, the range in feed costs ($54.76) was 33% of the average feed costs of $165.30. Payback to appropriate managerial decisions regarding feed management is great.

The second largest expense was yardage, which is the cost accrued per head per day to cover labor, equipment, facilities, utilities, fuel, repairs and management. These costs were set at $.20/day in the dry-lot and $.10/day on pasture and were not changed during the four years. The lower yardage charges were a result of heifers spending more time on grass. The third leading expense was breeding costs. These costs accounted for 14% of the total cost and were relatively constant from year to year (Table 1). The same can be stated for health costs which accounted for slightly more than 3% of the total cost followed by 2% miscellaneous expenses.

Feed costs need to be targeted for cost reduction, in order to least cost a development program. Table 2 presents the feed costs by year for the various feeds delivered to the bunk. In the future, continued efforts are being made to reduce heifer development costs. Experimental protocols will be developed to effectively reduce feed cost without decreasing performance, as well as potentially reducing yardage costs incurred through exploring more extensive rather than intensive development systems.

Overall heifer performance is presented in Table 3. The heifers averaged 84.4 lbs. at birth, 567 lbs. at 205 days of age, 5.6 frame score, with an estimated mature weight of 1220 lbs. As designed by the project, these heifers reached 72.1 percent of their estimated mature weight prior to breeding (75, 71, 68 and 72 percent, year 1,2,3 and 4, respectively). This was achieved with an average daily gain of 1.67 pounds from the weight on test (599 lbs.) to the pre breeding weight (884 lbs.). Heifers averaged 1 lb. average daily gain on summer pasture with a project ending weight of 1034 lbs.

The genetics and management of these heifers resulted in 92.6 percent (table 4) of the heifers returning home pregnant. Although not all heifers were bred to artificial insemination, 77.8% of the heifers expressed estrus following exposure to a synchronization program and 54.3% conceived to AI service. Overall, 42.9% were bred to AI service, 49.7% were bred to natural service and 7.4% were open.

**Table 1. Heifer development costs by project year (dollars per heifer)**

| | 1993-1994 | 1994-1995 | 1995-1996 | 1996-1997 |
|---|---|---|---|---|
| **FEED COSTS** | | | | |
| Drylot | 124.54 | 94.55 | 84.56 | 148.17 |
| Pasture[a] | 52.50 | 55.20 | 55.27 | 46.42 |
| **Total feed costs** | 177.04 | **149.75** | **139.83** | **194.59** |
| **YARDAGE** | | | | |
| Drylot | 38.20 | 31.19 | 34.98 | 40.44 |
| Pasture | 17.40 | 18.40 | 18.42 | 15.63 |
| **Total yardage costs** | **55.60** | **49.59** | **53.40** | **56.07** |
| **BREEDING** | | | | |
| Synchronization | 4.67 | 3.55 | 6.25 | 4.37 |
| Artificial breeding costs[b] | 17.46 | 17.72 | 21.66 | 17.84 |
| Cleanup bull[c] | 12.38 | 13.26 | 12.00 | 16.80 |
| Pregnancy diagnosis | 2.00 | 2.00 | 2.00 | 2.00 |
| **Total breeding costs[d]** | 35.98 | **35.28** | **41.91** | **33.42** |
| **HEALTH** | | | | |
| Vaccinations | 3.97 | 4.13 | 6.31 | 4.85 |
| Parasite control | 3.65 | 2.60 | 2.65 | 3.25 |
| Treatments[e] | 2.21 | 2.93 | 0.27 | 0.14 |
| **Total health costs** | **9.83** | **9.66** | **9.23** | **8.24** |

| MISCELLANEOUS[f] | | | | |
|---|---|---|---|---|
| **Total misc. costs** | **3.45** | **9.84** | **5.10** | **4.87** |
| **TOTAL DEVELOPMENT COSTS** | **282.60** | **254.12** | **249.47** | **297.19** |

[a] Pasture charges were $.30 per head per day. This charge includes the cost of salt and mineral-vitamin supplementation, at approximately $1.62 per heifer.

[b] Percent of heifers artificially inseminated (AI) are as follows: 89% 1993-1994, 91% 1994-1995, 100% 1995-1996, and 62% 1996-1997.

[c] Cleanup bull charges were at $12 per heifer if artificially inseminated, and $24 per heifer if not.

[d] Total Breeding Cost was per heifer in project, some columns will not total, since not all heifers incurred all itemized costs.

[e] The health problem requiring the most treatment was respiratory distress with foot rot being second. Mortality was at .73% with morbidity at 6.2% across the four years of the project.

[f] Miscellaneous expenses consisted of trucking, identification, etc.

**Table 2. Feed costs by project year (price per ton)**

| Feed ingredients[a] | 1993-1994 | 1994-1995 | 1995-1996[b] | 1996-1997[b] |
|---|---|---|---|---|
| Alfalfa hay | -- | -- | 55 | 55 |
| Alfalfa/Grass hay | -- | -- | -- | 50 |
| Barley | 58 | 69 | 125 | -- |
| Corn grain | -- | -- | -- | 106 |
| Corn silage | 18 | 18 | 18 | 18 |
| DiCalcium Phosphate | -- | -- | 444 | 494 |
| Grass hay | 40 | 40 | 40 | 40 |
| Oat grain | 78 | 63 | -- | -- |
| Oat hay | 40 | 40 | 40 | 40 |
| Oatlage | 20 | 40 | 20 | 20 |
| Soybean oil meal | 249 | 178 | -- | 270 |

| | | | | |
|---|---|---|---|---|
| White salt | 110 | 110 | 100 | 108 |

[a] Mineral and vitamin supplementation was provide at an average cost of $456/ton with an approximate cost of $20.50 per heifer. The ionophore Bovatec™ (lasalocid) was provided at 250mg to 360mg per head per day. White salt and mineral-vitamin supplementation were provide free-choice while heifers were on pasture.
[b] Decox™ (Decoquinate) was fed for 30 days in 1995-1996 and 1996-1997 for prevention and control of the parasite coccidiosis.

**Table 3. Heifer performance by project year**

| **Project averages** | **1993-1994** | **1994-1995** | **1995-1996** | **1996-1997** |
|---|---|---|---|---|
| Number of heifers | 130 | 114 | 50 | 255 |
| | | | | |
| Birth date | 3/17 | 3/20 | 3/13 | 3/12 |
| Birth weight | 83 | 85 | 89 | 84 |
| Weaning weight | 597 | 580 | 584 | 524 |
| Adj. 205 day weaning weight | 611 | 576 | 554 | 544 |
| Adj. 205 day ratio | 103 | 110 | 106 | 103 |
| | | | | |
| Weight on project | 636 | 631 | 612 | 564 |
| % Mature weight on project | 52 | 49 | 49 | 48 |
| | | | | |
| Frame score | 5.8 | 6.4 | 5.7 | 5.1 |
| Projected mature weight[a] | 1238 | 1280 | 1237 | 1180 |
| Adj. 365 day yearling weight | 911 | 826 | 778 | 824 |
| Pelvic area | 158 | 182 | 195 | 183 |
| | | | | |

| | | | | |
|---|---|---|---|---|
| Pre-breeding condition[b] | 7.2 | 6.8 | 6.8 | 6.7 |
| Pre-breeding weight | 940 | 917 | 841 | 850 |
| Days of age at breeding | 432 | 428 | 416 | 438 |
| % Mature weight at breeding | 75 | 71 | 68 | 72 |
| | | | | |
| Weight off project | 1039 | 1101 | 1043 | 1000 |
| Condition off project[b] | 6.7 | 6.7 | 6.2 | 5.8 |
| % Mature weight off project | 83 | 88 | 84 | 84 |
| | | | | |
| ADG in drylot | 1.9 | 1.6 | 1.5 | 1.6 |
| ADG on pasture | 0.9 | 1.2 | 1.2 | 1.0 |
| Overall ADG | 1.5 | 1.4 | 1.3 | 1.4 |

[a] Project mature weight is estimated by using the following calculation (frame score*75)+800.
[b] Body condition score range 1 to 9, with 1 emaciated and 9 obese.
[c] Average daily gain (ADG) in drylot is also the same as ADG from time on the project to time of synchronized AI breeding.

**Table 4. Heifer reproduction by project year**

| **Project averages** | **1993-1994** | **1994-1995** | **1995-1996** | **1996-1997** |
|---|---|---|---|---|
| Number of heifers | 130 | 114 | 50 | 255 |
| | | | | |
| % Displaying estrus[a] | 89 | 91 | 100 | 62 |
| % Conception to AI service[b] | 55 | 61 | 46 | 55 |
| | | | | |

| | | | | |
|---|---|---|---|---|
| % Bred AI | 52 | 54 | 44 | 33 |
| % Bred natural service[c] | 40 | 38 | 44 | 61 |
| % Open[d] | 8 | 8 | 12 | 6 |
| Overall pregnancy percent[d] | 92 | 92 | 88 | 94 |

[a] Percent displaying estrus at time of synchronized AI breeding.

[b] AI conception rates were determined by using real-time ultrasound. Determining the stage of pregnancy was accomplished by taking measurements of fetal body length or fetal cranial (crown) width.

[c] Heifers were exposed to cleanup bulls for approximately 45 days following the synchronized AI breeding.

[d] Dead heifers were accounted as open. Average mortality rate was .73 percent.

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