



# Impacts of Crossbreeding on Profitability in Vertically Coordinated Beef Industry Marketing Systems

\*Preliminary Report – Year 1

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\*All results are based on limited numbers from year one. Results may vary as more data is collected. **It is important that no significant conclusions be drawn until the study is completed.**

# Abstract

Vertically coordinated beef marketing systems (alliances and partnerships) have become breed specific, generally Angus, in an effort to improve quality grade and tenderness and to focus on the consumer. However, by so doing, the value of crossbreeding (heterosis) has been diminished, particularly at the cow-calf level. The primary objective of this project is to measure the effect of controlled crossbreeding in range environments on predominantly Angus-based females. By determining the value of heterosis to beef cattle alliances, cattle breeding systems in the U.S. have the potential to be significantly modified to utilize systematic, controlled crossbreeding programs.

Ten Hereford bulls, selected for specific genetic parameters (expected progeny differences [EPDs]) were matched with 10 Angus bulls of comparable genetics. Bulls were randomly mated to 400 mature Angus-based cows. All cattle (cows and calves) were identified with electronic ear tags, and DNA samples were taken on all sires and calves to determine parentage. All cattle had equal access to comparable feed resources and management in extensive, relatively harsh environments. Differences in weaning performance, feedlot performance, carcass value and overall profitability were measured.



Subsequent to measurement of individual heterosis, the F1 female will be evaluated for the value contributed by maternal heterosis. The study is being conducted in cooperation with Harris Ranch, the American Hereford Association (AHA) and Lacey Livestock.

Preliminary data suggest a significant economic advantage in the feedlot phase for the crossbred (Hereford-sired) calves. Primary differences were gain, feed efficiency, morbidity and mortality, resulting in a dramatically lower cost of gain (\$11.94 per hundredweight [cwt.], \$7.32 per cwt. difference when mortality of the Angus-sired steers was excluded). The Angus-sired group had a significant advantage in quality grade, partially offsetting the value in the feedlot. However, the net advantage favored the Hereford-sired cattle by nearly \$78 per head for the entire production cycle.



All results are based on limited numbers from year one. Results may vary as more data is collected. It's important that no significant conclusion be drawn until the study is completed.



# Introduction

Historically, cattle improvement in the 1950s and 1960s was based on the introduction of purebred (registered) cattle, to upgrade and improve native stock. Remarkable strides were made in improving the uniformity and quality of the product. By the mid-1960s most herds were emphasizing the use of purebred Hereford, Angus and Shorthorn cattle.

In the 1960s, a tremendous body of research was developed evaluating the use of systematic crossbreeding to improve the profitability of beef production. The theory was to capitalize on heterosis (hybrid vigor) to improve lowly heritable traits, and breed complementarity (advantages and disadvantages of each breed). Systematic crossbreeding has the potential to significantly enhance traits that are difficult to measure (calf livability, mortality, conception rate, longevity, etc.) (Gregory, et al., 1991). Data suggests tremendous improvement in calves weaned per cow exposed when crossbreeding is properly implemented. (Ritchie, 1994, 1996). Based on this research, commercial producers began to utilize crossbreeding extensively to improve overall profitability. The increased longevity and lifetime productivity of the F1 cow became obvious and the “black baldie” became famous as the “ideal cow.” However, crossbreeding was not always systematic and planned but, frequently, the result of simply introducing a new breed as an experiment. The result was often an inconsistent cow herd consisting of multiple breeds with diverse biological types.



Beginning in the 1990s, there was a strong focus on consumer demand, which caused producers to emphasize carcass merit, particularly an improvement in quality grade (marbling). Concomitantly, there was a growing trend toward vertically coordinated marketing systems (alliances) between producers, feedlots and packing plants. The intent was to produce a more uniform, acceptable product for the consumer. These two trends resulted in a dramatic shift toward one breed (Angus) and a reduction in crossbreeding throughout the U.S. This trend has been occurring for more than 15 years and does not appear to be moderating. Carcass traits have improved, but the result is the development of a predominantly Angus cow herd under commercial range conditions that has limited hybrid vigor.

Under the new market direction, with vertically coordinated systems becoming more typical, it is critical to evaluate differences in profitability when controlled crossbreeding is implemented in an Angus-based operation. Potentially, there are significant opportunities for the cattle industry to capture value from crossbreeding while not sacrificing the consumer focus of the beef industry.

The primary objective of this study is to conduct a controlled crossbreeding system, comparing Angus and Hereford bulls, under commercial conditions, emphasizing economic differences at the ranch, feedlot and packing plant. Major traits that have the potential to impact the overall profitability to a vertically coordinated alliance are being recorded. Results should be applicable to any large-scale cow-calf operation and of particular interest to those participating in vertically coordinated partnerships and/or alliances.

In order to fairly assess the impact of crossbreeding, data on the productivity of the F1 female will be important and will require long-term commitment to measuring lifetime productivity.

## Methods

Four hundred mature Angus-based cows were sorted and identified with electronic ear tags in the Lacey Livestock program, based in Independence, Calif. Cows were randomly mated to 10 Hereford or 10 Angus bulls, selected based on rigorous genetic parameters (EPDs) for overall merit. The project is being conducted for a three-year period, the typical lifespan of a bull under Western range conditions.

Lacey Livestock has been utilizing Angus bulls exclusively for the past eight years on an Angus-, Hereford- and Gelbvieh-based cow herd. Retained replacement heifers are predominantly Angus yet still include some Hereford influence. Heterosis will not be maximized within this system. However, the breed composition of the cow herd is similar to many commercial programs in the West and the results should have application to most operations that have been using Angus sires for several years.



During selected phases of the production cycle (preconditioning, weaning, feedlot, carcass), complete records were maintained on all calves born to the project. However, these data were collected under extensive range conditions (real world), so cattle were not managed like a traditional research project but comparably to field trial data. For example, birth dates and weights were not recorded. All calves were weighed on the ranch at preconditioning. DNA samples were obtained for parentage verification and each calf was identified with an electronic identification device (EID) placed in the ear.

At feedlot arrival, cattle were sorted into sire breed groups. Fifty-six Hereford-sired steers and 63 Angus-sired steers were fed in separate, adjacent pens, located at Harris Feeding Co., under traditional commercial feedlot conditions. All steers were processed on delivery with a standard vaccination program, and approximately 30 days post arrival both pens were implanted with Component TE-S™. Only steers that could be individually identified to one sire (not multiple sires or unknowns) were included in the analysis. Individual morbidity and mortality were recorded along with group feed efficiency and gain data. Ultrasound of rib fat and an interim weight was used to assist in the determination of logical harvest endpoint. The steers were ultimately sorted into two separate harvest groups for each sire breed.



At the point of harvest, all carcass traits — carcass weight, backfat, ribeye area, KPH, marbling score — were determined by a U.S. Department of Agriculture (USDA) grader. Dressing percent was calculated using a pooled carcass weight divided by gross-truck weight.



Data will be analyzed using standard statistical procedures for comparing within and across-breed variation. In addition, heterosis values will be computed for all traits. All economic values (input and output) will be monitored and economic models assessing the value of heterosis will be evaluated.

For the purposes of the preliminary report, economic differences were assessed by actual costs and return through the packing phase and accrue back to the feedlot.

# Results and Discussion

Preliminary data are presented in Tables 1-5. Results present some interesting trends, but the authors would caution that the data is based on limited numbers from year one. Further observations are critical in order to draw valid conclusions.

With that said, there was an advantage to the Hereford-sired calves in net return (approximately \$78 per head), including ranch, feedlot and harvest results combined. The primary differences were in morbidity, mortality, gain and efficiency — resulting in a significantly lower cost of gain.

In the preweaning phase (see Table 1), there were very limited differences in the sire groups with a slight advantage in weight resulting in a \$10.80 advantage for the Hereford-sired calves, if sold at preconditioning or weaning.

Cattle were weaned and delivered to a grower lot for a short backgrounding phase prior to arrival at the feedlot. Primary differences during the grower phase (see Table 2) were attributed to animal health due to a 3% (two deaths) mortality rate in the Angus-sired pen. Hereford-sired steers experienced no death loss and had a \$14.10 per head economic advantage through the backgrounding phase.



**Table 1. Ranch performance summary (preweaning weight)**

| <b>Traits</b>           | <b>Angus sired<br/>(n = 65)</b> | <b>Hereford sired<br/>(n = 56)</b> |
|-------------------------|---------------------------------|------------------------------------|
| Weight                  | 494                             | 503                                |
| In Value (\$1.20)       | \$592.80                        | \$603.60                           |
| <b>Value Difference</b> |                                 | <b>\$10.80</b>                     |



**Table 2. Backgrounding performance (grower lot)**

| <b>Traits</b>           | <b>Angus sired<br/>(n = 65)</b> | <b>Hereford sired<br/>(n = 56)</b> |
|-------------------------|---------------------------------|------------------------------------|
| In Weight               | 494                             | 503                                |
| In Value (\$1.20)       | \$592.80                        | \$603.60                           |
| Out Weight              | 645                             | 637                                |
| Out Value (\$1.20)      | \$774                           | \$764.40                           |
| Morbidity               | 11.3%                           | 16.2%                              |
| Mortality               | 3.07% (2)                       | 0%                                 |
| Treatment Cost          | \$1.09                          | \$1.61                             |
| Mortality Cost          | \$23.76                         | \$0                                |
| Net Value               | \$750.24                        | \$762.79                           |
| <b>Value Difference</b> |                                 | <b>\$14.10</b>                     |



**Results and Discussion continued**



During the feedlot phase (see Table 3), average daily gain (3.65 H; 3.28 A), feed efficiency on a dry-matter basis (4.92 H; 5.64A); morbidity (12.5% H; 22.22% A) and mortality (0% H; 4.76% A) all favored the Hereford-sired steers. Hereford-sired cattle had a significantly lower cost of gain (\$11.94 per cwt.) resulting in a total feedlot advantage of \$86.10 per head.

At harvest (see Table 4), there were minor differences in carcass weight, dressing percent and yield grade (including all factors related to yield grade). However, there was a significant difference in marbling score (quality grade). The Angus-sired steers had a 23% advantage in percent grading Choice or higher (73.33% versus 52%, respectively), resulting in a \$33 per carcass advantage to the Angus-sired group due to carcass quality. The price spread differential between Choice and Select was \$10/cwt. at the time of harvest of each group.

Hereford-sired

**Table 3. Feedlot and financial performance summary**

|   | Traits                               | Angus sired |           | Hereford sired |
|---|--------------------------------------|-------------|-----------|----------------|
|   |                                      | Deads In    | Deads Out |                |
| cattle had a significantly lower cost of gain resulting in a total feedlot advantage of \$86.10 per head. | Head                                 | 63          |           | 56             |
|   | Dead                                 | 3           |           | 0              |
|   | Finished                             | 60          |           | 56             |
|   | Weight In                            | 645         |           | 637            |
|   | Weight Out                           | 1,236       |           | 1,232          |
| <b>Feedlot Performance Summary</b>  |                                      |             |           |                |
|   | Day on Feed                          | 162         |           | 163            |
|   | ADG                                  | 3.28        | 3.47      | 3.65           |
|   | Conversion-As Fed                    | 7.89        | 7.46      | 6.88           |
|   | Conversion-Dry Matter                | 5.64        | 5.33      | 4.92           |
|   | Cost of Gain                         | 74.62       | 70.55     | 65.10          |
|   | Death Loss Percent                   | 4.76%       |           | 0              |
| <b>Morbidity</b>  |                                      |             |           |                |
|   | % Morbidity                          | 22.22%      |           | 12.50%         |
|   | Hospital Cost/Head Treated           | 16.24       |           | 9.12           |
|   | Hospital Cost/Head Placed            | 3.61        |           | 1.14           |
|   | Medicine and Processing Charges/Head | 9.62        |           | 7.18           |
| <b>Cost Summary</b>   |                                      |             |           |                |
|   | Delivered Cost/cwt.                  | 122.54      |           | 122.48         |
|   | Total Cost of Gain/cwt.              | 84.51       | 79.89     | 72.57          |
|   | Breakeven/cwt.                       | 105.35      |           | 98.38          |
|   | <b>Value Difference</b>              |             |           | <b>\$86.10</b> |

In summary, one major advantage in the crossbred cattle (Hereford-sired) was in morbidity/mortality, a lowly heritable trait that would be expected to demonstrate significant heterosis. However, even without inclusion of death loss into the feedlot closeouts, the Hereford-sired group still had a definitive advantage in average daily gain, dry-matter feed conversion and, ultimately, cost of gain compared to the Angus-sired group regardless of whether the mortality was calculated into the comparison or not. The advantage in quality grade of the Angus-sired group partially offset the economic advantage in feedlot performance of the Hereford-sired group. However, total profitability still favored the Hereford-sired pen and was most obvious at the feedlot phase of the production cycle.

In conclusion, the preliminary economic data suggests crossbreeding has the potential to significantly boost return in a vertically coordinated marketing system. Positive impacts were evident in most traits, with the exception of quality grade, and/or neutral in other traits (yield grade).

In order to provide more numbers for year two and three of the study, Lacey Livestock increased the number of cows to 600 for the remainder of the study, and the AHA and other collaborators have provided additional sires. The backgrounding, feedlot and carcass trial will be repeated in 2008 and 2009 with the subsequent calf crops. The effect of maternal heterosis will be determined by tracking productivity of the replacement heifers that were retained and identified to specific sires through DNA. Although difficult to assess in this commercial setting, the eventual objective would be to attempt to determine lifetime productivity and profitability differences between the sire groups.

**Table 4. Carcass performance summary**

| <u>Traits</u>                | <u>Angus sired</u> | <u>Hereford sired</u> |
|------------------------------|--------------------|-----------------------|
| <b>Carcass Summary</b>       |                    |                       |
| Live Weight                  | 1,236              | 1,232                 |
| Hot Weight                   | 780                | 776                   |
| Yield %                      | 63.11%             | 63%                   |
| <b>Quality Grade Summary</b> |                    |                       |
| Prime                        | 1.67               | 0                     |
| Choice                       | 73.33              | 52                    |
| %Choice or Better            | 75                 | 52                    |
| Select                       | 23                 | 48                    |
| <b>Yield Grade Summary</b>   |                    |                       |
| Total Yield Grade 1 & 2      | 26.67              | 37.50                 |
| Yield Grade 3                | 65                 | 48.21                 |
| Total Yield Grade 4 & 5      | 8.33               | 14.29                 |
| <b>Value Difference</b>      | <b>\$33.27</b>     |                       |

**Table 5. Economic summary**

| <u>Traits</u>               | <u>Angus sired</u> | <u>Hereford sired</u> |
|-----------------------------|--------------------|-----------------------|
| Ranch                       |                    | \$10.80               |
| Backgrounding               |                    | \$14.10               |
| <b>Pre-Feedlot</b>          |                    | <b>\$24.90</b>        |
| Feedlot                     |                    | \$86.10               |
| Carcass                     | \$33.27            |                       |
| <b>Feedlot and Carcass</b>  |                    | <b>\$52.83</b>        |
| <b>Net Value Difference</b> |                    | <b>\$77.73</b>        |

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