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# Assessing the Value of Coordinated Sire Genetics in a Synchronized AI Program

by

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## Assessing the Value of Coordinated Sire Genetics in a Synchronized AI Program

*Synchronized artificial insemination was used to inseminate cows using different types of sire genetics, including low-accuracy, calving-ease, and high-accuracy. These three calf sire groups were compared to calves born to cows bred using natural service. We found substantial production efficiency grains, carcass merit improvement, and economic value to calves born to cows following a synchronized artificial insemination program with high-accuracy semen included. The economic advantage to the high-accuracy calf sire group was computed to be in the neighborhood of $40 to $80/head, relative to the natural service calf sire group.*

**Keywords** : artificial insemination, beef, cow, carcass, feed-out, genetics, pre-conditioning, sire synchronization.

### Introduction

Production and quality variability in the cattle value chain persists due to breed and cross-breeding variation within and across beef cow herds in addition to beef cow operator management differences. The desire for production and quality consistency has lead to many innovations in the cattle industry in an attempt to project quality, including Leptin ghenotyping (e.g., DeVuyst et al., Lambert, DeVuyst, and Moss, and Lusk), ultrasound (e.g., Brethour), sorting (e.g., Koontz et al.), and most notable merit-based pricing for quality (Johnson and Ward). Conceptually, quality consistency in the cattle industry would develop like the pork or poultry industries. The capital costs of a fully integrated beef value chain are so large, all entities that have attempted to integrate have found it impossible due to the financial infeasibility of coordinating cow-calf, background system, feedlot, and processing on a large scale able to capture economies of size. Even those firms that have tried to integrate between segments of the beef value chain have faced issues related to non-perfect information due to the form of management and animal quality within segments not in their control. Predictability, i.e., tighter distribution of production and quality characteristics, benefits all beef industry entities beyond the cow-calf producer. One opportunity to control for the quality distribution within a beef herd and across beef operations occurs through coordinating sire genetics and heifer/cow conception date within and across beef herds. The objective of this research was to investigate, for a small sample, the economic value to cow-calf producers of managing for conception date and for sire genetic quality within and across beef herds.

The beef value chain contributes significantly to the U.S. economy. Beef production, processing, and distribution contributed a total of $188.4 billion toward domestic economic activity in 2000 (Cattle Fax). Today, this value exceeds $200 billion. Inefficiencies within the cattle production and beef marketing value chain persist due to the biological production lag for cattle, ineffective vertical flow of relevant information, and inadequate attention to end-user demand. However, the most important coordination problem relates to the need for improved beef product consistency within the value chain (Purcell, and Smith et al.).

For many years the wheat industry has structured its variety breeding program to deliver value up the wheat value chain. In doing so, wheat millers and bakers met consumer demands and simultaneously improved processing efficiencies. Wheat producer returns improved, particularly for producers who managed for quality. More recently, the pork industry adopted a quality-based genetics platform in order to meet processor demands for carcass consistency and consumer demand for quality. Due to these adoptions, we find specialization in the pork industry today. For both the wheat and pork industry, the objective reflects producers incorporating genetic verification into their management decisions are making profits because entities further up the value chain realize that production capabilities are improved, processing efficiencies are enhanced, and consumer desires are met. Predictability was the driving value factor. The cattle industry has struggled to develop similar vertically coordinated programs on a mass scale.

Domestic and global consumer preferences are changing from a low-price focus to a quality-price focus. Many examples of niche, coordination-enhancing efforts have been launched in the cattle industry attempting to create value by responding to changing consumer preferences. Most attempts have either failed or only succeeded in capturing value, never creating value. Cow-calf producers attempt a push-driven supply system where producers produce a product and then attempt to sell it without affirming that they are meeting the consumer demands. Retailers, via packers, attempt a pull system where quality-based pricing sends price signals in an effort to obtain the quality desired.

Fed cattle source, health, process, and genetic verification are being undertaken to address customer demand and capture value. Verification methods are simple to replicate individually, allowing competition to quickly make an otherwise niche market associated with verification strategies a commodity market. This leaves the question, what if one were able to economically bundle or stack verification methods throughout the value chain? Bundled verification impedes replication on a mass scale because of coordination costs. What value could be created by consistently coordinating the delivery of masses of cattle with similar, proven genetics, which are of a similar age, of assured health management programs, and source verified? However, cow-calf producers need to maintain their independence and ability to retain a majority of the decision making.

Managing for conception date and sire genetics within a beef herd and between beef cow herds represents an opportunity to add value (Figure 1). In practice, however, coordination of artificial insemination practices and agreements by producers to use similar sire genetics has been challenging. Coordination cost represents a substantial upfront investment, but removing decision making rights from independent producers substantially limits participation. Although, if producers are able to provide reliable information, then the marketing of quality-differentiated feeder calves will also have value (e.g., Bulut and Lawrence; Chvosta, Rucker, and Watts; Chymis, James, Konduru, and Pierce, Dhuyvetter et al.).

Hennessy, Miranowski, and Babcock indicated the benefits of improved genetic information in the agricultural industry. Stigler, as well as Ladd and Gibson, pointed out that there exists a cost for gathering information and a value exists for information itself. Only when the value exceeds the cost will genetic information be gathered, reported, and used to market commodities. For the current analysis we seek to assess the value of gathering the genetic information and coordinating genetics. The cost of coordinating genetics depends on the producer or producers involved with such an alliance.

## Experiment Background and Prior Research

In order to assess the production and marketing potential of cattle under a coordinated age, source, health, and genetic verified program, an experimental design was developed. The experimental design consisted of 328 animals in four sire groups. We use the term sire group throughout the remainder of the paper to differentiate between the alternative calf groups. The first calf sire group was "Natural Service," and this calf sire group represents calves born to a cow/heifer bred through natural service methods. The conception date of the cow/heifer is generally unknown, and the breed and quality of sire have little reliability. The second calf sire group was "Calving Ease," and this calf sire group represents calves born to heifers bred using artificial insemination (AI) where the sire was selected based on expected progeny difference (EPD) scores to minimize calving problems for the heifer. The third calf sire group was "Low-Accuracy," and this calf sire group represents calves born to cows bred using AI with sire semen EPD levels that are unproven. The fourth calf sire group was "High-Accuracy," and this calf sire group represents calves born to cows bred using AI with sire semen EPD levels that are proven. The primary calf sire group of interest for this study was the "High-Accuracy" group. For all calf sire groups sourced from AI bred cows, a timed and synchronized AI program was utilized.

The base lot represents a mixed lot, being a composite across all sire groups and reflects the typical commingled pen of cattle purchased through a sale barn, background system, or fed in a feedlot. The composite group was simulated based on the weighted average performance for all 328 calves. The Natural Service calf sire group was 93 animals, Calving Ease 36 animals, Low-Accuracy 101 animals, and High-Accuracy 96 animals.

Animals originated from four different farms, with four alternative management practices. The AI program utilized was the only similar management factor between the four farms. The female seedstock were of mixed breeds, with the highest prevalence of Angus or Angus crossbreeds. The sires, even for natural service, were of Angus breed. One Natural Service sire was Red Angus.

*Artificial insemination, timed/synchronized*

The beef cattle industry has seen rapid gains in economically desirable traits largely due to the selection and expanded use of genetically proven superior sires made available through AI. Recent surveys indicate, however that less than five percent of the beef cows in the United States are bred by AI, and only half of the cattle producers who practice AI use any form of estrus synchronization to facilitate their AI programs. The inability to predict time of estrus for individual cows or heifers in a group and the labor required for estrus detection, often make it impractical to use AI. Available procedures to control the estrous cycle of the cow can improve reproductive rates and speed up genetic progress. These procedures include the synchronization of estrus in cycling females and the induction of estrus accompanied by ovulation in heifers that have not yet reached puberty or among cows that have not returned to estrus after calving.

There are several advantages to a successful estrus synchronization program. These include: 1) Cows or heifers are in estrus during a predictable interval, which allows for artificial insemination, embryo transfer, or other planned reproductive techniques; 2) The time required to detect estrus can be reduced, which in turn decreases labor expense associated with the breeding program; 3) Cattle will conceive earlier during the breeding period; and 4) Calves will be older and heavier at weaning.

Following administration of protocols reported by Stegner et al., Bader et al., and Schaefer et al., the cumulative number of cows that calved within the first 30 days of the calving period was approximately 90% of the total number of cows that became pregnant during the entire breeding period. Estrus synchronization results in a shortened calving season that results in more uniform calves at weaning (Dziuk and Bellows). Reduced length of the calving season translates into a greater number of days for the postpartum recovery of the cow to occur prior to the subsequent breeding season. More recently, calving dates for cows that conceived on the same day to fixed-time AI were recorded to address concerns that pertain to the subsequent calving period (Bader et al.). Calf birth dates were recorded for cows that conceived to fixed-time AI at each location. This distribution suggests that the successful use of fixed-time AI will not result in an overwhelming number of cows calving on the same day(s).

Cows were bred using timed and synchronized AI following AI breeding procedures outlined by Schaefer et al.

*Pre-conditioning*

The value of pre-conditioning feeder calves has been well researched. Busby et al. reported the positive effect on feedlot performance and quality grade from post weaning health. Thus, any activity to enhance post weaning health should have a positive benefit on fed cattle profitability. Ward and Lalman show positive value to pre-conditioning feeder calves, and they point to the fact that pre-conditioning improves calf value beyond weight gain. They found higher pre-conditioning value when uniformity and health were accounted for in value component. Dhuyvetter found positive net returns to pre-conditioning when analyzing weight gain and price change over the period of the pre-conditioning program. He acknowledged that the pre-conditioning value will vary seasonally and across years.

Feeder calves from each of the four different farms were placed into a minimum 45-day pre-conditioning program. Cattle were fed MFA Cattle Charge at a minimum rate of 10 pounds per head per day for at least the first 14 days of the 45-day preconditioning period. Health requirements of the pre-conditioning program include immunization for 7-way blackleg-two doses, Haemophilus somnus-two doses, (IBR, BVD, PI3, BRSV)-two doses, Pasteurella hemolytica-one dose, dewormed and treated for external parasites, implanted (optional -- must record product and date if used), castrated with a knife (preferred) or verified to be a steer, and all calves must be polled or dehorned completely.

Feed conversion and average daily gain were each approximated, by sire group, based on observed pounds of feed consumed and observed weight gain. Values were computed based on an even quantity of feed allocated to each calf sire group. Recall, the pre-conditioning program was carried out separately for each farm.

*Feedlot*
At the conclusion of the pre-conditioning program, all calves were comingled and placed into pens at the University of Missouri Experiment Station feedlot located in Columbia, Missouri. Falkner emphasized indirect commingling costs, i.e., health from mixing cattle of different origins. However, we hypothesize that feeder calves of similar genetics and of similar age from across farms will have a lower rate of health issues when commingled.

On two separate occasions same sire group calves were separated and individual sire group feed efficiency and average daily gain was recorded.

*Processing*
Calves were marketed on six separate dates in 2006—March 14, March 21, April 18, May 9, May 16, and May 19. Finished steers were processed at Excel in Doge City, Kansas.

**Results**

Study results are listed in a series of tables based on the stage of calf production and one table summarizing an economic simulation analysis. Because of the small sample size used, we chose to not present the statistical significance level for each factor. We also present performance category histograms by calf sire group, without regard to measures of distribution statistical significance. The remainder of the results section lists sub-categorical sections of calf sire group production and processing performance.

*Birth Date*
Birth date was not reported in any of the tables. Calf birthing dates ranged from January 5 through April 5, 2005. Most of the calves sourced from AI bred cows were born between January 5 and March 5. By farm, calves born to AI bred cows calved within 20 days of each other. For calves born to natural service sired cows, birth dates varied from January 5 to April 5. By farm, calves born to natural service sired cows varied in birth date by as much as 45 days.

*Weaning and pre-conditioning*
Summary statistics from the calf production and pre-conditioning production phases of the study are presented in Tables 1 and 2, respectively. Calves in the High-Accuracy sire group were often weaned at a younger age relative to the other sire groups. This represents a benefit from using proven genetics.

For the pre-conditioning segment of the pilot study, two important finding were observed (Table 2). Average daily gain and feed conversion were exceptional for the High-Accuracy sire group calves. This result relates to better production performance of the calf due to proper sire EPD selection, and the age equality of the calves allows for them to uniformly compete for feed. These two factors lead to an observed pre-conditioning phase cost-of-gain that was $0.05/lb lower than for the base calf sire group. The cost-of-gain savings was even larger when the High-Accuracy sire group calves cost-of-gain was compared to the cost-of-gain for the other sire groups.

*Feedlot*
McDonald and Schroeder estimated the relative ranking of factors contributing to fed cattle profitability. Important feedlot variables, beyond cost of the feeder calf, represented feed conversion, average daily gain, and corn price. Mitigating corn price uncertainty lies with hedging. Typically, feed conversion and average daily gain will be attributed to the feedlot management. However, sourcing uniform lots of animals with known production performance makes possible reduction in feedlot management variability, thus, reducing cost to the feedlot operation.

To assess and compare the feedlot performance of animals in the pilot study presented here, summary statistics for the feedyard portion of the study were listed Table 3. We also made production performance comparisons based on proprietary data. Several key factors were observed from feed-out data.

In comparing the High-Accuracy sire group calves to the industry average some noticeable observations should be noted. While the High-Accuracy sire group calves performed well in comparison to peer sire groups in the pilot study, the comparison to the industry average was not as stark in difference. A difference was that the High-Accuracy sire group has a feedlot cost-of-gain lower than the seasonal cost-of-gain observed for the industry.

Calf days-on-feed was similar to the industry average, but this can differ by placement weight. Therefore, not much should garnered of the similarities. Average daily gain for the High-Accuracy sire group was observed to be similar to the industry average. However, the High-Accuracy sire group feed conversion was nearly one pound higher than that observed for the industry. The difference in feed efficiency between the High-Accuracy calf sire group and the industry average result from production seasonality or breed differences.

Recall, all calf sire groups were subject to a pre-conditioning program. Gardner et al. found significant improvement in feedlot performance and reduced medical costs due to pre-conditioning. For the current study all calf sire groups should have a reported health cost and percent sick at or below expected levels due to the pre-conditioning program. But, what about the advantage of timed/synchronized AI?

In comparison to the Natural Service calf sire group, all three AI calf sire groups were found to have a significant lower per head health cost and lower percentage of sick animals. Thus, the results presented here are consistent with the work of Gardner et al. An interesting finding from our study was the treatment cost per head and percent of treated calves for the High-Accuracy calf sire group, which performed extremely well. Only 4.17% of the High-Accuracy calf sire group were treated, for an average per head cost of $1.22. In comparison to the other calf sire groups in the study, the High-Accuracy calf sire group was very low. We hypothesize the good health performance for the High-Accuracy calf sire group to be due to the use of proven genetics.

Production performance predictability has significant cost savings to feedlot managers in the form of reduced labor and management costs. Production and marketing uniformity were important factors in delivering consistent quality in a cost efficient manner. Kovanda and Schroeder found that pen uniformity was an important determinant of whole pen profitability at the feedlot and processor level. Efficiency gains were obvious from a more uniform pen—less competition at the bunk, less sorting prior to selling, and better predictive power of weight level. Figures 1 through 3 indicate the high predictability of feedlot performance factors for calves from cows bred using synchronization and proven genetics. The High-Accuracy calf group tended to a right-skewed average daily gain, normal cost-of-gain distribution, and left-skewed days of age distribution. In general, the High-Accuracy calf group appears to be less variable, relative to the other sire groups, in feedlot performance factors.

Cost of gain represents a measure of potential profitability relative to average daily gain and feed efficiency. Increasing the predictability of cost of gain makes the value of feeder calves more predictable. Furthermore, a reliable cost of gain estimate makes hedging profit margins more attractive to cattle feeders. The cost of gain distribution for High-Accuracy animals was with few animals falling in the upper extreme of cost of gain (Figure 2).

Fewer days of age can be attractive for two reasons. Firstly, fewer days of age means a faster return on investment. Secondly, because of mad cow concerns, finishing animals in a timely manner was attractive in some market places, e.g., Japan. Over 90% of the High-Accuracy cattle were between 12 and 14 months of age (Figure 3). This is a young age relative to the industry average or relative to other sire groups in the pilot program.

*Processing*
Processing performance summary data was computed, by sire group (Table 4). Obvious from the study was the superior quality of the High-Accuracy sire group calves. These animals performed well on a quality-grade basis, which ultimately will translate into more dollars for producers. The High-Accuracy calf group graded 100% Choice or better and 66-67% CAB or better. The base sire group only yielded 36% CAB or better.

For the beef industry the percent of beef in the prime quality grade has remained steady over time. The same was not true for choice and select quality grades; these grades have converged from 1990 to 1997, with less beef falling into the choice category and more into the select category. From 1997 forward, the percentage of beef cattle earning the quality-grade Choice or Select was approximately 55% and 40%, respectively. The beef industry continues to strive for higher quality grade cattle.

The High-Accuracy sire group calves had the second lowest yield grade, but 6% of the animals in the sire group were yield grade 4 (Table 4). In general, the percentage of YG4 was below the typical plant average for the given time of year.

Fed cattle age was an important component of profitability when looking at profitability on a per day of ownership basis. As an owner of cattle, one most likely looks to maximize their daily profit across the year. The High-Accuracy calf sire group, on average, was 3/10 to one month older at processing than the other sire group calves.

Hot carcass weight represents a measure of pounds of carcass per animal (Figure 4). Almost 60% of the High-Accuracy sire group calves had a carcass weight between 650 and 700lbs. and approximately 95% of High-Accuracy calves have a hot carcass weight between 600 and 750lbs. This indicates a high probability of predictability and uniformity.

*Economic simulation*

Economic simulation was carried out for each sire group using collected production and carcass performance data. Base price as well as quality and yield grade premiums and discounts were allowed to vary over a five-year period. Feed cost represents the average cost for the period of the feed out and the corn cost is not allowed to vary. Directly, we chose to avoid making feed cost dynamic, as many other beef production factors vary seasonally, and we did not want to interject feed cost production performance cross-tab correlation matrixes into the analysis without a better understanding of such relationships. Cost of calf was computed by using a three year weighted average Missouri calf price adjusted for the price slide following Dhuyvetter and Schroeder.

Table 5 presents partial budget analysis by sire group for cattle in the study. Revenue represents the average revenue observed using five years of base price and grid value information. Net return values are reported as $/head, $/cwt, and $/day of ownership. Net returns were computed from weaning to pre-conditioning, from weaning to slaughter, and from sale barn (post-conditioning) to slaughter.

Gross revenue per head was largest for the High-Accuracy sire group. While High-Accuracy sire group calves were lighter than Low-Accuracy sire group calves, the higher carcass performance of the High-Accuracy calves more than off-set the weight difference when comparing revenue per head. From Figure 5, the High-Accuracy calf sire group was observed to be more uniform in gross revenue performance.

Feedlot cost per head was least for the Natural Service and High-Accuracy sire group calves. The difference in the $/head cost was due to days of feed, feed efficiency, cost of calf, and treatment cost.

Beef cow producer independence drive beef cow producer utility. We computed a representative value of calves at weaning based on projected feed lot production performance and carcass merit by sire group. The values on lines W and X represent the value a cattle buyer could pay and be no better off relative to calf performance and carcass merit. For example the line X value for the High-Accuracy sire group indicates a value of $112.48/head breakeven to the cattle buyer. The value of $5.57/cwt. below the $112.48 presents the difference between actual and able value paid. The largest discrepancy lies between High-Accuracy and Natural Service sire group calves of $13.43/cwt. ($5.57- (-$7.86)). This represents a nearly $80/head difference in value at the feeder calf age between calves with proven genetics and calves with unknown genetics. The relative difference between sire group calves should hold regardless of cattle buyer profit margin.

**Conclusions**

Our research analyzed whether genetic coordination and timed/synchronized artificial insemination can be used at the cow-calf production level to better predict calf feed-out efficiency and carcass traits, while simultaneously minimizing the loss of individual beef producer management decision making rights. That being understood, can genetic coordination and synchronization of breeding substitute for the differences in management decision making across beef herds? We first explained the experimental design, and then we summarized production efficiency differences, carcass quality trait difference, and economic implications. The results of our research should be used to motivate further analysis of bundling production practices and improving genetic verification within the beef industry. The information can be used to better determine enhanced feeder calf value, achieving critical mass, and providing optimal information to buyers.

The research presented here represented a pilot study to investigate the economic viability of coordinating cattle genetics across multiple cow-calf producers. The research yielded results leading to the economic and production comparison between four genetic groups of feeder-calves. Each group was tracked from birth through slaughter. The three important questions were answered relating to using genetics and timed artificial insemination to reduce variability across calves related to cow-calf management, feed yard performance, and processing. Results indicate significant production performance gains and economic gains due to coordinated genetics and timed artificial insemination. An economic advantage of over $70/head was realized for feeder calves from cows synchronized bred to high-accuracy sires relative to calves from cows bred to natural service sires.

We believe the economic advantage to be a conservative estimate. Kovanda, Schroeder, and Wheeler point out the lack of transparency in grid pricing and how the grid price may differ from the actual value available to packers. Johnson and Ward found that low quality grade carcasses were undervalued more than high quality carcasses were given premium value. We believe the high quality grade carcasses were undervalued because the value of reliability within the beef industry was unknown. So, delivering predictable high quality grade carcass cattle on a reliable basis and of sufficient numbers will have high value to the beef value chain.

Study limitations and challenges of the research are obvious. Small sample size limits the reliance of economic values computed. There exist many challenges with coordinating between many cow-calf producers to achieve timed and synchronized artificial insemination. Also, recent research by Riley, Schroeder, and Wheeler pointed out that grid value may not accurately reflect consumer preferences. Using research related to consumer beef tenderness preferences and consumer willingness-to-pay for tender beef, they concluded that quality-grade ranking premiums and discounts do not accurately reflect beef tenderness value. Thus, incorporating beef tenderness into our study may have yielded a significantly different economic value.

Two institutional limitations of this project relate to quantity needed to develop a branded beef product and to access to veterinarians to ultrasound cows for pregnancy. Discussion with industry personnel indicates a desire to source approximately 25,000 head per year to attract end-user interest in sourcing these animals for a branded beef program. By comparison, Missouri cow-calf producers annually produce 2.5 million calves. Seasonal delivery requires changes in calving dates. In order to adequately forecast animal availability, actual pregnancy must be determined. Ultrasound best determines pregnancy and at times fetal sex. Unfortunately, in addition to a shortage of large animal veterinarians, many existing veterinarians are not trained, nor have equipment, to ultrasound animals. The lack of ultra-sounding practitioners causes logistical challenges.

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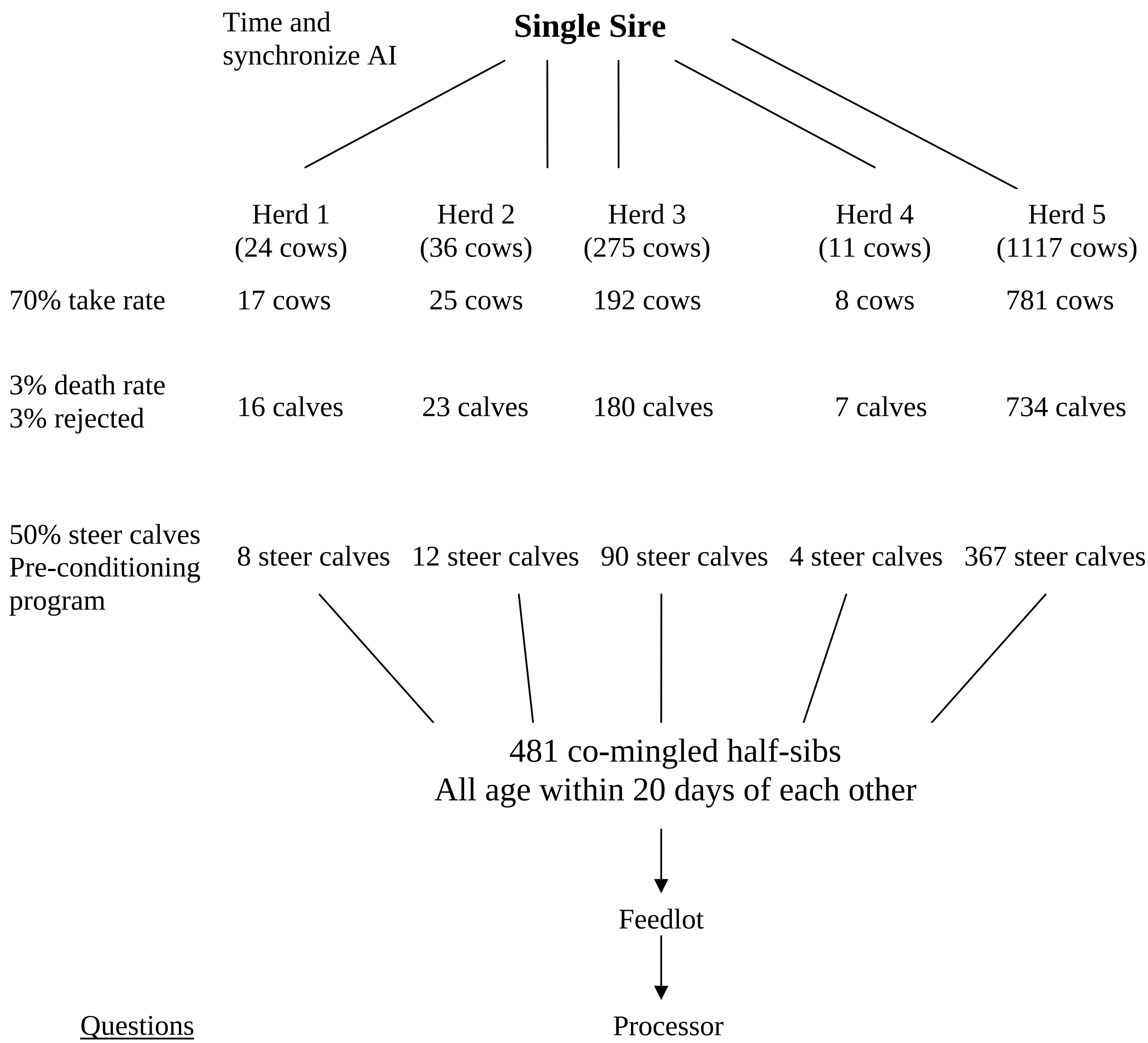
Ward, C.E. and D.L. Lalman. 2003. “Price premiums from a Certified Feeder Calf Preconditioning Program.” Presented at the NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management, St. Louis, MO, 21-22 April, 2003.

Figure 1. Flow diagram of a coordinated beef genetic management program.




<u>Questions</u>

Can genetic and timed AI control:

a) management across farms
b) feed-yard production variability
c) processing variability

Table1. Weaning characteristic summary by sire group

| | **Natural service** | **Calving ease** | **Low-accuracy** | **High-accuracy** | **All** |
|---|---|---|---|---|---|
| Number of animals | 93 | 36 | 101 | 96 | 328 |
| Weaning weight (lbs., average for sire group) | 490 | 527 | 573 | 509 | 522 |
| Weaning age (months) | 6.13 | 7.28 | 7.02 | 6.55 | 6.66 |
| Weaning age (days) | 183 | 218 | 210 | 196 | 199 |

Table 2. Pre-conditioning performance summary by sire group

| | **Natural service** | **Calving ease** | **Low-accuracy** | **High-accuracy** | **All** |
|---|---|---|---|---|---|
| Number of animals | 93 | 36 | 101 | 96 | 328 |
| Days Preconditioned | 53.32 | 55.95 | 55.39 | 55.75 | 54.97 |
| Average daily gain (lbs., average for sire group)^^ | 2.01 | 2.76 | 2.03 | 2.86 | 2.34 |
| Cost per lb. of gain (average for sire group)^^ | $0.55 | $0.49 | $0.54 | $0.45 | $0.50 |
| Feed conversion (average for sire group)^^ | 6.32 | 5.68 | 6.19 | 5.18 | 5.79 |

^^ Out weight was computed on a shrink weight bases, or the in weight into the feedyard

Table 3. Feedlot performance summary by sire group

| | **Natural Service** | **Calving Ease** | **Low-accuracy** | **High-accuracy** | **All** |
|---|---|---|---|---|---|
| Number of animals | 93 | 36 | 101 | 96 | 328 |
| In weight (lbs., average for sire group) | 597 | 681 | 685 | 668 | 650 |
| Days on feed (average for sire group) | 178 | 177 | 163 | 154 | 165 |
| Average daily gain (lbs., average for sire group) | 2.80 | 2.49 | 2.75 | 2.89 | 2.78 |
| Feed conversion (average for sire group) | 6.55 | 7.49 | 7.14 | 6.91 | 6.93 |
| Cost per lb. of gain (average for sire group)^ | $0.49 | $0.52 | $0.51 | $0.49 | $0.50 |
| Outs (%, average for sire group) | 0.00% | 5.56% | 0.00% | 0.00% | 0.61% |
| Treatment cost ($/head, average for sire group) | $11.88 | $3.94 | $3.20 | $1.22 | $5.17 |
| No. Sick (% of sire group) | 39.78% | 11.11% | 12.87% | 4.17% | 17.68% |

^ Does not include interest charge

Table 4. Processing performance summary by sire group

| | **Natural Service** | **Calving ease** | **Low-accuracy** | **High-accuracy** | **All** |
|---|---|---|---|---|---|
| Number of animals | 93 | 36 | 101 | 96 | 328 |
| Hot weight (lbs., average for sire group) | 646 | 660 | 690 | 669 | 664 |
| Age (months, average for sire group | 13.88 | 14.76 | 14.32 | 13.59 | 14.03 |
| Dressing percentage (average for sire group) | 59% | 61% | 61% | 60% | 60% |
| Quality Grade (% of sire group) | | | | | |
| Prime | 0.00% | 5.56% | 4.95% | 15.63% | 6.71% |
| Choice | 67.74% | 80.56% | 71.29% | 84.38% | 74.70% |
| Select | 32.26% | 13.89% | 22.77% | 0.00% | 17.68% |
| Standard | 0.00% | 0.00% | 0.99% | 0.00% | 0.30% |
| % Choice or better | 67.74% | 86.11% | 76.24% | 100.00% | 81.40% |
| % CAB (of sire group) | 13.98% | 55.56% | 13.86% | 51.04% | 29.27% |
| % CAB and better (sire group) | 13.98% | 61.11% | 18.81% | 66.67% | 35.98% |
| Yield grade ( % of sire group) | | | | | |
| YG1 | 2.15% | 0.00% | 3.96% | 2.08% | 2.44% |
| YG2 | 60.22% | 50.00% | 47.52% | 54.17% | 53.05% |
| YG3 | 35.48% | 47.22% | 44.55% | 37.50% | 39.94% |
| YG4 | 2.15% | 2.78% | 3.96% | 6.25% | 3.96% |
| YG5 | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Average yield grade | 2.38 | 2.53 | 2.49 | 2.48 | 2.46 |
| Ribeye area (average for sire group) | 11.54 | 11.38 | 11.75 | 11.98 | 11.72 |

Table 5. Economic partial budgeting for retained ownership beyond weaning

| | Natural service | Calving ease^ | Low-accuracy | High-accuracy | All |
|---|---|---|---|---|---|
| Number of cattle | 93 | 36 | 101 | 96 | 328 |
| **Revenue ($/cwt)** | | | | | |
| Price per cwt. ( Average Grid)* | | | | | |
| Live weight (avg.) | 1098 | 1084 | 1134 | 1115 | |
| Revenue per $/cwt, dressed weight* | $ 143.71 | $ 148.13 | $ 145.05 | $ 153.90 | 147.643 |
| Avg. dressed weight (lbs) | 646.4 | 660.2 | 690.3 | 669.3 | $ 664.19 |
| A. Revenue per head | $ 928.94 | $ 977.96 | $ 1,001.29 | $ 1,030.01 | $ 980.52 |
| B. Value of calf at weaning ($/head) | $ 613.68 | $ 640.24 | $ 670.65 | $ 627.55 | $ 634.45 |
| B1 ($/cwt.)^^ | $ 125.24 | $ 121.40 | $ 117.06 | $ 123.23 | $ 120.95 |
| C. Value of calf post pre-conditioning ($/head) | $ 672.83 | $ 722.19 | $ 724.27 | $ 714.59 | $ 702.21 |
| C1 ($/cwt.)^^ | $ 112.66 | $ 105.93 | $ 105.67 | $ 106.91 | $ 107.40 |
| **Cost ($/head)** | | | | | |
| *pre-conditioning* | | | | | |
| D. pre-conditioning feed cost | $ 58.91 | $ 75.39 | $ 60.81 | $ 70.91 | $ 64.45 |
| E. Interest for pre-conditioning period | $ 7.52 | $ 8.31 | $ 8.51 | $ 8.10 | $ 8.04 |
| F. Total variable pre-conditioning cost (D + E) | $ 66.43 | $ 83.70 | $ 69.32 | $ 79.01 | $ 72.49 |
| *Feedlot* | | | | | |
| G. Yardage fee ($0.39/day) | $ 69.61 | $ 69.12 | $ 63.59 | $ 60.24 | $ 64.54 |
| H. Feed cost | $ 162.94 | $ 157.80 | $ 160.74 | $ 155.85 | $ 158.63 |
| I. Treatment | $ 11.88 | $ 3.94 | $ 3.20 | $ 1.22 | $ 5.14 |
| J. Cost of calf (Three-year avg. of MO weighted avg. for relevant time period) | $ 672.83 | $ 722.19 | $ 724.27 | $ 714.59 | $ 702.21 |
| K. Interest on feedlot costs (calf cost + 1/2 other costs) | $ 58.61 | $ 62.26 | $ 62.01 | $ 60.85 | $ 60.35 |
| L. Total feedlot cost per head (G+H+I+J+K) | $ 975.88 | $ 1,015.30 | $ 1,013.81 | $ 992.75 | $ 990.87 |
| M. Total pre-conditioning cost forward (B+ D+G+H+I & interest) | $ 956.03 | $ 985.51 | $ 998.14 | $ 951.46 | $ 965.08 |
| **Returns** | | | | | |
| *($/head)* | | | | | |
| N. From weaning to post pre-conditioning ( C - B - F) | $ (7.27) | $ (1.75) | $ (15.69) | $ 8.03 | $ (4.73) |
| O. From weaning to slaughter ( A - M) | $ (27.09) | $ (7.55) | $ 3.15 | $ 78.55 | $ 15.44 |
| P. From salebarn to slaughter ( A - L) | $ (46.94) | $ (37.34) | $ (12.52) | $ 37.25 | $ (10.36) |
| *($/cwt)* | | | | | |
| Q. From weaning to post pre-conditioning ( (C - B - F)/ (weight gain)) | $ (6.78) | $ (1.13) | $ (13.94) | $ 5.05 | $ (3.68) |
| R. From weaning to slaughter ( (A - M) / dressed cwt.) | $ (4.19) | $ (1.14) | $ 0.46 | $ 11.74 | $ 2.32 |
| S. From salebarn to slaughter ( (A - L)/ dressed cwt.) | $ (7.26) | $ (5.66) | $ (1.81) | $ 5.57 | $ (1.56) |
| *($/day of ownership)* | | | | | |
| T. From weaning to post pre-conditioning ( (C - B - F)/ (pre conditioning days)) | $ (0.14) | $ (0.03) | $ (0.28) | $ 0.14 | $ (0.09) |
| U. From weaning to slaughter ( (A - M) / days) | $ (0.12) | $ (0.03) | $ 0.01 | $ 0.37 | $ 0.07 |
| V. From salebarn to slaughter ( (A - L)/ days) | $ (0.26) | $ (0.21) | $ (0.08) | $ 0.24 | $ (0.06) |
| **Calf purchase breakeven price ($/cwt.)** | | | | | |
| W. Weaning | $ 119.71 | $ 119.97 | $ 117.61 | $ 138.66 | $ 124.44 |
| (difference from market, W-B1) | $ (5.53) | $ (1.43) | $ 0.55 | $ 15.42 | $ 3.49 |
| X. Post conditioning | $ 104.80 | $ 100.45 | $ 103.84 | $ 112.48 | $ 106.30 |
| (difference from market, X-C1) | $ (7.86) | $ (5.48) | $ (1.83) | $ 5.57 | $ (1.10) |

* Dressed weight value base price is $137.32/cwt. based on 50/50 choice/select pen of cattle. Premiums and discounts added to the base price based on actual performance of cattles for the specific sire group. Quality and yield grade premiums and discounts are based on historical USDA Agriculture Marketing Service reported values.

** Calculation includes interest charge on weaned calf value and 1/2 cost

^ $/cwt price adjusted for out

^^ Uses price slide equation from Dhuyvetter and Schroeder

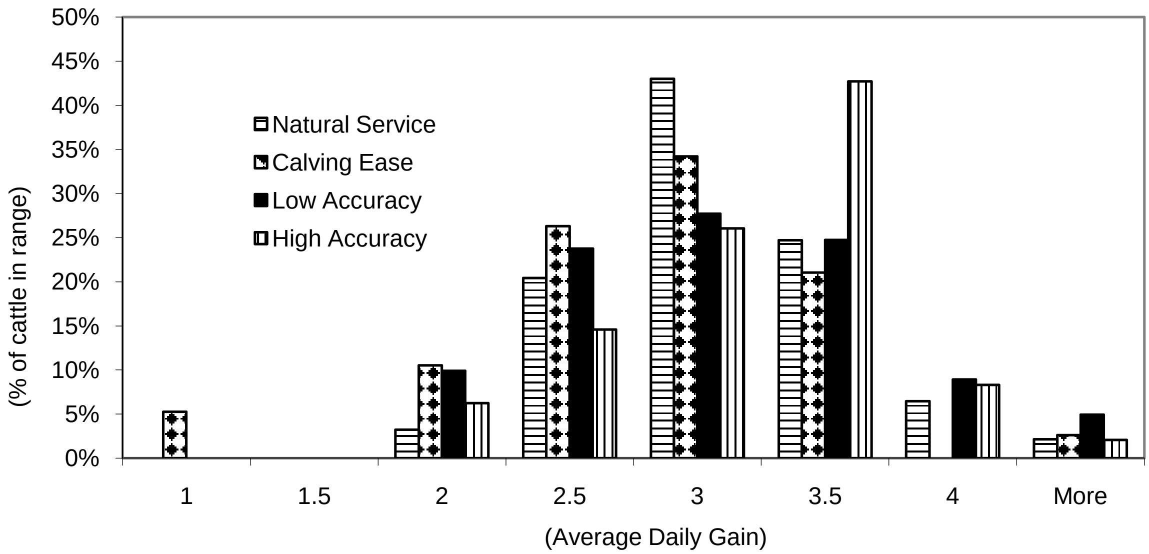



Figure 1. Average daily gain histogram, by sire group

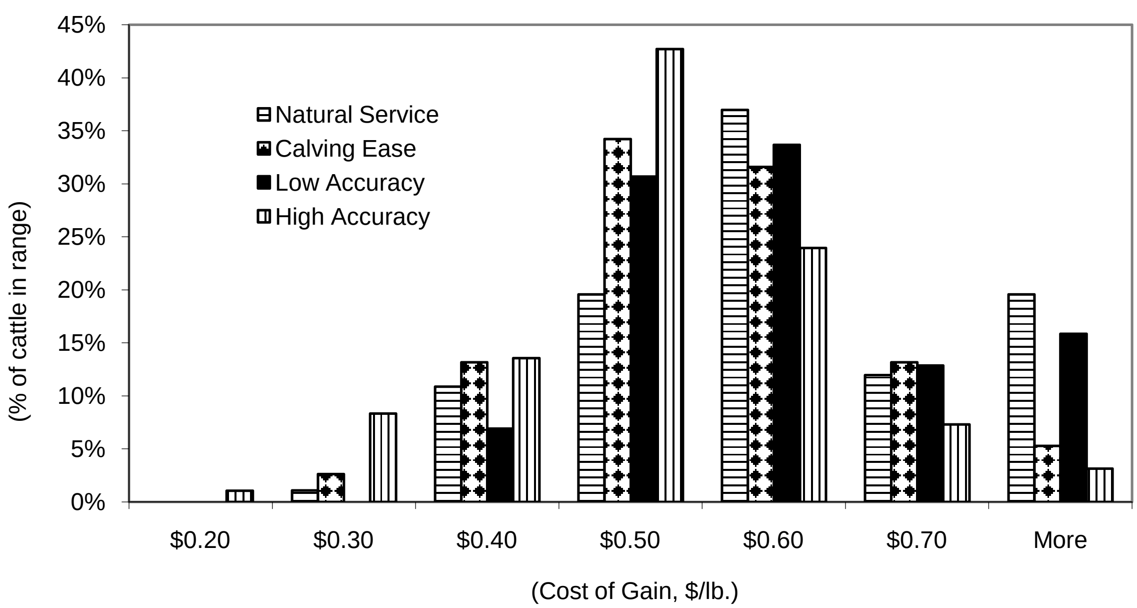



Figure 2. Cost of Gain histogram, by sire group

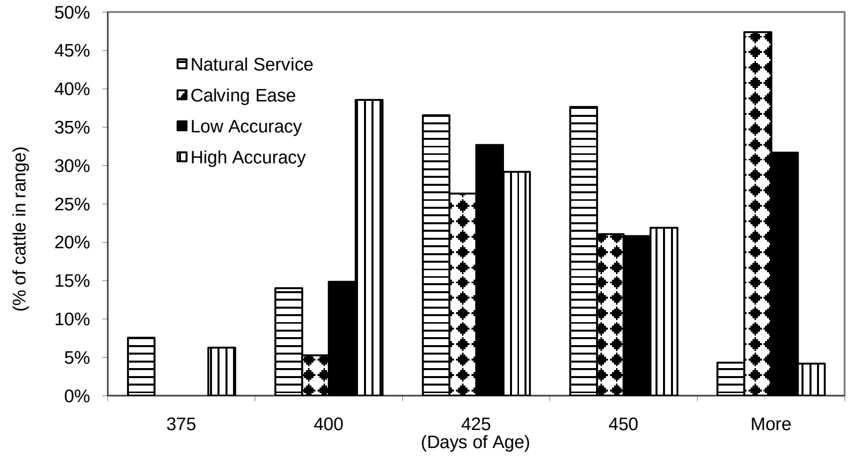



Figure 3. Days of age histogram, by sire group

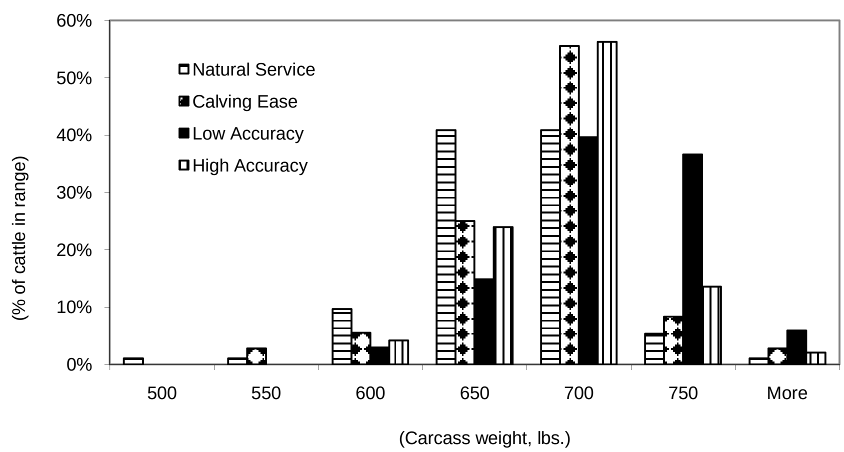
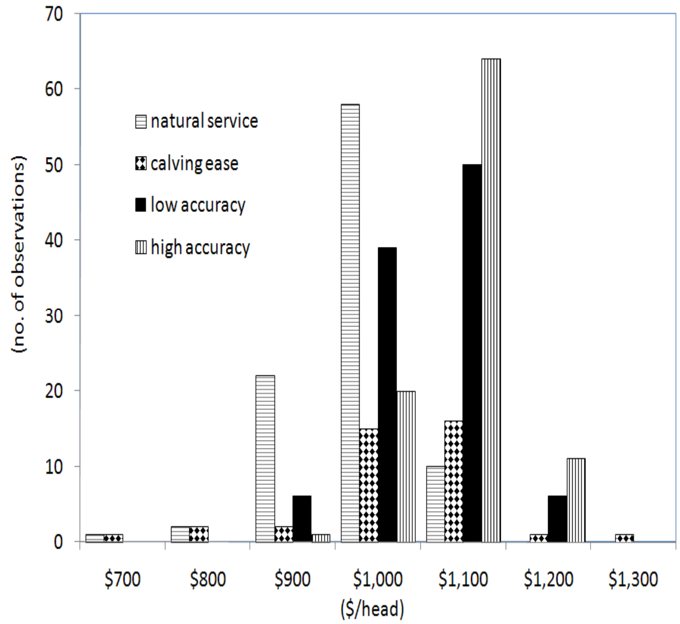



Figure 4. Carcass weight histogram, by sire group




| | Average | S.D. | Coef. Of Variation |
|---|---|---|---|
| Natural service | $929.00 | $63.49 | 6.83% |
| Calving ease | $978.24 | $116.44 | 11.90% |
| Low accuracy | $1,005.29 | $62.07 | 6.17% |
| High accuracy | $1,040.52 | $53.63 | 5.15% |

Figure 5. Gross revenue per head histogram, by sire group