# PROCEEDINGS

## BEEF IMPROVEMENT FEDERATION

### RESEARCH SYMPOSIUM & ANNUAL MEETING

BEEF IMPROVEMENT FEDERATION

BIF

25TH ANNIVERSARY MEETING

THE GROVE PARK INN AND RESORT
ASHEVILLE, NORTH CAROLINA
MAY 26 - 29, 1993

# 1993 BEEF IMPROVEMENT FEDERATION
# BOARD OF DIRECTORS

| NAME | YEAR TERM EXPIRES | REPRESENTING |
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| Paul Bennett | 1994 | Eastern BCIA |
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**This Beef Improvement Federation 25th Proceedings is Dedicated to the Memory of**

*Frank H. Baker*

## BEEF IMPROVEMENT FEDERATION PUBLISHES HISTORY

As part of its 25th Anniversary, the Beef Improvement Federation (BIF) has published "Ideas Into Action", a history of the BIF organization. BIF consists of state, national and international organizations that are actively conducting performance programs in beef cattle for their members. "Ideas Into Action" was authored by Dr. Richard Willham of Iowa State University; Mr. Roy Wallace of Select Sires, Inc.; and the late Dr. Frank Baker of Winrock International. The history chronicles the development of this unique organization and its many accomplishments. "Ideas Into Action" is filled with anecdotes and personal accounts of BIF meetings and work shops. Historical documents, letters and pictures help tell the story of unifying various beef industry organizations into one group dedicated to the improvement of beef cattle.

"Ideas Into Action" will be a valuable addition to both personal and organizational libraries. Order your copy today for $12.50 from Dr. Ron Bolze, Executive Director of BIF, NW Research-Extension Center, 105 Experiment Farm Road, Colby, Kansas 67701. Quantity discounts are available.

# 1993 Beef Improvement Federation Conference
# The Grove Park Inn- Asheville, North Carolina
# May 26-29, 1993

**WEDNESDAY, MAY 26, 1993**

3:00 - 8:00 PM **REGISTRATION** - Level 8 - Grand Ball Room Registration Desk

4:00 - 7:00 PM **Board of Directors Meeting** - Bryan Suite

**NAAB Symposium: Improving Reproductive Performance**
Grand Ballroom A - Norm Vincel, Moderator

7:00 PM **MGA-Prostaglandin Synchronization System: Where we have come from and where we are heading.** K.G. Odde, Colorado State University

7:30 PM **Other Progestin Synchronization Systems: Can we make them better?** W.E. Beal, Virginia Tech

8:00 PM **Getting More Cows Bred: Improving post-partum interval through biostimulation.** John Spitzer, Clemson University

8:30 PM **Future Development in Reproductive Management: What biotechnology and research hold.** Roy Ax, University of Arizona

**THURSDAY, MAY 27, 1993**

7:00 AM-
5:00 PM **REGISTRATION** - Level 8 Grand Ballroom Registration Desk

**BEEF IMPROVEMENT - WHAT WE HAVE LEARNED IN THE PAST 25 YEARS**
Grand Ballroom A - Ronnie Silcox, Moderator

8:30 AM **BIF - Past, Present & Future** - Dave Nichols, Nichols Genetics, Bridgewater, Iowa

9:10 AM **Birth Weight and Calving Ease**- Terry Kiser, University of Georgia

9:50 AM **BREAK**

10:10 AM **Milk Production** - W.E. Beal, Virginia Tech

10:50 AM **Growth and Mature Size** - Don Boggs, South Dakota State University

11:30 AM **Discussion**

12:00 NOON **LUNCHEON** (ticket required) Grand Ballroom B

2:00 - 5:00 PM **COMMITTEE MEETINGS**

**CENTRAL TEST AND GROWTH COMMITTEE**
Coolidge Room, Ronnie Silcox, Chairman

PANEL DISCUSSION: Optimizing Traits
Terry Kiser, University of Georgia
W.E.Beal, Virginia Tech
Don Boggs, South Dakota State University

**GENETIC PREDICTION COMMITTEE**
Grand Ballroom A, Larry Cundiff, Chairman

EDITS FOR GENETIC PREDICTION ANALYSIS
Keith Bertrand, University of Georgia

INTERIM EPD's
Bruce Cunningham, American Simmental Association

INTER-BREED COMPARISONS
Larry Cundiff, USDA-ARS

ACCURACY OF INTER-BREED COMPARISONS
L.D. Van Vleck, USDA-ARS

6:00 - 7:30 PM **RECEPTION** - Pool Terrace

**FRIDAY, MAY 28, 1993**

**TOOLS TO ENHANCE THE COMPETITIVENESS OF THE BEEF CATTLE INDUSTRY**
Grand Ballroom A - Ron Bolze, Moderator

| | |
|---|---|
| 8:30 AM | **COMPETITIVE TOOLS IN TODAY'S PORK INDUSTRY** - Randy Stoecker, Group Vice-President Murphy Farms, Rose Hill, North Carolina |
| 9:10 AM | **THE IMPACT OF IRM/NCA/SPA ON THE COMPETITIVENESS OF THE BEEF CATTLE INDUSTRY** - Lee Leachman, Leachman Cattle Co., Billings, Montana |
| 9:50 | **BREAK** |
| 10:10 AM | **BOOSTING COMPETITIVENESS THROUGH TOTAL QUALITY MANAGEMENT**- Darrell Wilkes, Vice-President National Cattlemen's Association |
| 10:50 AM | **MODERN BIOLOGY TOOLS TO IMPROVE GENETIC PROGRESS** - Roy Ax, University of Arizona |
| 11:30 AM | **CAUCUS FOR ELECTION OF DIRECTORS** - Norm Vincel, Select Sires, Inc. |
| 12:00 NOON | **LUNCHEON** (ticket required) Grand Ballroom B |
| 2:00 - 5:00 PM | **COMMITTEE MEETINGS** |

**SYSTEMS COMMITTEE**
Eisenhower Suite, Jim Gibb, Chairman

WHAT SPA IS TELLING US SO FAR
UPDATE ON STATUS OF SEEDSTOCK SPA
ECONOMIC VALUE OF TRAITS
SHOULD BIF MONITOR END-PRODUCT TARGETS?

**LIVE ANIMAL EVALUATION COMMITTEE**
Coolidge Suite, John Crouch, Chairman

PROGRESS REPORT: Instrument Grading Research
Doug Parrett, University of Illinois

ULTRASOUND TRAINING AND CERTIFICATION SEMINAR, IOWA STATE UNIVERSITY, AMES, June 2-5, 1993
Doyle E. Wilson, Iowa State University

SUBCOMMITTEE REPORT: RECOMMENDATIONS FOR THE USE OF PERFORMANCE DATA IN THE SHOW RING
Jim Leachman, Billings, Montana

**REPRODUCTION COMMITTEE**
Hoover Suite, Bruce Cunningham, Chairman

GENETIC EVALUATION OF REPRODUCTIVE TRAITS
David Notter, Virginia Tech

ADJUSTMENT FACTORS FOR SCROTAL CIRCUMFERENCE
Robert Schalles, Kansas State University

REVISED GUIDELINES FOR BREEDING SOUNDNESS EXAMINATION

7:00 PM **SILVER ANNIVERSARY BANQUET** - Grand Ballroom B

**SATURDAY, MAY 29, 1993**

8:30 AM **BOARD OF DIRECTOR'S MEETING** - Coolidge Suite

10:45 AM **TOUR: BILTMORE ESTATE**
* Beef Herd
* Winery
* House & Gardens

7:00 PM **RETURN TO GROVE PARK INN**

# TABLE OF CONTENTS

## SYMPOSIUM: BEEF IMPROVEMENT - WHAT WE HAVE LEARNED IN THE PAST 25 YEARS.



## SYMPOSIUM: TOOLS TO ENHANCE THE COMPETITIVENESS OF THE BEEF CATTLE INDUSTRY



## CENTRAL BULL TEST AND GROWTH COMMITTEE
(Ronnie Silcox - Chairman)



## GENETIC PREDICTION COMMITTEE (Larry Cundiff - Chairman)

**MGA-PROSTAGLANDIN SYNCHRONIZATION SYSTEM: WHERE WE HAVE COME FROM AND WHERE WE ARE HEADING**

M.E. King and K.G. Odde
Colorado State University

## Introduction

Synchronization of estrus in cattle implies the manipulation of the estrous cycle or the induction of estrus to bring a high percentage of a group of females into estrus at a predetermined time. The ideal synchronization system should elicit a fertile, tightly synchronized estrous response in a high percentage of the treated females. The system should also be economical and easy to use, and require minimal handling of the cattle. In some situations, the ability to inseminate all treated females at a fixed, predetermined time is advantageous. Synchronization systems that allow for a timed insemination eliminate the time and labor needed to detect estrus.

Methods of evaluating synchronization systems include estrous response (percentage of females showing estrus of those treated), synchronized conception rate (percentage of females pregnant of those inseminated), synchronized pregnancy rate (percentage of females pregnant of the total treated), and pregnancy rates at various stages of the breeding season. Distribution of estrus after treatment or degree of synchrony is important when evaluating a system's potential for timed breeding.

Progestogens are compounds which suppress estrus and ovulation in cattle, and thus, have been used as synchronization agents. Melengestrol acetate (MGA; The Upjohn Co., Kalamazoo, MI) is an inexpensive oral progestogen that synchronizes estrus in a group cattle when fed at a rate of 0.5 mg/head/day for at least 14 days (Zimbelman and Smith, 1966; Zimbelman et al., 1970). However, the estrus following MGA treatment is subfertile (De Bois and Bierschwal, 1970), and this decrease in fertility has limited the use of estrous synchronization programs that depend on MGA alone. The reduced fertility is confined to breeding at an estrus occurring within 10 days after MGA withdrawal.

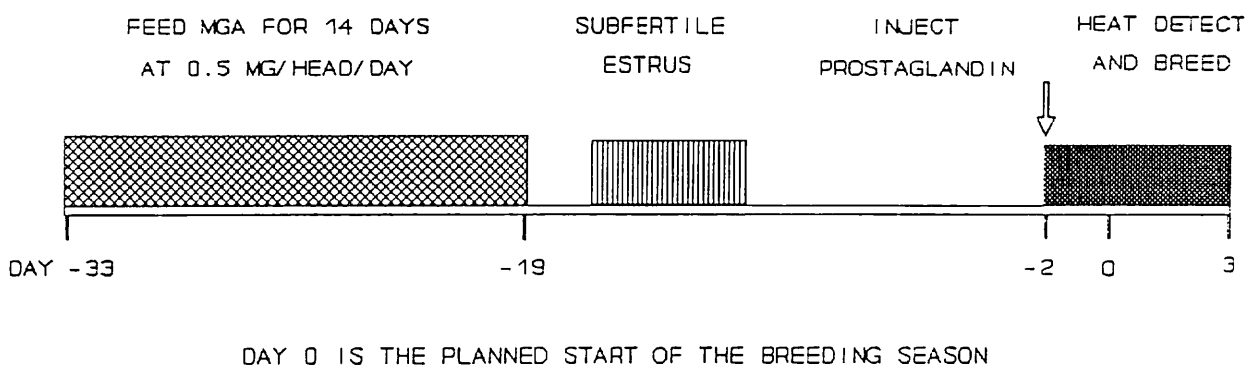
Prostaglandin $F_2\alpha$ ($PGF_2\alpha$) and its analogues cause regression of the corpus luteum and return to estrus when given to cattle on Days 5 to 15 of the estrous cycle (the day of estrus is defined as Day 0 of the cycle; Lauderdale, 1972; Rowson et al., 1972), and the fertility of the induced estrus is normal (Lauderdale et al., 1974; Roche, 1974). Research has shown that the estrous response, synchronized conception rate, and interval to estrus in cattle following a prostaglandin injection were affected by the stage of the cycle when the injection was administered. Late cycle females (Days 10 to 15 of the estrous cycle) had a higher estrous response following a prostaglandin injection than did early cycle females (Days 6 to 9; King et al., 1982; Tanabe and Hann, 1984; Watts and Fuquay, 1985). Synchronized conception rate was also higher in heifers injected with $PGF_2\alpha$ during the late luteal phase compared with that of heifers injected during the early luteal phase (King et al., 1982; Watts and Fuquay, 1985). The interval from a $PGF_2\alpha$ injection to the onset of estrus was longer in late cycle females compared to that in early cycle females (King et al., 1982).

In order to take advantage of the higher estrous response and conception rate obtained in beef females injected with $PGF_2\alpha$ during the late luteal phase of the estrous cycle, Brown et al. (1988) developed an estrous synchronization system that combined feeding MGA for 14 to 16 days followed by a single injection of $PGF_2\alpha$ 16 or 17 days after the final feeding of MGA. Females came into estrus 2 to 6 days after withdrawal of MGA from their ration but were not bred at this estrus. At the time of the $PGF_2\alpha$ injection, the treated females were grouped into the late luteal phase of the cycle. This paper summarizes the developmental history of the use of the 14-day MGA-prostaglandin estrous synchronization system in beef heifers and cows at Colorado State University.

## Use of the 14-day MGA-prostaglandin system in heifers

The 14-day MGA-prostaglandin system has been shown to be an effective method of synchronizing estrus in beef heifers (Brown et al., 1988). In this study, 310 beef heifers were divided into two treatment groups: Treatment 1 heifers (MGA-PG) were fed 0.5 mg MGA/head/day for 14 to 16 days followed by a 25 mg $PGF_2\alpha$ injection 16 or 17 days after the final feeding of MGA (Figure 1); Treatment 2 heifers received Syncro-Mate B (SMB) which consisted of a 9-day norgestomet implant plus an injection containing 3 mg norgestomet and 5 mg estradiol valerate at implant insertion. MGA was fed to the MGA-PG heifers in a pelleted protein supplement top dressed on silage or mixed in a ground concentrate ration. Heifers in both treatment groups were observed for estrus every 6 hours after the end of treatment and were artificially inseminated 12 to 18 hours after observed estrus.

Figure 1. The 14-day MGA-prostaglandin system for estrous synchronization in beef heifers and cows.




The estrous response in heifers synchronized with MGA-PG was 83.4% which was similar to that of heifers synchronized with SMB (90.2%; Table 1). Synchronized conception (68.7 vs 40.6%) and pregnancy (57.3 vs 36.6%) rates were higher in the MGA-PG heifers. These results indicated that the fertility of the synchronized estrus was higher in heifers treated with MGA-PG compared with heifers treated with SMB. Since the estrous response was similar in both treatment groups, the higher fertility of the MGA-PG heifers resulted in more of these heifers becoming pregnant during the synchronized period. Breeding season pregnancy rates were similar for both treatment groups. The percentages of heifers in estrus during the peak 24-hour period following the end of each synchronization system was similar for both treatments (71.8% for MGA-PG vs 79.0% for SMB), and this suggests that the MGA-PG system may have potential for use with timed insemination.

Table 1. Effect of estrous synchronization treatment on estrous response, degree of synchrony, conception rate and pregnancy rate in beef heifers.

| Measurement | Treatment | n | Observed mean (%) | P value |
|---|---|---|---|---|
| Estrous response[a] | MGA-$PGF_2\alpha$ | 157 | 83.4 | > 0.10 |
| | SMB | 153 | 90.2 | |
| Degree of synchrony[b] | MGA-$PGF_2\alpha$ | 131 | 71.8 | > 0.10 |
| | SMB | 138 | 79.0 | |
| Synchronized conception rate[c] | MGA-$PGF_2\alpha$ | 131 | 68.7 | < 0.01 |
| | SMB | 138 | 40.6 | |
| Synchronized pregnancy rate[d] | MGA-$PGF_2\alpha$ | 157 | 57.3 | < 0.01 |
| | SMB | 153 | 36.6 | |
| Breeding season pregnancy rate[e] | MGA-$PGF_2\alpha$ | 141 | 95.0 | > 0.25 |
| | SMB | 126 | 91.3 | |

[a]Number in estrus in 120 hours after treatment, divided by number treated.
[b]Number in estrus in peak 24-hour period, divided by number in estrus in synchronized period.
[c]Number pregnant in synchronized period, divided by number bred.
[d]Number pregnant in synchronized period, divided by number treated.
[e]Number pregnant during breeding season, divided by number treated. Forty-three heifers were removed from the project before the final pregnancy test.

Other advantages of the MGA-PG system compared with the SMB system are that females only have to be worked through the chute one time to inject the prostaglandin, while females synchronized with SMB must be worked twice (once to implant and give the injection and a second time to remove the implant), and the drug cost is lower for the MGA-PG treatment.

The success of the MGA-PG system depends on all females consuming a consistent quantity of MGA during the 14-day feeding period. Thus, the MGA-PG system can be used most practically in replacement heifers that are being developed in a dry lot. If heifers are being fed a supplement, feeding the MGA requires no additional labor.

One disadvantage of the 14-day MGA-PG synchronization system is that the producer must begin feeding MGA 32 or 33 days before the beginning of the breeding season. This requires that the producer plans ahead for the breeding season while he is still busy finishing his calving season. Feeding MGA for 7 to 9 days and giving a prostaglandin injection on the final day of MGA feeding has been reported to synchronize estrus in beef cows (Beal and Good, 1986). The shorter MGA-PG system would require less pre-planning by the producer and a shorter MGA feeding period than the 14-day MGA-PG program, and thus, would be more attractive to producers if the reproductive performance of this system was equal to that of the 14-day system.

Mauck et al. (1987) compared the reproductive performance of 192 beef heifers that served as controls or were synchronized with either a 7-day or 14-day MGA-PG system. Heifers in the 7-day MGA-PG group were fed 0.5 mg MGA/head/day for 7 days and given a 25 mg $PGF_2\alpha$ injection on the last day of MGA feeding. The 14-day MGA-PG heifers were fed 0.5 mg MGA/head/day for 14 days and injected with 25 mg $PGF_2\alpha$ 17 days after the last MGA feeding. Control heifers were given no synchronization treatment.

The estrous response following treatment was higher in the 14-day MGA-PG heifers compared with the 7-day MGA-PG heifers (76.5 vs 56.3%; Table 2). The synchronized conception rate was also higher in the 14-day group (65.3%) compared to the 7-day group (41.7%) which indicated that the induced estrus was more fertile following the 14-day MGA-PG treatment. The synchronized conception rate of the 14-day MGA-PG heifers was numerically higher than that of the control heifers (65.3 vs 45.4%). The combined effects of the higher estrous response and synchronized conception rate resulted in more than twice as many 14-day MGA-PG heifers becoming pregnant during the synchronized period as 7-day MGA-PG heifers. These data indicated that the 14-day MGA-PG system was a more effective method of synchronizing estrus in beef heifers than was the 7-day MGA-PG program.

Table 2. Estrous response and synchronized conception and pregnancy rates in beef heifers after synchronization with two different MGA-Lutalyse combinations.

| Treatment | n | Estrous response[a] | Synchronized conception rate[b] | Synchronized pregnancy rate[c] |
|---|---|---|---|---|
| 14-day MGA-PG | 64 | 76.5%[d] | 65.3%[d] | 50.0%[d] |
| 7-day MGA-PG | 64 | 56.3%[e] | 41.7%[e] | 23.4%[e] |
| Control | 64 | -- | 45.4%[de] | 7.8%[f] |

[a]Number in estrus in 168 hours after treatment, divided by number treated.
[b]Number pregnant in synchronized period, divided by number bred.
[c]Number pregnant in synchronized period, divided by number treated.
[d,e,f]Percentages in the same column without a common superscript differ (P < .05).

The 14-day MGA-PG system was designed to group females into the late luteal phase of the estrous cycle (Days 10 to 15) at the time of the prostaglandin injection. The estrous response and the fertility of the induced estrous may differ according to the specific day of the cycle within the late luteal phase that the prostaglandin injection is given. Thus, the interval from the last MGA feeding to the injection of prostaglandin may influence the results of a synchronization program using this system.

We evaluated our data from several studies to determine the best time interval from MGA withdrawal to the prostaglandin injection for the 14-day MGA-PG system in beef heifers (Mauck et al., 1988). Heifers were synchronized by feeding MGA for 14 days and giving a 25 mg $PGF_2\alpha$ injection 16, 17, or 18 days after MGA withdrawal. Heifers were observed for estrus following the end of MGA feeding to determine the day of the estrous cycle that each heifer was on at the time of the PG injection. Heifers were not bred at this estrus. Following the PG injection, heifers were detected for estrus and inseminated 12 to 18 hours later.

The estrous response tended to be higher in heifers injected with PG on Days 11 to 15 of the estrous cycle compared with heifers injected on Days 6 to 10 (Table 3). Synchronized conception rates were highest when heifers received the PG injection on Days 11, 12, or 13 of the estrous cycle. Since the mean time interval from MGA withdrawal to the onset of the subfertile estrus was 4.9 days and the highest reproductive performance was achieved when heifers were injected with PG on Days 11 to 13 of the estrous cycle, the best time interval from the last day of MGA feeding to the injection of PG was 17 days (Day 12 of the cycle + 4.9 days from MGA withdrawal to onset of subfertile estrus = 16.9 days). Injecting PG 17 days after the end of the MGA feeding period, would place most heifers on Days 11 to 13 at the time of the PG injection and would give maximum reproductive performance.

Table 3. Effect of the day of the estrous cycle at the time of the prostaglandin injection on reproductive performance of beef heifers synchronized with the 14-day MGA-PG system.

| Day of cycle at PG injection | n | Estrous response[a] | Synchronized conception rate[b] |
|---|---|---|---|
| 6-9 | 10 | 87.5% | 67.6% |
| 10 | 20 | 89.4% | 51.2% |
| 11 | 41 | 94.3% | 72.6% |
| 12 | 50 | 93.7% | 80.8% |
| 13 | 71 | 98.4% | 73.3% |
| 14-15 | 33 | 95.6% | 62.2% |

[a]Number in estrus after treatment, divided by number treated.
[b]Number pregnant in synchronized period, divided by number bred.

The next step in refining the 14-day MGA-PG system in beef heifers is to determine if a timed insemination will give equal reproductive performance as breeding by detected estrus. Pregnancy rates during the first 5 days following synchronization of estrus with SMB in beef heifers and cows have been similar whether the heifers were bred by estrus or time inseminated 45 to 60 hours after implant removal (Mares et al., 1977; Miksch et al., 1978; Spitzer er al., 1981). Since the degree of estrous synchrony was similar in heifers synchronized with MGA-PG or SMB in the study by Brown et al. (1988), these results suggest that the MGA-PG system may have similar potential as SMB for timed insemination. A study will be conducted in 1993 to evaluate the effectiveness of a timed insemination in beef heifers synchronized with the 14-day MGA-PG system. Approximately 230 heifers will receive the 14-day MGA-PG treatment. Half of the heifers will be time inseminated at 72 hours after the prostaglandin injection. The other half will be detected for estrus and inseminated according to estrus. If synchronized pregnancy rates are similar in each treatment group, the 14-day MGA-PG program could be used in artificial insemination programs where detection of estrus is either difficult or impossible.

Data from a small, uncontrolled trial indicated that a timed insemination 72 hours after the PG injection in 52 beef heifers synchronized with the 14-day MGA-PG system has the potential for acceptable synchronized pregnancy rates (D.G. LeFever, personal communication). In this trial, 71% of all treated heifers became pregnant to the timed insemination.

**Use of the 14-day MGA-prostaglandin system in cows**

Theoretically the 14-day MGA-PG system has the same potential to synchronize estrus in postpartum beef cows as it does in heifers. However, there are at least two factors that make the use of the system less practical in cows than it is in heifers. First, most cow herds are not maintained in a dry lot situation, and this makes getting consistent consumption of MGA difficult. By the beginning of the breeding season, many cow herds are on green pasture and the cattle are not interested in eating range cubes or coming to a bunk to eat a grain supplement. This makes feeding the MGA to cows on pasture a problem. The second factor that limits the use of the MGA-PG system in cows is that the program begins 33 days before the breeding season, and some of the cows in the herd will not have calved by the beginning of treatment. If the program is to be used in a cow herd, the cows need to be separated into two groups during the MGA feeding. We recommend that cows should be at least 7 days postpartum at the beginning of the MGA feeding period to be included in the 14-day MGA-PG synchronization program.

In order to eliminate the difficulty of MGA consumption in range beef cows, MGA can be replaced in the MGA-PG system with a 14-day norgestomet implant. Norgestomet is a progestogen, and the norgestomet implant is available as part of the Syncro-Mate B treatment. Five hundred and six beef cows were used by King et al. (1988) to evaluate the effectiveness of two estrous synchronization systems. Cows were synchronized with either a 6-mg norgestomet implant placed in the ear for 14 days followed by a prostaglandin injection given 16 days after implant removal (NOR-PG) or with Syncro-Mate B (SMB). The prostaglandin injection in the NOR-PG cows was given the same day as implant removal in the SMB cows. These treatment groups were compared to a group of untreated controls. Only cows that were at least 7 days postpartum at the time of implant insertion for the NOR-PG group were included in the study. All cows were observed for estrus for 5 days after the end of treatments and were inseminated 12 to 18 hours after the beginning of estrus.

SMB cows had a higher estrous response after treatment (78.6 vs 64.0%) than did NOR-PG cows. Controls had a lower estrous response compared to either of the synchronized groups (27.1%). The degree of estrous synchrony was identical in both synchronization systems (72.7%). Synchronized conception rate tended to be higher in the NOR-PG group compared with the SMB group (74.5 vs 62.5%). Synchronized, 21-day, 25-day and breeding season pregnancy rates of the two synchronization systems were not different. Approximately 50% of the cows became pregnant during the first 5 days of the breeding season in each synchronization treatment. These results indicated that the NOR-PG system was as effective as SMB in synchronizing estrus in beef cows.

Norgestomet implants are only available by purchasing the entire SMB treatment; this makes the NOR-PG system economically unfeasible. Another drawback to the NOR-PG system is that cattle must be handled three times.

Yelich et al. (1988) synchronized beef cows by feeding MGA for 14 days followed by a prostaglandin injection 17 days after MGA removal. MGA was either fed in pellets top dressed over silage or in range cubes fed on pasture. The reproductive performance of synchronized cows was compared to that of untreated control cows.

More synchronized cows showed estrus within 5 days after the end of treatment than did control cows (51.1 vs 8.2%). Synchronized conception rate was also higher for the MGA-PG cows compared to control cows (80.0 vs 50.0%). Estrous response in the synchronized group was lower for cows that had a body condition score of 3 or 4 at the beginning of treatment compared with that of cows that had a condition score $\geq$ 5 (Table 4). The fertility of the synchronized estrus was also lower in those cows in low body condition compared with cows in moderate to good condition. These results indicated that body condition was an important factor influencing the effectiveness of the 14-day MGA-PG treatment in beef cows. Likely, most of the low condition score cows were not cycling at the time of the prostaglandin injection, and this resulted in the low estrous response in this group.

Table 4. Effect of body condition score on reproductive performance of beef cows synchronized with the 14-day MGA-PG system.

| Body condition score[a] | n | Estrous response[b] | Synchronized conception rate[c] | Synchronized pregnancy rate[d] |
|---|---|---|---|---|
| 3 | 15 | 20.0%[e] | 66.7%[ef] | 13.3%[e] |
| 4 | 88 | 32.9%[e] | 62.1%[e] | 20.4%[eg] |
| 5 | 38 | 60.5%[f] | 91.3%[f] | 55.2%[f] |
| 6 | 45 | 75.5%[f] | 91.2%[f] | 68.8%[f] |
| 7 | 9 | 66.6%[f] | 66.7%[ef] | 44.4%[fg] |

[a]1 = very thin; 5 = moderate; 9 = very fat.
[b]Number in estrus in 120 hours after treatment, divided by number treated.
[c]Number pregnant in synchronized period, divided by number bred.
[d]Number pregnant in synchronized period, divided by number treated.
[efg]Values in a column that do not have a common superscript differ ($P < 0.05$).

One factor that limits the efficacy of estrous synchronization programs in postpartum beef cows is the percentage of females cycling at the beginning of the breeding season. The length of the postpartum period can be shortened by removing calves from their dams for 48 hours just prior to the breeding season (Lesmeister and Drake, 1978). There is also evidence that MGA initiates cycling in some postpartum anestrus beef cows (Beal and Good, 1986; Boyd and Corah, 1986).

With this information in mind, Yelich et al. (1989) conducted a second research project to evaluate the effect of 48-hour calf removal during the 14-day MGA-PG treatment and to determine if the MGA-PG system initiates cycling in postpartum beef cows. One hundred sixty-four suckled beef cows were divided into three treatment groups: 1. the normal 14-day MGA-PG system with the prostaglandin injection given 17 days after the last day of MGA feeding (MGA-PG); 2. the same synchronization treatment as group 1 with calves removed from the cows for 48 hours beginning the second day after the last day of MGA feeding (MGA-CR-PG); and 3. untreated controls. Cows were maintained on range and MGA was administered to the first two treatment groups by feeding range cubes containing MGA. Controls received the same quantity of cubes without MGA. To evaluate the effectiveness of the MGA systems in initiating cycling, blood samples were collected from all cows 7 days prior to the start of MGA feeding, at the start of MGA feeding, 7 days prior to the PG injection, and at the time of the PG injection. Serum samples were analyzed for progesterone concentrations.

Adding calf removal to the 14-day MGA-PG system did not increase the estrous response, synchronized conception rate, or pregnancy rates in this study. The percentages of cows cycling a the end of treatment were 44.7, 55.1, and 58.7% for the control, MGA-PG, and MGA-CR-PG groups, respectively. Both synchronization systems increased the percentage of cycling cows at the end of treatment compared to controls, but the increase was relatively small (11 to 14%).

As mentioned earlier in the paper, one limitation of using the 14-day MGA-PG system in range beef cows is obtaining uniform consumption of the MGA in all cows over the 14-day period. A possible solution to this problem would be to increase the amount of MGA fed/cow/day. This would help ensure that all cows are consuming enough MGA to inhibit estrus and ovulation during the MGA feeding period.

Two hundred ninety-nine suckled postpartum beef cows were utilized in two trials to determine the effect of dosage of MGA in the 14-day MGA-PG treatment (Doubet et al., 1990). Cows were divided into three treatment groups: 1. 0.5 MGA-PG—cows were fed 0.5 mg MGA/head/day for 14 days with 25 mg of $PGF_2\alpha$ injected 17 days after the withdrawal of MGA; 2. 1.0 MGA-PG—cows received the same treatment as group 1 with the exception that MGA was fed at 1.0 mg/head/day; 3. controls—cows were fed the carrier supplement without MGA and did not receive a $PGF_2\alpha$ injection. In Trial I, MGA was administered in a corn-based range cube and fed on native range. A pelleted supplement was formulated and top dressed on silage in Trial II. In both trials, cows were detected for estrus and inseminated for a 6-day period after the PG injection.

The estrous response and synchronized pregnancy rate were higher in the 0.5 MGA-PG cows compared with the cows receiving 1.0 mg MGA in Trial I. In Trial II, the level of MGA had no effect on reproductive performance. These data indicated that feeding a higher level of MGA during the 14-day MGA-PG program did not improve reproductive performance in beef cows and that in some situations, the higher level of MGA may reduce the percentage of cows becoming pregnant during the synchronized period.

## Conclusion

Work at Colorado State University indicates that a synchronization system that consists of feeding 0.5 mg/head/day of MGA for 14 days followed by a prostaglandin injection given 17 days after the last day of MGA feeding is an effective method of synchronizing estrus in beef heifers and cows. This system is most practical in heifers that are being fed in a dry lot. The treatment will work in beef cows if uniform consumption of the MGA can be obtained and if the cows are in adequate body condition at the beginning of the treatment to ensure that a high percentage of cows are cycling. Future research will investigate the effectiveness of timed insemination of beef heifers following the MGA-PG system.

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# ESTRUS SYNCHRONIZATION WITH SYNCRO-MATE-B OR PROGESTINS AND PROSTAGLANDIN $F_{2}\alpha$ - *limitations and ideas for improvement* [1]

W. E. Beal and E. E. Custer [2]
Department of Animal and Poultry Science
Virginia Polytechnic Institute & State University

## INTRODUCTION

The disappointing results of using progestin feeding to synchronize estrus in the 1960's dampened enthusiasm for estrous cycle control. However, three subsequent research findings renewed interest in the development of improved synchronization schemes involving exogenous progestins. The discovery that estrogen was luteolytic when administered early in the estrous cycle (Wiltbank et al., 1961) was followed by the characterization of the luteolytic effect of prostaglandin $F_{2}\alpha$ ($PGF_{2}\alpha$) administered after d 5 of the estrous cycle (Lauderdale, 1972). Developed concurrently was the knowledge that if exposure to exogenous progestins was reduced from 18 or 21 d to less than 14 d, the fertility of cattle inseminated at the synchronized estrus was improved (Roche, 1974). These events led to the formulation of estrus synchronization methods combining short-term exposure to progestins (<14 d) and treatment with a luteolytic drug (see Hansel and Beal, 1978).

The new methods of estrus synchronization involved either administration of estrogen at the outset of a 7- to 14-d progestin treatment or the injection of either $PGF\alpha$ or one of its analogues at or near the end of such a progestin treatment. Of these treatment regimes, only SYNCRO-MATE-B (SMB) has been approved by the U.S. Food and Drug Administration for use in suckled beef cows and beef or dairy heifers. The SMB treatment consists of a 9-d subcutaneous ear implant containing 6 mg of norgestomet plus an intramuscular injection of 5 mg of estradiol valerate (EV) and 3 mg of norgestomet given at the time of implant insertion. Alternative synchronization treatments in which $PGF_{2}\alpha$ was injected after short-term exposure to melengestrol acetate (MGA, oral), progesterone (intravaginal), or norgestomet (subcutaneous implant) have also been developed.

The first goal of this paper is to review the results of trials conducted with SMB or progestin-$PGF_{2}\alpha$ treatments with emphasis on identifying the factors limiting the efficacy of these treatments. A second, more constructive, goal is to offer means by which these treatments could be improved. The focal points of this presentation are the effectiveness of these treatments to synchronize estrus and the fertility following insemination at the synchronized estrus.

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[1] Where tradenames are used, no endorsement is intended, nor criticism implied of similar products not named.

[2] Current address: Worcester Foundation, 222 Maple Ave., Shrewsbury, MA 01545

## SYNCHRONIZATION OF ESTRUS

SYNCRO-MATE-B treatment is usually followed by a high incidence (>90%) of estrus during the 5 d following implant removal. Odde (1990) prepared an excellent review of estrus synchronization methods with numerous references to trials conducted using SMB and other short-term progestin treatments. Among the experiments cited by Odde (1990) were 15 trials conducted with 1032 puberal heifers that were observed for signs of estrus following SMB and bred 12 h after estrus detection. Of those heifers, 92.5% were observed in estrus within 5 d after implant removal. Combining insertion of the 6-mg norgestomet implant for 7 d with an injection of $PGF_{2}\alpha$ at the time of implant removal produced similarly high rates of synchronization in experiments reported by Beal et al. (1984; 90%) and Whittier et al. (1986; 94%). Conversely, the injection of $PGF_{2}\alpha$ on the last day of a 7-d MGA feeding period (.5 mg/d) produced estrus synchronization rates of 72% during the 6 or 7 d following treatment (Beal et al., 1988; Chenault et al., 1990).

The failure to achieve synchronization rates of 100% in cyclic heifers or cows treated with SMB may be related to the differing responses of animals treated at different stages of the estrous cycle. To be effective in cyclic animals that are in the first 7 d of the estrous cycle at initiation of SMB treatment, the EV and norgestomet injected must cause luteolysis before the norgestomet implant is removed 9 d later. Early reports by Miksch et al. (1978) indicated that 5 mg of EV regressed corpora lutea in 80 to 86% of the heifers that began SMB treatment on d 1 through 8 of the cycle. Pratt et al. (1991), however, reported that the corpus luteum (CL) was regressed in only 48% of the cows treated on d 3, but that CL regression was 100% when treatment began on d 9. The same group (Fanning et al., 1992) demonstrated that increasing the dose of injectable norgestomet in the SMB treatment from 3 to 6 mg increased luteolysis and synchronization rate from 58 to 84% in cows treated beginning on d 2 of the cycle. These are the only documented reports of the ineffectiveness of SMB to induce luteolysis and synchronize estrus when administered early in the estrous cycle. More research is necessary to confirm these effects and to investigate more effective means of inducing luteolysis during the first 7 d of the cycle.

Failure of $PGF_{2}\alpha$ to consistently cause luteolysis also reduces the estrus response in cattle treated with progestins and prostaglandins. Chenault (unpublished data) summarized the effect of day of the estrous cycle on percent of cattle synchronized by an injection of 25 mg of $PGF_{2}\alpha$. He noted that luteolysis and synchronized estrus response was lowest (67%) among heifers treated on d 5 through 9, moderate (77%) when heifers were treated on d 9 through 12 and highest (>91%) among those injected after d 12 of the cycle. To achieve a synchronized estrus when progestins are administered for 7 d with an injection of $PGF_{2}\alpha$ on the last day it is necessary to induce luteolysis in animals that start the treatment during the first 7 d of the estrous cycle. Unfortunately, at the time of $PGF_{2}\alpha$ injection these animals are between d 7 and 14 of the cycle, when the response to $PGF_{2}\alpha$ would be expected to be only moderately effective.

Methods of improving the luteolytic action of $PGF_{2}\alpha$ or its analogues, including increased dosages or multiple injections separated by 12 to 24 h, have been suggested. However, no controlled studies have been reported which support those speculations.

The distribution of estrus following SMB treatment is highly synchronized (Table 1). In 15 separate trials in which the standard SMB treatment was used to synchronize estrus in 736 cows or heifers, a majority (65%) of the animals were observed in estrus between 24 and 48 h after implant removal (Miksch et al., 1978; Spitzer et al., 1978). The same high degree of synchrony can be achieved when either the norgestomet implant or a progesterone-releasing intravaginal device (PRID) is inserted for 7 d in conjunction with an injection of $PGF_{2}\alpha$. To achieve synchrony comparable to that following SMB, however, the $PGF_{2}\alpha$ must be injected 1 d prior to the removal of either the PRID (Smith et al., 1984) or norgestomet implant (Beal et al., 1984).

**Table 1. The Number of Cows or Heifers in Estrus at 24-h Intervals Following SYNCRO-MATE-B Treatment to Synchronize Estrus**

| Reference | No. treated | Hours after implant removal 0-24 | 24-48 | 48-72 | 72-96 | 96-120 |
|---|---|---|---|---|---|---|
| Miksch et al. 1978 | 18 | 0 | 11 | 4 | 2 | 0 |
| | 44 | 0 | 14 | 21 | 3 | 3 |
| | 44 | 0 | 9 | 15 | 8 | 7 |
| | 23 | 0 | 9 | 10 | 3 | 1 |
| | 21 | 0 | 14 | 2 | 2 | 0 |
| | 22 | 0 | 13 | 3 | 2 | 4 |
| | 18 | 4 | 12 | 0 | 0 | 2 |
| | 17 | 1 | 13 | 1 | 1 | 0 |
| | 50 | 12 | 29 | 3 | 2 | 1 |
| | 119 | 0 | 93 | 8 | 5 | 2 |
| Spitzer et al. 1978 | 78 | 5 | 54 | 11 | 5 | 3 |
| | 98 | 16 | 70 | 8 | 3 | 0 |
| | 56 | 17 | 32 | 3 | 2 | 1 |
| | 39 | 1 | 22 | 8 | 3 | 0 |
| | 99 | 4 | 65 | 19 | 3 | 5 |
| Total | 746 | 60 | 460 | 116 | 44 | 29 |
| Proportion of those observed in estrus | | 8.4% | 64.9% | 16.4% | 6.2% | 4.1% |

The synchrony of estrus following SMB treatment of cows nursing calves can be increased if 48-h calf removal is performed beginning at the time of implant removal (Williams, 1990). Smith et al. (1979) demonstrated that when coupled with SMB, calf removal increased both the number of suckled cows exhibiting a synchronized estrus and the synchrony of the distribution of estrus. Unpublished results from our group indicate that 48-h calf removal also hastened the onset of estrus following implant removal. Calf removal has also increased the estrus response among cows treated with a norgestomet implant for 9 d and $PGF_2\alpha$ injection at implant removal (Brown et al., 1986). When calves were removed from cows immediately after 7-d MGA feeding, high rates (66%) of estrus synchronization were recorded even though the herd consisted of a mixture of cyclic and non-cyclic cows (Bolze and Day, 1989). Patterson (1990) has suggested that 48-h calf removal following MGA feeding should not begin at the time of the last MGA feeding, but may need to be delayed until the second and third days after the last MGA feeding.

The tight synchrony of estrus that occurs following either SMB treatment of heifers or SMB treatment and 48-h calf removal in postpartum beef cows makes these treatments logical for use with timed insemination. Similarly, the synchrony that can be achieved when $PGF_2\alpha$ is administered 1 d before removing a PRID or norgestomet implant also makes these treatments suitable for use with timed breeding. Conversely, when $PGF_2\alpha$ is administered simultaneous to implant or PRID removal or in any scheme in which MGA is fed just prior to the synchronized estrus, timing of estrus is not synchronized well enough to recommend timed breeding .

The recommendation for timed breeding of SMB-treated cattle is to inseminate each animal between 48 and 54 h after implant removal. Despite the unavoidable cases in which the timing of the insemination is not appropriate to maximize chances for conception in some animals, overall pregnancy rates reported for heifers bred at a timed insemination after SMB treatment were actually higher (55%) than pregnancy rates for heifers bred 12 h after estrus detection (44%) in trials where the two methods were directly compared (Miksch et al., 1978; Spitzer et al., 1978). Smith et al. (1984) synchronized estrus with a PRID for 7d and $PGF_2\alpha$ injection on d 6. Heifers in those trials were bred 84 h after the $PGF_2\alpha$ injection. Pregnancy rate after timed insemination was 66%, which was not significantly lower than the 73% pregnancy rate recorded for untreated heifers bred 12 h after detection of estrus.

## FERTILITY AFTER ESTRUS SYNCHRONIZATION

The goal of any synchronization program is to achieve conception rates at the synchronized breeding that are equal to those recorded after a spontaneous estrus. Reducing progestin exposure from 21 or 18 d to 12 d improved conception rates of the synchronized animals (Roche et al., 1981). Combining progestin administration with a luteolytic dose of $PGF_2\alpha$ or estrogen allowed the period of progestin exposure to be further reduced to 7 or 9 d. Conception rates of cattle treated with progestins for 7 or 9 d were often reported to be not significantly different from those of untreated controls in the same trial (see Odde, 1990). However, upon closer inspection of the fertility of cattle treated with either SMB or fed MGA for 7 d with $PGF_{2\alpha}$ injected on the last d of MGA feeding, it became apparent that while the reduction in conception rates of all the animals treated may not have been statistically significant, the conception rates of those cattle that began progestin treatments late in the estrous cycle (> d 14) were significantly lower (Table 2; Brink and Kiracofe, 1988; Beal et al., 1988; Patterson et al., 1989).

**Table 2. Conception Rates of Animals Treated with SYNCRO-MATE-B (SMB) or Melengestrol Acetate (MGA) and Prostaglandin $F_{2\alpha}$ Beginning at Different Stages of the Estrous Cycle.**

| Stage of the cycle at initiation of treatment | Synchronization Treatment | | | |
|---|---|---|---|---|
| | SMB | | MGA + $PGF_{2\alpha}$ | |
| | Brink and Kiracofe 1988 | Beal unpublished | Patterson et al 1990 | Beal et al 1988[a] |
| 0-5 | 10/21 (47%) | 12/19 (63%) | 18/22 (82%) | 42/64 (66%) |
| 6-11 | 12/26 (46%) | 8/13 (62%) | 9/13 (69%) | |
| 12-16 | 9/24 (37%) | 8/13 (62%) | 5/12 (42%) | 13/36 (36%) |
| 17-21 | 5/14 (36%) | 3/8 (38%) | 3/14 (21%) | |

[a] Stage of the estrous cycle reported as < or > d 14.

The use of transrectal ultrasonography has allowed sequential monitoring of the ovulatory follicle in animals that are treated with progestins beginning late in the estrous cycle. We conducted an experiment to compare the development of the ovulatory follicle in cows fed MGA (.5 mg/d) for 7 d beginning on d 7 or 17 of the estrous cycle and injected with $PGF_{2\alpha}$ at the last MGA feeding (Beal et al., 1990). Treatment with MGA beginning late in the estrous cycle (d 17) delayed estrus and caused a large, estrogen-active, dominant follicle to persist on the ovary throughout the 7-d treatment period in 80% of the treated cows. In each case that persistent follicle ovulated after the synchronized estrus (Figure 1). Conversely, the largest follicle present in cows beginning treatment on d 7 regressed during MGA feeding and another follicle developed and ovulated. The persistence of the dominant follicle in the cows fed MGA beginning late in the cycle was accompanied by elevated estradiol concentrations for more than 7 d prior to ovulation (Figure 2).

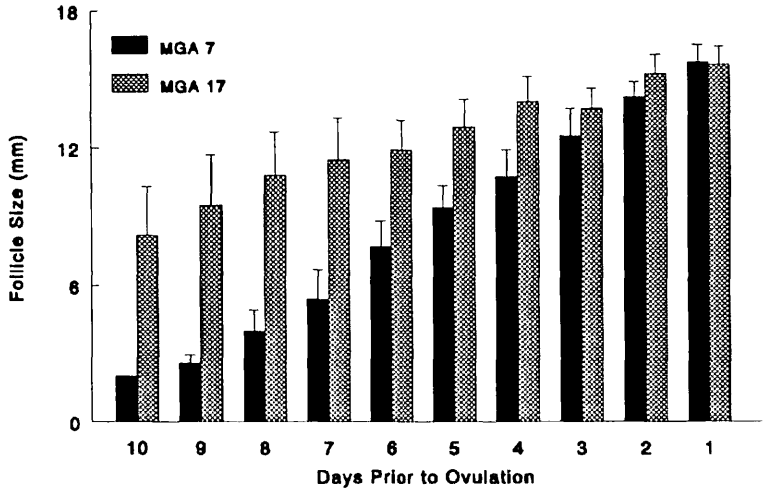


Figure 1. The diameter of the ovulatory follicle in cows treated with melengestrol acetate (.5 mg/d for 7 d) and $PGF_{2}\alpha$ (25 mg at last MGA) beginning on day 7 or 17 of the estrous cycle.

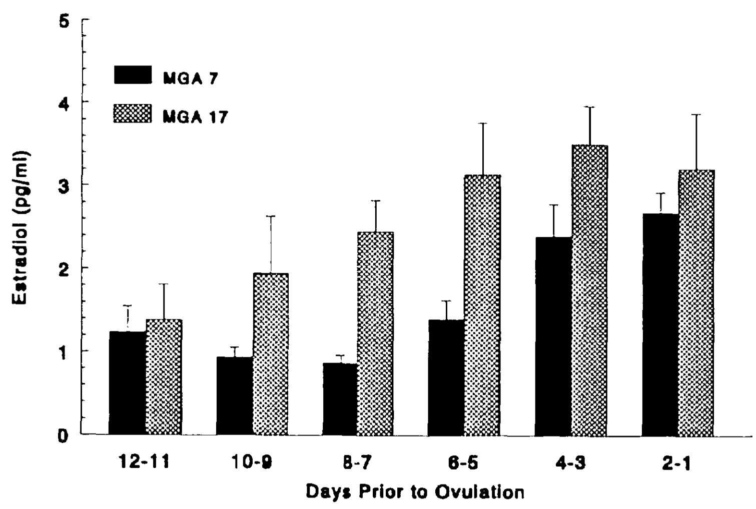


Figure 2. Serum concentrations of estradiol prior to ovulation in cows treated with melengestrol acetate (.5 mg/d for 7 d) and $PGF_{2}\alpha$ (25 mg at last MGA) beginning on day 7 or 17 of the estrous cycle.

The ability to "hold" a large, estrogen-active follicle when the estrous cycle is extended is not unique to treatment with MGA. Treatment with controlled internal drug release devices (CIDR) containing 1.9 g of progesterone placed in the vagina for 14 or 15 days (Lucy et al., 1990; Sirois and Fortune, 1990) or treatment with SMB (Jones et al., 1989) beginning late in the estrous cycle have had a similar effect. Stock and Fortune (1993) treated six heifers with a CIDR for 14 d beginning on d 14 of the estrous cycle and documented by ultrasonography that the dominant ovulatory follicle in treated heifers grew larger and was present longer than the ovulatory follicle of untreated control animals. Furthermore, only one of six heifers (17%) that ovulated a persistent follicle after CIDR treatment conceived compared to five of six (83%) of the control heifers. While the number of heifers bred in that trial was small, the low fertility of heifers in which the persistence of the ovulatory follicle was documented is reminiscent of the lower fertility in larger groups of animals in which the cycle had been extended with progestin treatment (Table 2; Brink and Kiracofe, 1988; Beal et al., 1988; Patterson et al., 1989).

The persistence of a large, dominant follicle when the estrous cycle is extended by progestin administration appears to be caused by an increase in the pulsatile release of luteinizing hormone (LH). The release pattern of LH changed from 1.6 pulses/6 h on d 17 of the cycle when MGA feeding began to 4.3 pulses/6 h on d 20 in cows which retained a large, dominant follicle (Custer, 1992). That increase in the frequency of LH pulsatility is similar to the change recorded in untreated cows following luteolysis (Schallenberger et al., 1985). Other researchers have reported that LH pulses increased when a corpus luteum (CL) was not present, but estrus was being delayed by administration of one norgestomet implant (Savio et al., 1993) or one CIDR (Stock and Fortune, 1993). When fed .5 mg MGA daily or when administered either a single CIDR or one norgestomet implant, the level of exogenous progestin released after a few days is adequate to inhibit estrus and ovulation, but inadequate to suppress LH pulses. The increased pulsatile release of LH appears to cause a dominant, estrogen-active follicle to develop and persist, thereby inhibiting the development of a "new" ovulatory follicle.

Higher levels of progestins are capable of suppressing LH pulses and allowing continuous waves of follicular growth. When Roberson et al. (1989) increased the level of exogenous progesterone by administering two PRIDs, LH pulse frequency remained low, even when the CL was regressed. Furthermore, it has been demonstrated that reimplanting with a fresh norgestomet implant (Savio et al., 1993) or inserting a second CIDR 10 d after the initial treatment reduced the frequency of LH pulses and caused regression of the persistent dominant follicle that had developed. These observations suggest that if the level of progestin released from a CIDR, PRID, or norgestomet implant could be increased, development of persistent, dominant follicles that ovulate following treatment could be avoided.

With the observations of follicular development collected recently through the use of ultrasonography the effect of both long- and short-term progestin treatment on fertility are more understandable. Levels of progestins delivered in implants, intravaginal devices or through daily feeding have consistently been titrated to the lowest level adequate to inhibit estrus and ovulation. However, that dosage is inadequate to suppress high frequency release of LH pulses. If the progestin exposure continued beyond the lifespan of the CL, when there was only an exogenous source of progestin, a persistent, dominant follicle developed and ovulated after the cessation of progestin treatment. It is becoming apparent that ovulation of that persistent follicle is the reason for the lower fertility of animals bred after progestin treatment has extended the estrous cycle.

This hypothesis explains why shortening the period of progestin treatment (i.e., 7 or 9 d versus 14, 18 or 21 d) resulted in increased fertility. Animals treated for fewer days were less likely to have the CL regress, the estrous cycle extended and LH pulse frequency increased to cause development of a persistent follicle. Hence, with each reduction in the length of treatment, a smaller proportion of the synchronized animals ovulated a persistent, low-fertility follicle.

## PRACTICAL IMPLICATIONS

Estrus synchronization treatments combining short-term progestin administration with estrogen or $PGF_{2\alpha}$ are of practical value to the cattle industry. The convenience of a 7- or 9-d treatment regime that is reasonably priced and fairly simple to administer is attractive. SMB or progestin-$PGF_{2\alpha}$ programs can provide a synchrony of estrus that is suitable for timed insemination. The ability to induce estrus in some non-cyclic cows and prepuberal heifers is a legitimate management advantage. The limitations of SMB and progestin-$PGF_{2\alpha}$ treatments include the failure to achieve a synchronized estrus in all the animals and, to a greater extent, the lower fertility associated with animals that begin treatment late in the estrous cycle.

Improving fertility at the estrus immediately following progestin administration depends on avoiding the development of a large, persistent ovulatory follicle in those animals that begin progestin treatment late in the estrous cycle. The most apparent method to insure continuous waves of follicular growth is to develop a progestin delivery device (i.e., intravaginal device, implant or feed source) that supplies the animals with sufficient levels of progestin to suppress the frequency of LH pulses and not cause the persistence of a dominant follicle. A more immediate solution may be to include a mechanism for increasing progestin delivery for 1 or 2 d within the current progestin schemes, just enough to suppress pulsatile LH release for a period that would allow a new follicular wave to emerge.

Increasing the response of cyclic animals to short-term progestin synchronization programs depends on developing a more consistent method for inducing luteolysis early (< d 9) in the estrous cycle. Alternatively, if a progestin delivery device that supplies the animals with high enough levels of progestin to suppress the frequency of LH pulses and not cause the development of a persistence follicle is developed, it might be possible to reconsider the use of longer periods of progestin treatment to synchronize estrus.

More effective delivery systems for progestins and improved methods of inducing luteolysis are goals for the future. The best advice for current users of SMB, the only approved short-term progestin treatment, is to have as many cows or heifers cycling before treatment as possible. However, it appears to be advantageous to avoid treating cattle that are in the early (<d 5) or late (>d 14) phase of the estrous cycle at the initiation of SMB treatment.

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# INFLUENCE OF BIOSTIMULATION ON ENHANCEMENT OF REPRODUCTIVE PERFORMANCE IN BEEF CATTLE

John C. Spitzer
Professor of Reproductive Physiology
Animal, Dairy, and Veterinary Sciences Department
Clemson University, Clemson SC

## Introduction

Cows calving early breed back earlier in the subsequent breeding season (Lesmeister et al., 1973; Spitzer et al., 1975). It is therefore essential that virgin heifers reach puberty and cows be cyclic prior to or early in a breeding season to achieve early pregnancy. However, wide variations occur in onset of puberty (Beverly and Spitzer, 1980) and average postpartum intervals to estrus range from 46 to 168 days in suckled beef cows (see review of Dunn and Kaltenbach, 1980). With such large variations in reproductive response, many virgin heifers and lactating cows may not be cyclic either at the start of or early in a breeding season.

Males play important roles in reproductive function in addition to mating. In many species, males seem to trigger neuroendocrine reflexes which alter reproduction (positively or negatively) in females (see review of Signoret, 1980). A "negative" example is the "Bruce Effect" where pregnant mice will abort if exposed to a male mouse of a different strain (or even if placed in a cage recently vacated by a male). A "positive" example is induced ovulation in cats where male copulation is an absolute prerequisite for ovulation to occur. These reflexes are very species specific.

Biostimulation is a term coined to describe the stimulatory (positive) effects of a male on estrus, ovulation, or pregnancy (Chenoweth, 1983). Presence of a male clearly hastens onset of puberty in ewe lambs (Dyrmundsson and Lees, 1972) and gilts (Brooks and Cole, 1970; Kirkwood et al., 1981), and certainly advances onset of estrus in mature ewes (Oldham et al., 1978; Pearce and Oldham, 1988), goats (Shelton, 1960) and lactating sows (Rowlinson and Bryant, 1974). Sheep, goat, and swine producers routinely utilize these effects in management procedures to enhance reproductive performance.

In cattle, biostimulatory effects were first inferred by producers with well-fed cows on year-round natural mating breeding programs who observed cows returning to estrus earlier than most data would indicate. Studies where natural mating has shown advantages over artificial insemination also imply a biostimulatory effect for males (Mattner et al., 1974; Langley, 1978).

## Biostimulatory Effects On Puberty In Heifers

In heifers, acceleration of puberty by biostimulation has yielded inconsistent results. Neither short-scrotum bulls nor vasectomized bulls exposed to prepuberal heifers for periods of 18 to 30 days enhanced cyclicity (Berardinelli et al., 1978; Macmillan et al., 1979). Roberson et al. (1987) penned heifers with or without exposure to mature teaser bulls from 9.5 to 15 months of age (152 days duration), but saw no effects on proportion of heifers reaching puberty (Table 1).

Table 1. Cumulative percentages of heifers reaching puberty by age in months

| | | Cumulative percent in estrus | | | | |
|---|---|---|---|---|---|---|
| Group | n | 11 Mo | 12 Mo | 13 Mo | 14 Mo | 15 Mo |
| Bull exposure | 48 | 13 | 48 | 65 | 77 | 83 |
| Isolated | 50 | 14 | 50 | 66 | 84 | 88 |

Roberson et al., 1987

Conversely, in a later study conducted over a 4-year period (Roberson et al., 1991), heifers were exposed to or isolated from bulls from 11.5 to 14 months of age (76 days duration), with more exposed heifers being cyclic at initiation of breeding at 14 months of age (Table 2).

Table 2. Cumulative percentages of heifers reaching puberty by age in months

| | | Cumulative percent in estrus | | |
|---|---|---|---|---|
| Group | n | 12 Mo | 13 Mo | 14 Mo |
| Bull exposure | 136 | 25 | 52[a] | 60[a] |
| Isolated | 131 | 10 | 23[b] | 30[b] |

[ab] Figures with different superscripts, within age differ (P<.05)
Roberson et al., 1991

A follow-up experiment from the same study indicated a significant interaction between rate of gain postweaning (High = 1.75 lbs/day, Moderate = 1.30 lbs/day) and bull exposure from 9 to 15 months of age (175 days duration). Effects of bull exposure were greater for heifers in High gain group than for heifers in Moderate gain group. However, heifers fed to attain either high or moderate growth rate and exposed to bulls attained puberty at younger ages than heifers isolated from bulls.

Chenoweth and Lennon (1984) reported higher cyclicity rates and greater pregnancy rates when peripubertal heifers were exposed to testosterone-treated cows (TTC) between first and second prostaglandin injections (13 days duration) and then exposed to fertile bulls. Thus, biostimulatory effects on advancing puberty in heifers appear, in part, to be dependent on rate of gain, other environmental factors (location, season), length of exposure, and probably inherent differences (breed, biological type), as well as on factors we may not have identified to date.

**Biostimulatory Effects On Reproduction In Postpartum Cows**

To my knowledge, all controlled studies to date have shown biostimulatory effects on reducing postpartum interval to estrus in primiparous (Gifford et al., 1989; Custer et al., 1990; Fernandez et al., 1993) as well as multiparous (Zalesky et al., 1984; Alberio et al., 1987; Naasz and Miller, 1990; Burns and Spitzer, 1992) cows.

When multiparous cows were exposed to bulls within three days of parturition, onset of estrus was advanced by about 20 days (Table 3) compared to cows isolated from bulls until 53 days postpartum (Zalesky et al., 1984).

Table 3. Days from calving to resumption of estrous cycles

| | Days from calving to estrus | |
|---|---|---|
| Group | 1981 | 1982 |
| Bull exposure | 43[a] | 39[a] |
| Isolated | 63[b] | 61[b] |

[ab] Figures with different superscripts within year differ (P<.01)
Zalesky et al., 1984

This biostimulatory effect on return to postpartum estrus can also be elicited with testosterone-treated cows [(TTC - see Appendix 1) (Burns and Spitzer, 1992)]. In this study (Table 4), it was observed that cows exposed to either bulls or TTC had similar postpartum intervals to estrus (Exp. 1). However, in Exp. 2, cows exposed to bulls had an 8-day earlier return to estrus than did cows isolated from biostimulation, and in Exp. 3, cows exposed to TTC had a 12-day earlier return to estrus than did cows isolated from biostimulation. It would appear that bulls or androgenized females elicit similar biostimulatory effects in reducing postpartum interval to estrus.

Table 4. Effects of Biostimulation on Postpartum Intervals to Estrus (ITE) and Pregnancy (ITP)

| Group | ITE | ITP |
|---|---|---|
| Exp. 1 | | |
| Bull exposure | 43 | 80 |
| TTC[a] exposure | 43 | 85 |
| Exp. 2 | | |
| Bull exposure | 44[b] | 81 |
| Isolated | 52[c] | 85 |
| Exp. 3 | | |
| TTC[a] exposure | 41[b] | 87 |
| Isolated | 52[c] | 91 |

[a] Testosterone-treated cows
[bc] Figures with different superscripts within experiment differ ($P<.05$).
Burns and Spitzer, 1992

Note that interval to pregnancy was not different in this series of experiments. This was because biostimulation exerted its stimulatory effects early postpartum (Table 5). By 40 days postpartum, 29 and 31% more cows exposed to bulls or TTC, respectively, were observed to be in estrus compared with cows isolated from biostimulation (Exp. 2 and 3, respectively). By 60 days postpartum, 23% more cows exposed to TTC were observed to be in estrus compared with cows isolated from biostimulation (Exp. 3). After 60 days postpartum, biostimulation had no effect on percentage of cows in estrus. Zalesky et al., (1984) indicated the biostimulatory effect occurred prior to day 53 postpartum in their study.

With the fixed breeding season used in these experiments, a majority of cows were cyclic before the start of the breeding season, regardless of treatment. In the study of Burns and Spitzer, after the first 20 days of breeding, 97% of cows exposed to biostimulation and 94% of cows isolated from biostimulation were observed to be in estrus. Therefore, biostimulation had no effect on postpartum interval to pregnancy. However, biostimulation would seem to be beneficial in reducing postpartum interval to estrus in late-calving cows to ensure cyclicity at the start of a breeding season.

Table 5. Effects of biostimulation on cumulative percentages in estrus by days postpartum

| | Cumulative % in estrus | | | | |
|---|---|---|---|---|---|
| Group | 20 d | 40 d | 60 d | 80 d | 100 d |
| Exp. 1 | | | | | |
| Bull exposure | 2 | 52 | 84 | 96 | 100 |
| TTC[a] exposure | 4 | 55 | 85 | 94 | 97 |
| Exp. 2 | | | | | |
| Bull exposure | 4 | 52[b] | 76 | 95 | 96 |
| Isolated | 0 | 26[c] | 62 | 92 | 98 |
| Exp. 3 | | | | | |
| TTC[a] exposure | 3 | 62[b] | 87[b] | 95 | 95 |
| Isolated | 5 | 31[c] | 64[c] | 90 | 100 |

[a] Testosterone-treated cows
[bc] Within experiment, means with different superscripts within day differ (P<.05).
Burns and Spitzer, 1992

## Mechanisms for Biostimulation

Mechanisms by which bulls or TTC reduce postpartum interval to estrus are unknown. Puberty occurred earlier in heifers when bull urine was placed directly in the vomeronasal organ than in heifers having water placed in the vomeronasal organ (Izard and Vandenbergh, 1982). Androgens in the urine may act as pheromones [compounds that are perceived by the vomeronasal organ to elicit endocrine and behavioral responses (Doty, 1976)] to reduce postpartum interval to estrus.

Olfactory and auditory signals have been implicated as possible mechanisms for effects of biostimulation, as have been direct genital contact and allelomimetic (i.e. "copy-cat") behavior. Nuzzling, nudging and licking of the perineal region of a female by a bull might initiate estrus behavior, and may be important in mediating these effects. Certainly, studies indicating biostimulatory effects with testosterone-treated cows (Chenoweth and Lennon, 1984; Burns and Spitzer, 1992) indicate the stimulatory factors are not exclusively linked to a bull. Further work is needed to determine exact mechanisms involved with biostimulatory effects on postpartum reproduction.

## Discussion and Conclusions

Both delayed puberty in heifers and long postpartum intervals to estrus in cows are recognized as major causes of reduced reproductive performance in beef herds. While data concerning biostimulatory effects on earlier puberty are inconsistent, there is overwhelming evidence to support this application in inducing earlier return to postpartum estrus. That this effect may be elicited by testosterone-treated cows may make its application easier.

Biostimulation appears to have its effect prior to day 60 postpartum, after which no effects were observed. Therefore, biostimulation would be a useful management tool for increasing reproductive performance in late-calving cows by reducing postpartum interval to estrus and having these cows cyclic at either the start of or early in a breeding season to ensure early pregnancy.

This would appear to work extremely well in situations where artificial insemination (AI) will be used. Select a sound, early calving individual from the bottom end of the cow herd. Begin testosterone treatments as soon as she calves and continue through the AI breeding season. This will provide potential benefits of biostimulation and an aid to estrous detection for AI breeding.

## Appendix 1

### Testosterone Treated Cow

Our procedure for programming a testosterone-treated cow (TTC) is based on Kiser et al., (1977) as modified by Heekin (1983).

| | |
|---|---|
| Day 1 | - 1.5 gm(1500 mg) Testosterone Enanthate Subcutaneously plus .5 gm(500 mg) Testosterone Enanthate Intramuscularly |
| Days 14 and 28 | - 1 gm(1000 mg) Testosterone Enanthate Subcutaneously |
| Days 42 and on | - 1.0 gm(1000 mg) Testosterone Enanthate Subcutaneously every 14 to 21 days depending on behavior of individual TTC |
| Withdrawal | - 6 months from last injection to sale or slaughter |

Testosterone Enanthate is a controlled substance, prescription drug only available through your veterinarian. Consult with him concerning use and extended withdrawal times to slaughter required. A veterinarian's easiest source is to write a prescription to your local pharmacist. Testosterone Enanthate is supplied in 10ml vials (200 mg/ml) by Geneva Pharmaceutical, Inc., Broomfield Co.

In our experiences, 90% of cows thus treated will become adequate TTC. Mature cows seem to work much better than first-calf cows, and virgin heifers seldom work at all.

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# FUTURE DEVELOPMENTS IN REPRODUCTIVE MANAGEMENT: WHAT BIOTECHNOLOGY AND RESEARCH HOLD*

R. L. Ax, M. E. Bellin, T. C. McCauley, J. N. Somoza
Department of Animal Sciences, University of Arizona
Tucson, AZ 85721

## INTRODUCTION

When I agreed to make this presentation, the topic seemed straightforward and offered an opportunity to highlight some of the exciting developments in biotechnology. However, since most reproductive traits are lowly heritable, some of the genetic advances being heralded in livestock breeding schemes will not affect reproductive performance to any great extent. Nevertheless, there are some biotechnological advances that promise to change management of bulls and cows to optimize reproductive potential. Since this cannot be an exhaustive treatise of numerous research efforts in reproductive biology, I will expand on detecting differences in fertility of bulls after they have qualified for a breeding soundness exam (BSE). This area reflects my personal interests in bull reproductive management that can return the greatest profit to a cattle breeding enterprise.

## RESEARCH SUMMARY

About a decade ago, our laboratory showed that large complex sugars known as glycosaminoglycans (GAG) are present in the female reproductive tract (Lee et al., 1984). As sperm progress through the female tract they are prepared for fertilization of the egg. This process is referred to as capacitation. GAGs added directly to sperm in vitro result in increased fertilization potential similar to naturally occurring capacitation (Lenz et al., 1982, 1983 a,b). The most potent GAG in terms of eliciting the final stage of capacitation, or acrosome reaction (AR), was heparin (Handrow et al., 1982). Ability of heparin to induce AR corresponded to a bull's fertility. Higher fertility bulls produced sperm which displayed a greater frequency of AR in response to heparin-like compounds compared to sperm from lower fertility bulls (Ax and Lenz, 1987).

Sperm from higher fertility bulls also exhibited a greater binding attraction for heparin than sperm from lower fertility bulls (Marks and Ax, 1985). No difference in number of binding sites for heparin per sperm cell was detected, and each sperm possessed about 1 million binding sites (Marks and Ax, 1985). Therefore, sperm cells from higher fertility bulls were more responsive to undergoing an AR in the presence of heparin and also possessed a higher affinity or probability to respond to a given dose of heparin.

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Heparin binds to a group of proteins on the surface of sperm. Those proteins are produced by the male accessory glands, secreted into seminal fluid (Nass et al., 1990), and at ejaculation, bind to sperm (Miller et al., 1990). Due to this event, ejaculated sperm possess more binding sites for heparin than epididymal sperm. Addition of heparin binding proteins (HBP) from seminal plasma of vasectomized bulls induced epididymal sperm to undergo AR upon subsequent addition of heparin (Miller et al., 1990).

Seminal fluid and sperm membrane proteins were isolated from semen samples and quantified using a high performance liquid chromatography heparin affinity column. Five different protein peaks elute as the NaCl concentrations increase from 0.1 to 1.2 M NaCl. Heparin binding protein (HBP) peaks are labeled B1-B5 with B1 corresponding to the protein peak that is removed at .1 M NaCl corresponding to the lowest attraction for heparin and B5 corresponding to the proteins that require 1.2 M NaCl to break their higher affinity binding to heparin.

Two consecutive field fertility trials at King Ranch were conducted based on heparin binding ability of sperm membranes. Bulls were grouped according to presence or absence of HBP-B5 in seminal fluid and in sperm membranes. Bulls were pastured at a ratio of 1 bull per 25 cows. Each bull had initially passed a BSE (Elmore, 1985) prior to screening his ejaculate for presence of HBP-B5. Fertility for each group of bulls was determined by the number of cows pregnant for each group. Trial 1 had 58 bulls bred to 1302 cows in 5 pastures on 26,547 acres. Trial 2 was expanded the second year to include 132 bulls representing four different breeds bred to 3690 cows in 14 pastures on 68,703 acres.

Bulls which had B5 in sperm membrane but no detectable B5 in seminal fluid displayed highest fertility (82% of the cows were pregnant). Bulls with non-detectable B5 in the sperm membrane had lower fertility (65% of the cows were pregnant). In conclusion, bulls with high affinity B5 in sperm membrane but not in seminal fluid had significantly elevated fertility compared to bulls with other HBP distributions.

Average fertility for each group of bulls differed and ranged from 58% to 84%, but the difference of almost 20% in fertility could be discriminated by measuring protein composition on sperm surfaces. Bulls in the high fertility groups produced an average of 17.4 calves per bull, whereas lower fertility bulls tested in the study produced only 13 calves per bull.

## CONCLUSION

These field trials showed that presence of a high affinity HBP peak (B5) on sperm membranes was related to higher field fertility of bulls. Current research is centering on development of an antibody-particular HBP found in B5. That type of approach would enable us to perform a bull-side test with an end-point of a color change that corresponds to higher fertility. Feasibility of such an approach is high based upon our preliminary work to date.

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# BIRTH WEIGHT AND CALVING EASE

**Terry E. Kiser, Keith Bertrand and Andra Nelson**
**The University of Georgia, Athens**

## INTRODUCTION

Most commercial cattleman don't care how much a calf weighs at birth as long as the birth process is of short duration with minimal stress on the cow, the calf comes unassisted, is vigorous and has the ability for rapid growth until a year of age. Notwithstanding this observation, calf birth weight is a prime consideration for cattlemen as they select bulls to use in their cow herds. Several studies have concluded that calf birth weight was the single most important source of variation for dystocia (Bellows et al., 1971; Morrison et al., 1985; Naazie et al., 1989). More recently, Cook et al. (1993) using a computer simulation model suggested that use of low birth weight EPD bulls would be more effective than selection of heifers based on large yearling pelvic area in reducing dystocia. Theoretically, use of birth weight EPDs and pelvic area concurrently should maximize our ability to reduce dystocia, however, while pelvic area is quantitatively precise, our ability to predict absolute birth weights under diverse environmental conditions is equivocal.

Examination of sire evaluation reports clearly demonstrates what is happening to birth weight trends and birth weight EPDs in most breeds of cattle. For example, in the Angus breed birth weight has increased about 10 pounds per decade since 1972 and birth weight EPDs have increased in a linear fashion during this same time period (Figure 1). These linear increases have potentially tremendous implications to purebred and commercial cattleman alike because birth weight has a threshold effect on calving difficulty.

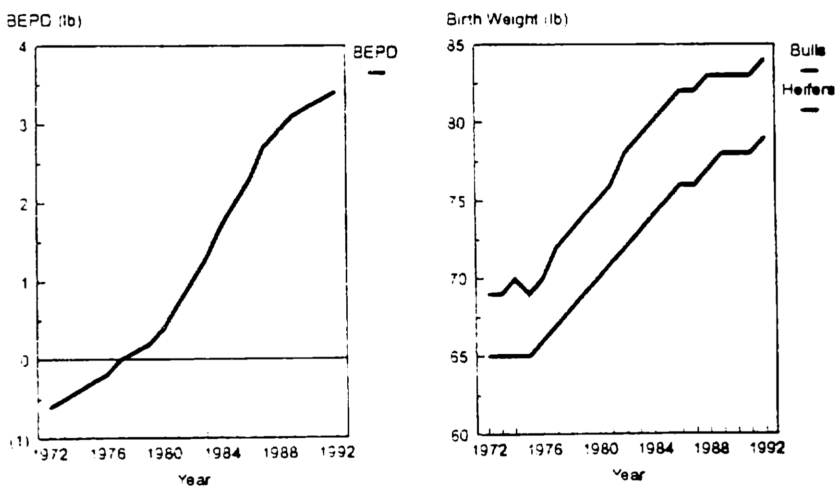


Figure 1. Angus genetic trend for birth weight EPD and average adjusted birth weights for bulls and heifers.

Many factors influence birth weight and these factors may interact with each other to give unexpected results. For a comprehensive review of factors affecting calf birth weight the reader is referred to Holland and Odde (1992).

Our experience with National Cattle Evaluation has provided excellent information on ranking of sires within breeds but strategies for minimizing calf birth weight and exploiting growth and maternal traits are still being debated. Most National Cattle Evaluation programs calculate or have the ability to calculate the maternal component for various growth traits. Can we effectively use this data in a strategic plan to reduce dystocia? Finally, the environment and biological diversity within and among breeds of cattle can fool the most astute cattleman.

## INFLUENCE OF THE SIRE ON CALF BIRTH WEIGHT

A study conducted at The University of Georgia (Arnold et. al., 1990) examined using low and high birth weight Angus bulls in a herd of Angus cows. In this study, one-half of the cows were bred to low birth weight (EPD ≤ 3.0 lb) bulls and one-half of the cows were bred to high birth weight (EPD ≥ 7.0 lb) bulls. All sires had yearling weight EPDs the year they were chosen greater than 45 pounds with an accuracy greater than 80 percent.

During the four year study (1984-1987) birth weights, weaning weights, yearling weights, pelvic areas and gestation lengths were measured on progeny from the low and high birth weight sires. Only birth weight differed (78.2 versus 69.9 pounds) significantly between the high and low birth weight sires. Table 1 shows the actual birth, weaning, and yearling weight differences for low and high birth weight EPD sires and the projected differences obtained from the Angus Sire Summary.

TABLE 1. COMPARISON OF ACTUAL WEIGHT DIFFERENCES TO PROJECTED DIFFERENCES BASED ON SIRE EPD'S

| Trait | Actual | Projected |
|---|---|---|
| BWGT (lb) | 8.3 | 6.5 |
| WWGT (lb) | 13.4 | 11.7 |
| YWGT (lb) | 14.5 | 13.9 |

These data indicate that if the accuracy for birth, weaning, and yearling weight is at least 0.80, then the sire summary is a good relative predictor of these growth traits. In addition, the results clearly indicate that it is possible to select for low birth weight and still maintain moderate weaning and yearling growth in Angus cattle. The long range consequence of selecting for low birth weight on production efficiency has not been determined. Breeders will sacrifice some weaning and yearling growth to get smaller calves at birth, but the tradeoff of lower dystocia may be worthwhile. If breeds have enough genetic diversity then antagonistic trait selection may offer a strategy for minimizing birth weight and exploiting the other growth traits.

In this study neither gestation length nor pelvic differed between high and low birth weight EPD sires (Table 2). Using antagonist trait selection, (low birth weight and moderate to high yearling growth), we suggest that the effect of low birth weight EPD sires was to produce calves that grew slower in utero without affecting gestation length. There was an association between gestation length and birth weight but these effects were similar across genetic lines. In other words, long gestation lengths were associated with heavier birth weight calves from both low and high birth weight EPD sires.

TABLE 2. GESTATION LENGTH (GL) AND PELVIC AREA (PA) FOR HIGH AND LOW BIRTH WEIGHT ANGUS SIRES

| Trait | Sire Line | |
|---|---|---|
| | High | Low |
| GL (days) | 280 | 280 |
| PA $CM^2$ | 145 | 147 |

From 1988 to 1991 high and low birth weight bulls were stratified across cows with out regard to genetic lines. Then in 1992 and 1993 pedigrees were stacked to develop divergent lines with the emphasis on 1) a low birth weight, high growth line and 2) a high growth line of cattle without regard for birth weight. Of course, the high growth line sires also had significantly higher birth weight EPDs (Table 3).

What is the trade off for higher birth weights in a commercial herd of cattle? If we can get optimal performance from low birth weight EPD sires then all high birth weight bulls can be castrated at birth. In general, most cattlemen are not willing to sacrifice additional growth in the cow herd if they are not experiencing calving problems. Table 4 illustrates differences in weaning and yearling weights of bulls from high and low birth weight EPD bulls. Although the number of animals is small, the growth performance advantage was in favor of the high birth weight, high growth EPD sires. All animals were raised in the same contemporary group and there were no significant differences in calving difficulty in the cows, thus the differences in growth were explained by higher weaning and yearling weight EPDs.

TABLE 3. BIRTH WEIGHTS OF CALVES FROM HIGH AND LOW BIRTH WEIGHT EPD BULLS

| Sex | 1988-1991 | 1992 | 1993 |
|---|---|---|---|
| | - - - - - - - - - - - - - - - | lb - - - - - - - - - - - - - - - | |
| Bulls | | | |
| High EPD | 87.4 | 90.3 | 93.8 |
| Low EPD | 77.6 | 77.3 | 83.5 |
| Diff. | 9.8 | 13.5 | 10.3 |
| Heifers | | | |
| High EPD | 80.2 | 84.9 | 85.9 |
| Low EPD | 72.3 | 68.3 | 72.5 |
| Diff. | 7.9 | 16.6 | 13.4 |

TABLE 4. COMPARISON OF WEANING AND YEARLING WEIGHTS OF YEARLING BULLS FROM HIGH AND LOW BIRTH WEIGHT EPD SIRES

| Trait | WWGT | YWGT |
|---|---|---|
| High BEPD | 601 | 1164 |
| Low BEPD | 559 | 1079 |
| Difference | 42 | 85 |

The above studies show conclusively that use of low and high birth weight EPD bulls with at least .80 accuracy resulted in predictability of relative birth weight differences. In addition, because birth weight is correlated to weaning and yearling weight, the high birth weight bulls had an increased growth advantage at both of these production phases. Therefore, it seems logical to use low birth weight bulls on heifers where calving difficulty may be a problem and conversely, use high growth bulls in the mature cow herd to maximize calf weights at weaning and at yearling time.

Because most commercial cattlemen use non-progeny bulls with low accuracy we designed a research trial using non-progeny Angus bulls in a commercial cow herd (Central Branch Experiment Station) to compare projected versus actual birth weight differences of the resulting progeny. Eight pairs of low and high birth weight EPD bulls from The University of Georgia's Wilkins Beef Unit were stratified across pastures during 1991 and 1992. Two bulls used during 1991 breeding season were used during the 1992 breeding season. Multiparous crossbred Brangus-Hereford cows were exposed to the Angus bulls for approximately 70 days. Calf birth weights were taken within 24 hours of birth.

Table 5 shows birth weights of calves from Brangus-Hereford cross cows mated to non-progeny low or high birth weight EPD Angus bulls. Surprisingly, calf birth weights were similar during the 1992 calving season for calves sired by low and high birth weight EPD bulls. However, during the 1993 calving season male calves were 8.0 pounds and heifer calves were 7 pounds heavier from the high birth weight EPD sires compared to the low birth weight EPD sires.

TABLE 5. BIRTH WEIGHT OF CALVES FROM CROSSBRED COWS MATED TO NON-PROGENY ANGUS BULLS

| Sex | 1992 | 1993 |
|---|---|---|
| Bulls | | |
| High BWGT | 75 | 84 |
| Low BWGT | 75 | 76 |
| Difference | 0 | 8 |
| Heifers | | |
| High BWGT | 70 | 77 |
| Low BWGT | 72 | 70 |
| Difference | -2 | 7 |

The University of Georgia - Central Branch Experiment Station.

Comparison of sires that were used during both breeding seasons showed that calves born during 1993 were on the average 4.0 pounds heavier than calves born during 1992. This observation suggested an environmental effect which may have occurred across consecutive years during gestation. For example, during 1992 there was approximately 18 inches greater rainfall from May to December compared to the same time interval during 1991 and comparable difference in temperature was 4° Fahrenheit. In addition, cow weight gain from May to September averaged 0.4 pounds per cow per day greater in 1992 than 1991. Taken together, under the conditions of this study, we suggest that the environment did not allow for expression of *in utero* fetal growth differences during 1991 compared to 1992.

## DOES THE DAM CONTRIBUTE TO BIRTH WEIGHT?

Producers often assume that only the bull contributes to the birth weight of the calf. However, half the genes for birth weight and every other trait comes from the female. Table 6 illustrates the influence of the female with different birth weight EPDs on birth weight of the calf. As birth weight EPDs increase in the female, birth weight EPDs of the male must decrease if birth weight is to stay constant. Thus, it is possible to use a bull in one contemporary group with out increased birth weight and calving problems and use the same bull in another contemporary group with significant birth weight and calving problems simply because of the birth weight EPDs of the cow. If environment and sire birth weight EPDs remains constant, then the birth weight EPD of the dam most likely contributes the majority of difference between the two contemporary groups. For herds where growth genetics have been stacked for many years, the birth weight genetics may represent a significant source of variation for calving problems. In addition, in those commercial herds where stacking of growth genes and cross breeding are used concurrently, problems with increased birth weight and calving difficulty may be intensified.

TABLE 6. EFFECT OF COW BIRTH WEIGHT EPD ON THE RESULTING CALF BIRTH WEIGHT EPD

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Example 1 | | | |
| Cow EPD | -2.0 | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 |
| Sire 1 EPD | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 |
| Calf EPD | **.6** | **1.6** | **2.6** | **3.6** | **4.6** | **5.6** |
| | | | Example 2 | | | |
| Cow EPD | -2.0 | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 |
| Sire 2 EPD | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| Calf EPD | **3.0** | **4.0** | **5.0** | **6.0** | **7.0** | **8.0** |

Sire 1 birth weight EPD is breed average.

## MATERNAL EFFECTS FOR BIRTH WEIGHT

In view of the increase interest in birth weight, additional effort may need to be directed toward maternal effects on calf birth weight. Several studies have shown that the direct effects for birth weight are higher than maternal effect for birth weight (Trus and Wilton, 1988). In general, direct heritabilities ranged from 0.27 to 0.42 and maternal heritabilities ranged from .13 to .20. Interestingly, the relationship between direct and maternal is negative for most breeds. Maternal birth weight EPDs are not reported by breed associations at present. The long term breeding value trends for direct and maternal birth weight are shown in Figure 2. Clearly, the direct effects have increased over the years which indicates a national selection scheme by seed stock producers. On the other hand maternal breeding value has fluctuated up and down probably as a consequence of planned and unplanned breeding schemes.

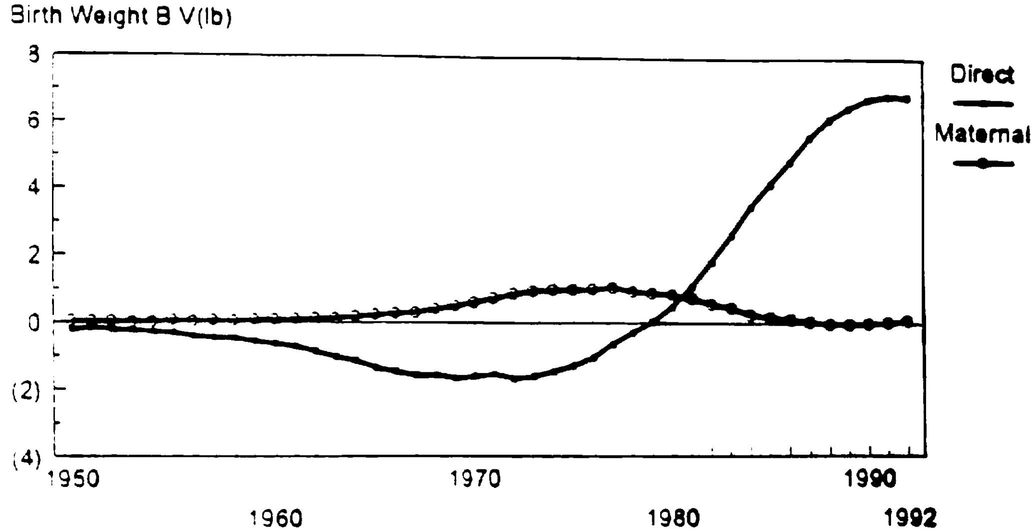


Figure 2. Direct and maternal birth weight breeding value (BV) trends for Angus sires.

To illustrate what is meant by negative maternal effects for birth weight consider the well known antagonism between growth and milk. Those sires with high growth potential generally produce daughters with decreased milk production potential. The same concept applies to negative maternal effects for birth weight. For example, a sire with a high birth weight potential will produce females that have the maternal ability to lower or dampen *in utero* growth of the fetus. This phenomenon is best illustrated between breeds of cattle. Comerford et al. (1987) illustrated this concept using between breed comparisons (Table 7). Regardless of mating type Braham sired calves had the heaviest birth weight. In contrast, regardless of mating type calves from Brahman dams had the lightest birth weight. In this scenario, negative antagonism appears to be an advantage because the dam is compensating for the high birth weight potential of the sire by decreasing *in utero* growth of the fetus by maternal mechanisms. Most National Cattle

Evaluations have demonstrated that this same relationship exist within breeds of cattle. The big question is how do we use this information to curb increasing birth weight trends and still maintain growth efficiency?

TABLE 7. AVERAGE BIRTH WEIGHTS FOR BREEDS OF SIRES AND DAMS AND THEIR RECIPROCAL CROSSES

| Breed | Birth Weight (lbs) |
|---|---|
| Brahman Sires | **80.1** |
| Hereford Sires | 72.7 |
| Limousin Sires | 74.7 |
| Simmental Sires | 78.1 |
| | |
| Brahman Dams | **65.7** |
| Hereford Dams | 77.7 |
| Limousin Dams | 81.3 |
| Simmental Dams | 80.9 |

Adapted from Comerford et al., 1987.

Calculation of the maternal birth weight frequencies for sires in the Angus breed reveals a normal distribution with 99.4 percent of all observation falling within three standard deviations of the mean (Table 8). In addition, maternal birth weight EPDs ranged from -4 to +6 pounds. The implications for this data is that regardless of the direct effects for birth weight, the effects due to maternal environment could be substantial.

Many of the sires that are 1 to 3 standard deviations below the mean for maternal birth weight will also be low growth sires. However, a small percentage of sires will have the combination of above average growth and below average direct and maternal birth weight effects (Table 9). Only 294 Angus sires are above average for yearling weight and below average for both direct and maternal birth weight, which illustrates the tremendous selection pressure which could be utilized with this breeding strategy. Identifying these sires within a breed it should be possible to increase growth potential and at the same time balance or abate the correlated response between birth weight and yearling weight.

TABLE 8. MATERNAL BIRTH WEIGHT FREQUENCIES FOR ANGUS SIRES

| MBWT S.D. | (MBWT EPD) | | | Sires |
|---|---|---|---|---|
| - 4 | (-4.0 | to | -3 lb) | 23 |
| - 3 | (-2.9 | to | -2 lb) | 168 |
| - 2 | (-1.9 | to | -1 lb) | 839 |
| - 1 | (-0.9 | to | 0 lb) | 2013 |
| +1 | (+0.1 | to | +l lb) | 1933 |
| +2 | (+1.1 | to | +2 lb) | 777 |
| +3 | (+2.1 | to | +3 lb) | 140 |
| +4 | (+3.1 | to | +4 lb) | 11 |
| +5 | (+4.1 | to | +4 lb) | 2 |
| +6 | (+5.1 | to | +6 lb) | 1 |

TABLE 9. ANGUS SIRES THAT ARE ABOVE AVERAGE FOR YEARLING WEIGHT EPD AND BELOW AVERAGE FOR DIRECT (DBWGT) AND MATERNAL (MBWGT) BIRTH WEIGHT EPD

| YWGT S.D. | (YWGT EPD) | DBWGT | MBWGT | N |
|---|---|---|---|---|
| +1 | (35.1 TO 52) | - | - | 239 |
| +2 | (52.1 TO 69) | - | - | 49 |
| +3 | (69.1 TO 86) | - | - | 6 |
| +4 | (86.1 TO 103) | - | - | 0 |

## EFFECTS OF ENVIRONMENT ON CALF BIRTH WEIGHT

Birth weight and birth weight EPD trends have increased dramatically during the last two decades. Many in the cattle industry would conclude that this increase has occurred because of the increase in emphasis placed upon growth genetics. However, all growth traits have two major components which influence whether they increase or decrease...genetics and environment. And in most situations environment is a major player, albeit it is not a permanent effect.

Examination of the contemporary (environmental) effects on birth weight shows that, in the Angus breed, this effect has changed from -10.2 lbs in 1972 to -3.5 lbs in 1992 (Figure 3). In other words, environmental factors such as improved herd health, better nutrition, increased disease resistance, and more efficient control of internal and external parasites have most likely contributed to a part of the increase in birth weight that has occurred.

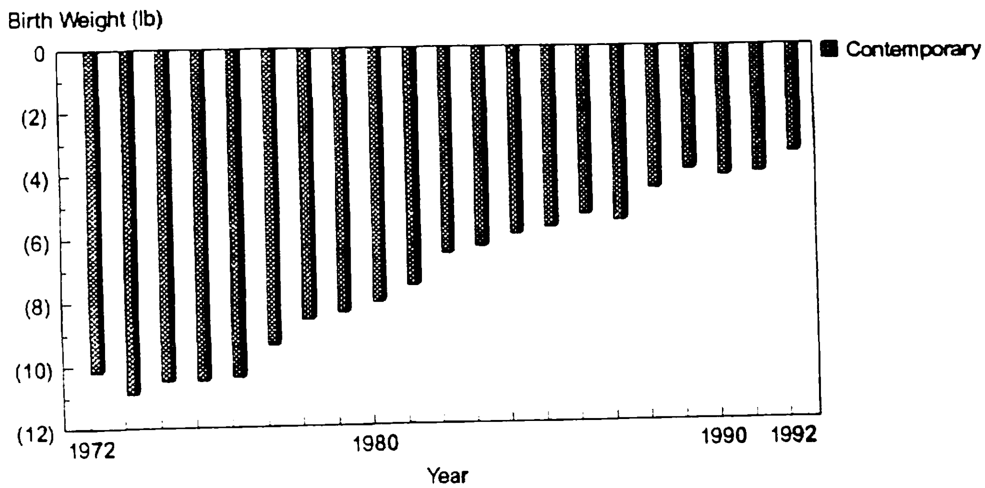


Figure 3. Effect of the environment (contemporary) on birth weight trends in Angus cattle.

In summary many factors influence birth weight of calves from a given sire. Direct effects of the sire on birth weight are predictable when the environment and maternal effects are considered, but the interactions of these factors on birth weight are less well understood.

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# MILK PRODUCTION AND CALF WEANING WEIGHT

## *Being Smart About Where We Are and Where We Are Going*

W. E. Beal and J. M. Kearnan

Department of Animal and Poultry Science
Virginia Polytechnic Institute and State University

## INTRODUCTION

In a state like Virginia milk production is KING. Cattle and calves are the number one agricultural commodity in the state and represent $412 million in annual revenue. However, fewer than 40,000 head are fed to slaughter weight in-state each year. Instead, Virginia cattle producers market weaning weight in the form of thousands of calves that are shipped to the Midwest and Southwest. Hence, interest in factors that affect milk production of beef cows is high and one focus of research at Virginia Tech has been on milk EPDs and factors that affect milk production.

The first purpose of the information that follows is to reemphasize the relationship between milk production and calf weaning weight and to illustrate the importance and potential impact of maternal milk EPDs. The second purpose is to frankly discuss the two most disturbing antagonisms that have been related to selection for increased milk production in beef cattle, namely, reduced reproductive efficiency and higher dietary energy requirements for maintenance of body weight.

## MILK PRODUCTION AND CALF WEANING WEIGHT

Milk produced by beef cows is a high-energy, high-protein nutrient source. The average milk composition of Bos taurus breeds of beef cattle is 4.1% fat, 3.3% protein and 12% dry matter on an as fed basis. When compared to grain or protein supplements on a dry matter basis, milk provides more energy than corn or soybean meal and the protein content ranks between the two dry feeds (Table 1).

**Table 1. Comparison of Nutrient Composition of Milk, Corn and Soybean Meal (NRC, 1984)**

| | | Dry Matter Basis | |
|---|---|---|---|
| Feedstuff | Percent Dry Matter | Metabolizable Energy (Mcal/lb) | Crude Protein (%) |
| Milk | 13 | 2.14 | 25.8 |
| Corn | 88 | 1.47 | 10.1 |
| Soybean meal | 89 | 1.38 | 49.9 |

Given the nutrient content of milk, it is not surprising that the correlation between estimated milk production of dams and preweaning weight gain of their calves is usually high (r >.50; Gleddie and Berg, 1968; Neville, 1962). In our experiments (Beal et al., 1990; Kearnan and Beal, 1992) the correlation has been >.70. In each case the coefficient of determination ($r^2$), which is an estimate of the amount of variation in calf weight gains that can be explained by differences in the milk production of the dams, has been greater than 50% (.50). The milk production of the dam accounted for 56% of the difference in calf gain in one experiment, regardless of whether milk production was estimated by machine milking or the weigh-suckle-weigh technique. The consistently strong, positive relationship between milk production and calf weaning weight indicates that milk production is the single greatest factor influencing preweaning gain.

Estimates of the milk yield during lactation in beef cows have usually been derived from data collected by the weigh-suckle-weigh technique. In this procedure calves are separated from their dams and then weighed before and after nursing to obtain an estimate of milk intake. Use of such data has generated lactation curves that indicate milk production increased during the first 2 mo of lactation before peaking and declining slowly (Figure 1). When milk production is estimated by machine milking after a period of calf removal, a linear decrease in the pattern of milk production appears (Figure 1).

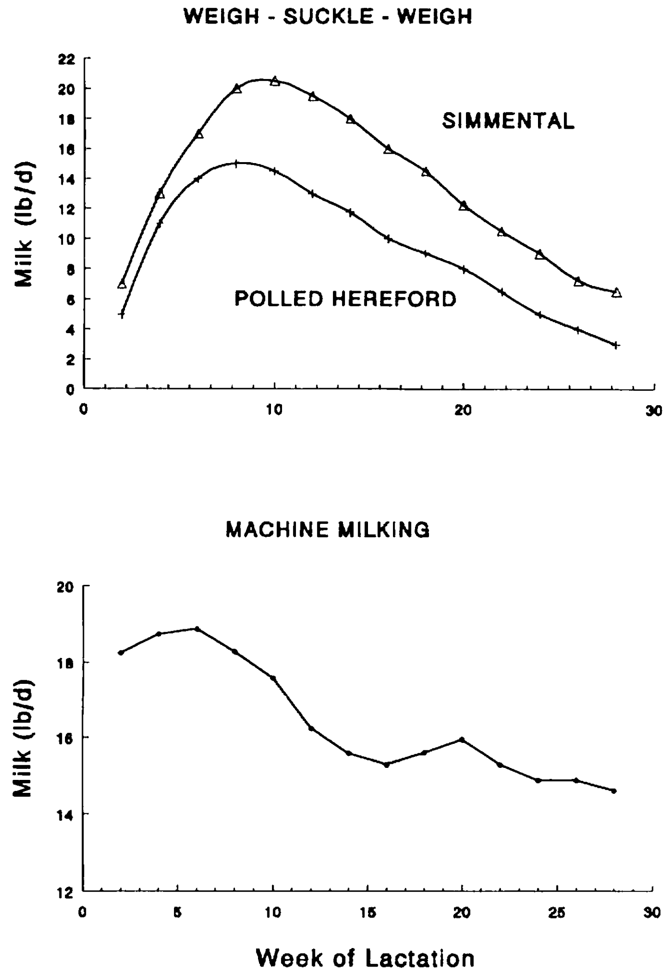


Figure 1. Estimated lactation curves for beef cattle based on weigh-suckle-weigh (Schalles, 1990) or machine milking (Kearnan and Beal, 1992) records of milk production.

Differences in estimating milk yield during a lactation are related to the measurement techniques. Weigh-suckle-weigh depends on the intake capacity of the calf which is limited in young calves and increases with age. This would cause the weigh-suckle-weigh technique to underestimate potential milk yield early in lactation. Conversely, machine milking after exogenous administration of oxytocin collects all available milk from the mammary gland, even residual milk that may not be available to a calf. Hence, the machine milking procedure may be a better estimate of maximum milk producing potential, but it overestimates the amount of milk to be consumed by the calf, especially early in lactation.

The difference between estimates of milk yield obtained using weigh-suckle-weigh or machine milking demonstrates an important biological limit to milk production of beef cows. Milk producing potential (measured by machine milking) decreases until the calf is capable of consuming all the milk produced by the dam (peak estimate by weigh-suckle-weigh). It follows that the maximum milk production of the cow is controlled by the intake of the calf early in lactation and that few beef cows produce milk to their maximum genetic potential. If this hypothesis is true, it represents a limit to the potential of genetic selection for changing milk production and should influence our ideas about calf growth and early calf management.

Reported estimates of the amount of milk required to produce a pound of calf gain vary from 5 to 30 lbs (Melton et al., 1967; Boggs et al., 1980). The amount of gain per pound of milk will vary based on environmental factors and growth potential of the calves, however, most common estimates have been that between 12 and 20 lbs of milk are produced per pound of calf gain (Beal et al., 1990; Drewry et al., 1959; McMorris and Wilton, 1986; Freking and Marshall, 1992).

## MILK EPDs AND SELECTION FOR MILK PRODUCTION

Five years ago there was a need to test the validity of EPDs by performing experiments that compared actual performance and the performance predicted by breeding values (EPDs). The scientific value of such research was real, but the greatest value of such research was to bolster the confidence of the users in EPDs. Today, much of the "show me" research has been done, however, enough time has passed for evidence of the use of EPDs to be apparent in the genetic trends of each breed. The genetic trend data of the Angus breed (Figure 2) are testimony to the effect of breeders using growth EPD information (yearling and weaning weight) since 1974 (arrow, Figure 2) and having the EPDs for weaning direct and weaning maternal separated for use in 1985 (arrow, Figure 2). In both cases the rate of genetic change (slope of the line) for a trait was increased following introduction of the EPD for that trait. There is no more profound testimony to the effectiveness of EPDs than genetic trend data which is based on hundreds of thousands of performance records.

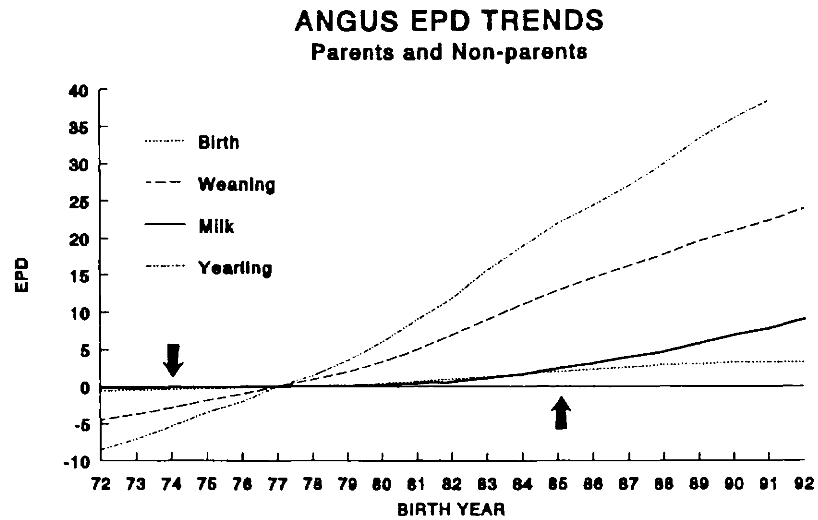


Figure 2. Changes in the average growth and maternal expected progeny differences (EPDs) in Angus cattle.

Skepticism over milk EPDs may be greater than that for other breeding values because the milk EPD bears such an indirect relationship to actual milk production. For example, an actual amount of milk per se is never measured to calculate a milk EPD. Furthermore, bulls have milk EPDs, but they predict how the milk production of that bull's daughter will affect the weaning weight of the daughter's calves. Hence, there is great interest in whether the milk EPD values actually correlate with milk production of the cows. Research at Virginia Tech and Kansas State has been conducted to assess the relationship between milk production and milk EPDs in Polled Hereford, Angus and Simmental cattle (Diaz et al., 1992; Marston et al., 1992). In both experiments the correlation between milk EPDs and milk collected by machine milking was low to moderate (Table 2).

**Table 2. Relationship Between Milk EPD and Milk Collected by Machine Milking**

| Reference | No. Animals | Correlation of milk EPD and actual milk |
|---|---|---|
| Diaz et al. (1992) | 116 | .26 |
| Marston et al. (1992) | 114 | .32 |
| | 82 | .44 |
| Beal (unpublished) | 87 | .19 |

The low correlation between milk production and milk EPDs may seem disappointing initially, however, it is easily explained and to be expected. The relationship between milk EPD and milk collected by machine milking can not be higher than the product of the following three factors: 1) the relationship between milk EPD and the genes for milk; 2) the relationship between genes for milk and the actual milk produced and 3) the repeatability of the machine milking procedure (Figure 3). Based on this concept, a cow with a milk EPD accuracy of .25 would have a relationship between the milk EPD and actual genes for milk of approximately .6. If the heritability of milk production is .25, the relationship between genes for milk and milk produced is $\sqrt{.25}$ or .5. The machine milking repeatability is .7, therefore, the relationship between actual milk produced and the milk EPD is expected to be .21. The data collected by researchers yielded relationships that were close to the predicted value. Agreement between the theoretical and recorded correlations is further evidence that the milk EPD is a valid selection tool. The low magnitude of the correlation between milk EPDs and actual milk reemphasizes that the heritability for milk production is lower than that for the growth traits and that many factors other than genetics affect milk production.

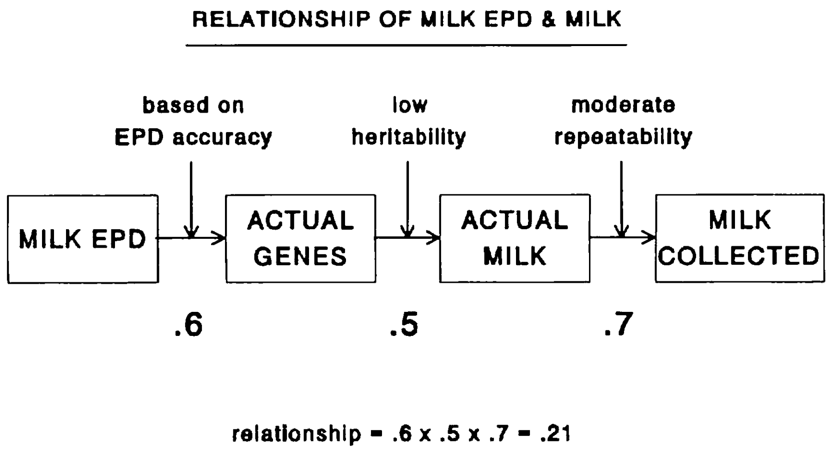


Figure 3. Theoretical relationship between expected progeny difference for weaning weight maternal (milk EPD) and milk collected by machine milking.

Perhaps the most straight forward demonstration of the effects of selection based on milk EPDs is the comparison of the milk production or weaning weights of groups of calves from cows with different milk EPDs. We milked 93 Angus cows at an average of 119 days in lactation with milk EPDs that ranged from -.4 to +23.4 lbs. We found that the cows with high milk EPDs, >+10 lbs, gave more milk per day (22.6 lbs) than cows with milk EPDs between +5 and +10 lbs (21.6 lbs) or cows with milk EPDs of <+5 lbs (20.8 lbs). The difference in milk of 1.8 lbs/day between the high- and low-EPD group seems small, however, if that difference is assumed to persist across the entire 205-day lactation, a calf nursing the high-EPD cow would have access to 369 lbs more milk than the calf nursing the average low-EPD cow. At an expected conversion ratio of 15 lbs milk to 1 lb of calf gain derived from other experiments, the extra milk was expected to produce an additional 24.6 lbs of calf weaning weight in the high-EPD group. In our experiment the actual difference was 27 lbs (548 vs. 521 lbs).

Experiments designed to "prove" that milk EPDs are valid have corroborated evidence provided by the genetic trend in milk EPD. Together they point out the potential for changing the level of milk production if cattle are selected based on milk EPDs. The decision to base selection on milk EPDs and the direction of genetic selection for milk production is a separate issue. That decision must be based on the economic value of the change in weaning weight that comes from changing the level of milk production and careful consideration of the beneficial or antagonistic correlated responses that may accompany a change in milk production.

## GENETIC ANTAGONISMS

Use of genetic selection to change milk production in beef cows may be linked to antagonistic changes in other traits. The most disturbing of these antagonisms are: 1) the reported relationships between increasing the level of milk production and decreasing reproductive efficiency; and 2) the reported increase in energy required to maintain body weight in high-milk type cows. Understanding and confronting these two issues is a must before a decision is made to make selection decisions based on milk EPDs.

The idea that high milk production is accompanied by lower reproductive efficiency, namely longer intervals from calving to estrus and lower fertility, are fostered by reports of high-producing dairy cows that have serious problems rebreeding. New York DHIA records indicated that the AI conception rate in dairy cows decreased as the production level of the cows increased. Cows with the highest 305-day lactation milk yields (> 16,000 lbs) had the lowest conception rate, 40%. Cows that produced less than 12,000 lbs of milk had the highest conception rate, 60% (Butler and Smith, 1989). Extrapolating these relationships to beef cows is dangerous, however.

The high-producing dairy cow produces between 75 and 100 lbs of milk per day at peak lactation (4 to 6 wk postcalving). This occurs at the time that she is expected to return to estrus and rebreed. This level of milk output raises the nutrient requirement of the cow above the limit of her ability to consume adequate feed to maintain both her bodyweight and milk production. The result is a negative energy balance, during which the cow mobilizes her body reserves for maintenance and looses weight. Cows loosing weight have significantly lower conception rates than cows that are gaining weight prior to breeding. Hence, the high-producing dairy cow suffers lower reproductive efficiency.

Beef cows produce much less milk than even the average cow in a dairy herd. The peak milk production for cows of most breeds of beef cattle is less than 25 lbs/day. Hence, the nutrient requirements of beef cows do not exceed their limit for feed intake. Therefore, beef cows are not unavoidably prone to experience a negative energy balance and lower reproductive efficiency like that of high-producing dairy cows. Body condition and weight gain before and after calving is important for achieving early rebreeding in beef cows (Richards et al., 1986; Corah et al., 1991), however, the lower level of milk production among beef cows makes it possible to meet their nutrient needs for both maintenance and milk production. Conversely, if lactating beef cows are poorly managed and undernourished they will experience longer periods from calving to rebreeding and lower fertility similar to that observed for high-producing dairy cows.

The antagonism between milk production and reproductive efficiency appears to be mediated by energy balance. Although achieving weight gain or adequate body condition is easier in beef cows than in dairy cows, the potential remains for the nutrient requirements of higher milking beef cows to exceed the feed availability in certain environments. The decision to increase milk production by using higher-milking breeds or by selecting for higher milk EPDs within a breed should be made with consideration of the "worst case scenario" for feed availability in a given environment. If adequate feed is consistently available, however, then an increase in milk production should not be expected to decrease reproductive efficiency.

Another antagonism that has been reported in conjunction with milk production is an increased maintenance requirement for cows that are of a high-milk type. Montano-Bermudez et al. (1990) utilized crossbreeding to produce cows of similar body size, but with either low (Hereford x Angus) or high (Milking Shorthorn x Angus) milking ability. Cows of the high-milk type produced more milk, however, the energy required to maintain bodyweight was higher for the high-milk type cows, both during lactation and during the dry period (Table 3). The increased energy required to maintain the bodyweight of high-milk type cows caused them to be less efficient in producing pounds of calf at weaning than the low-milk type, despite 40-lbs heavier weaning weights of calves nursing high-milk type dams.

**Table 3. Maintenance Requirements of High- and Low-Milk Type Beef Cows**

| | | Low Milk | High Milk |
|---|---|---|---|
| Milk production (lbs/d) | | 18.8 | 23.2 |
| Adjusted body weight (lbs) | | 1140 | 1102 |
| Maintenance requirement (kcal ME/kg$^{.75}$/d) | during lactation | 130.5 | 143.5 |
| | dry period | 108.5 | 118.5 |

The lower efficiency of high-milk type cows was recorded in other across-breed studies (Green et al., 1991; Jenkins and Ferrell, 1992) and a large proportion of the extra energy expended by the more productive animals has been attributed to energy utilization by a greater mass of visceral organs (Ferrell and Jenkins, 1985). When this added maintenance requirement was factored into computer simulation models designed to compare cow-calf systems employing either high- or low-milk type cows, the low-milk type was consistently predicted to be more biologically and economically efficient (Stokes et al., 1986; Bourdon and Brinks, 1987).

The antagonistic relationship between higher milk production and a greater maintenance requirement that has been demonstrated using different breeds is exactly the opposite of the results of an experiment done within-breed by Freking and Marshall (1992). They reported that increasing milk yield among Hereford cows was not associated with a greater maintenance requirement and that increasing milk yield improved both biological and economic efficiency. The difference between this and other studies that indicate higher-producing cows are less efficient may be due to differences in the level of milk production and the breed effects. Freking and Marshall (1992) utilized first-calf Hereford dams and evaluated differences in the effects of level of milk production within one breed. Those first-calf heifers produced an average of only 13 lbs of milk per day. Other researchers created greater differences in milking levels by using crossbreeding and employed high-milk type cows that produced more than 20 lbs of milk per day.

The biological and economic impact of the increased maintenance requirement for higher producing cows may depend on the level of milk production and whether differences in milk production are those within a breed or as large as those which can be created by crossbreeding. Recent recommendations questioned both the use of high-milk-level dams in commercial cow herds and the selection for higher milking ability within a beef breed with an adequate milk level (van Oijen et al., 1993). The data support the recommendation against using crossbreeding systems that include one or more breeds with very high milk producing potential as the base for a commercial cow herd. Recommendations to limit selection for milk production within a breed, particularly among breeds with moderate levels of milk, are questionable, however, the relationship between differences in milk level and efficiency within a breed need to be more clearly defined before such a recommendation is applied.

## IMPLICATIONS

Milk production of the dams is the most important factor in determining differences in preweaning calf gain in a herd. Milk EPDs and crossbreeding are proven tools for achieving a genetic change in milk production. The decision of purebred breeders or commercial cattlemen to increase the level of milk production, however, depends on the economic value of increasing weaning weight by increasing milk production of the cow herd. Genetic antagonisms between milk production and either reproductive efficiency or maintenance requirements may make selection for increased milk production unadvisable. Therefore, careful consideration of the feed resources available to support an increase in milk production and the biological efficiency of cows with a higher milk production level must be considered before a decision to increase milk production through selection or crossbreeding can be justified.

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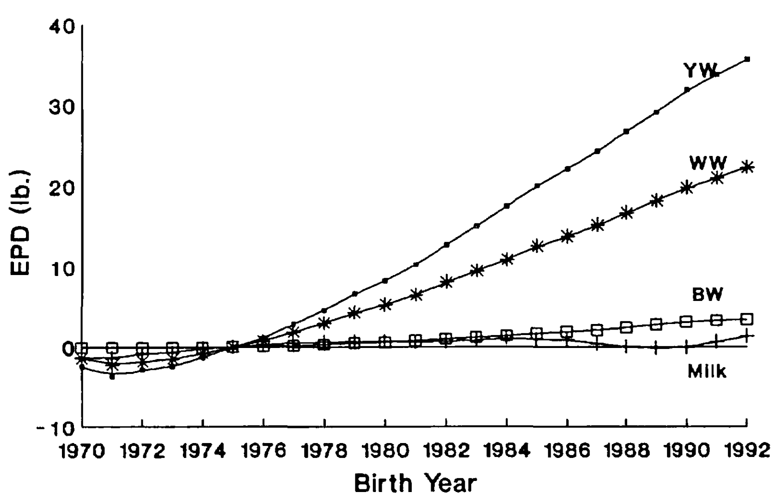
# 25 YEARS OF GROWTH
# BEEF IMPROVEMENT FEDERATION'S 25TH ANNIVERSARY

Don Boggs, Extension Beef Specialist
South Dakota State University

"Twenty-five Years of Growth" quickly characterizes both the BIF organization on its 25th Anniversary and the selection results of many of its members. Just as the leaders of BIF have worked hard to see the organization grow and prosper, so have beef producers worked to increase the performance of their cattle. Producers have utilized various tools, such as on-farm performance testing, central test stations, AI and embryo transfer to enhance the growth performance of their herds. Several new breeds which excel in growth rate have been introduced into the U.S. beef population. And, the development of National Cattle Evaluation programs and their resulting EPD's and sire summaries have greatly improved our ability to accurately identify high growth rate cattle. These tools have further accelerated the efforts to produce high performance cattle. The genetic trends for the Polled Hereford breed shown in Figure 1 typify the genetic trends for most any breed during the past 20-25 years; rapid increases in weaning and yearling weight EPD's, moderate to high increases in birth weight EPD's and no change to slight decreases in milk EPD's.

Figure 1. Genetic Trend of EPD's by Birth Year for Polled Herefords




Unfortunately, these increases in growth have been accompanied by unfavorable changes in some related traits. Hough (1992) did an excellent job of describing these correlated responses to selection for growth which include increased birth weight, decreased calving ease, reduced milk production and bigger cows to maintain. One must realize that increased outputs, whether they be due to increased growth or increased milk production, do not ensure increased biological or economic efficiency. Therefore, it is important to understand how selection for increased growth and the potential for increased frame and mature size can impact your management program.

## Relationship of Traits With Mature Weight

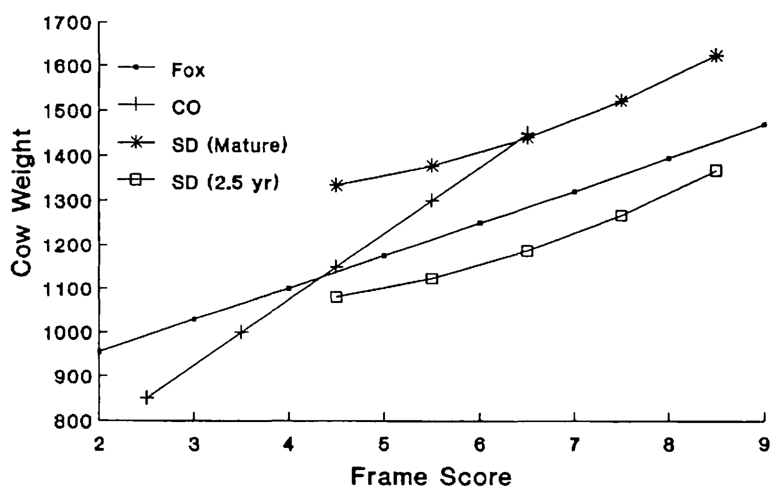
Maintenance costs, which are a function of mature weight, typically account for 50-60% of the total costs in a cow calf operation. Therefore, selection decisions which increase mature size have a significant impact on feed requirements. Table 1 shows the genetic correlations of various traits with mature weight. Birth, weaning and yearling weights are all highly correlated with mature weight. Yearling and mature hip heights are also highly correlated with mature weight. Therefore, as

Table 1. Genetic Correlations of Birth, Weaning and Yearling Weight and Yearling and Mature Height with Mature Weight

| | BW | WW | YW | YH | MH |
|---|---|---|---|---|---|
| Bullock (1993) | .64 | .80 | .76 | .89 | |
| Northcutt (1993) | | | | | .78 |
| Smith (1976) | .55 | .60 | .80 | | |
| Brinks (1964) | .61 | .40 | .41 | | |

you select for increases in any of these correlated traits, you are likely to get increases in mature cow weight and maintenance. The degree to which mature weight increases appears to be variable and dependent upon the ranch's environment. Figure 2 shows the relationship of mature weight with frame score from three different locations, as well as one relationship of frame score to weight at first weaning (2.5 years). The discrepancies in these numbers simply indicate that each producer needs to assess the current mature weight average for their herd and evaluate the range in cow weight created by size or frame variation.

Figure 2. Frame Score to Cow Weight Relationships



## Effects of Mature Weight on Nutritional Requirements and Stocking Rates

Let's now look at how mature weight changes affect the energy requirement (pounds of total digestible nutrients (TDN) per day) of the cow. Table 2 shows the relationship of frame score (FS) and hip height to mature cow weight and to TDN requirements postweaning and at two different levels of milk production during peak lactation. Increasing cow size from FS 3 to a FS 5 results in an additional 145 lb of cow weight to maintain. This additional size requires an 11% increase in TDN during gestation and a 7 to 8% increase during lactation. If the feed is available, the larger intake capacity of the bigger cow will generally allow her to consume enough feed to meet these higher requirements. However, these additional feed costs have to be made up through additional calf growth or increased selling price per pound.

Table 2. Relationship of Frame Score and Hip Height to Mature Cow Weight and Energy Requirements Following Weaning and During Peak Lactation[a]

| | | | TDN, lb per day | | |
|---|---|---|---|---|---|
| | | | | Lactation | |
| Frame Score | Cow Hip Height, in. | Mature Cow Weight | Postweaning | 12 lb Per Day | 18 lb Per Day |
| 1 | 44 | 880 | 7.4 | 11.6 | 13.2 |
| 2 | 46 | 955 | 7.9 | 12.0 | 13.7 |
| 3 | 48 | 1030 | 8.3 | 12.6 | 14.2 |
| 4 | 50 | 1100 | 8.7 | 13.1 | 14.7 |
| 5 | 52 | 1175 | 9.2 | 13.6 | 15.2 |
| 6 | 54 | 1250 | 9.6 | 14.1 | 15.7 |
| 7 | 56 | 1320 | 10.1 | 14.6 | 16.1 |
| 8 | 58 | 1395 | 10.5 | 15.0 | 16.6 |
| 9 | 60 | 1470 | 10.9 | 15.5 | 17.0 |

[a]Adapted from Fox et al., 1988

Heavier milking cows also require more feed. As shown in Table 2, increasing peak milk production from 12 lb per day to 18 lb per day requires approximately 1 1/2 lb more TDN per day. This translates into a 10 to 14% increase in energy requirement, depending on the cow's size. The 1984 NRC indicates that increasing the peak milk production potential of an 1100-lb cow from 10 lb per day (average) to 20 lb per day (superior) will raise her daily requirement for energy by 25%, protein by 30%, phosphorus by 25% and calcium by 40%. Whereas increases in requirements due to size are partially offset by increases in intake, increased requirements due to increases in milk production are not usually offset by increased intake. While simply increasing intake will generally meet the needs of bigger cows, increasing both intake and diet quality (i.e., higher percentage TDN), whether in the form of grain or higher quality forage, may be needed to meet the higher nutritional demands (Table 3) due to increased milk.

Table 3. Impact of Cow Size and Milk Production Level on Feed Intake (DMI) and Feed Quality (%TDN)[a]

| | Average Milk | | High Milk | |
|---|---|---|---|---|
| Cow Weight | DMI | % TDN | DMI | % TDN |
| 1000 | 20.2 | 57 | 20.6 | 67 |
| 1200 | 23.0 | 56 | 23.8 | 64 |
| 1400 | 25.6 | 55 | 26.7 | 62 |

[a]NRC, 1984

These increases in output also affect pasture stocking rates. Table 4 shows the projected herd sizes for cows of various mature weights and peak milk production compared to 100 head of 1030 lb cows with 18 lb peak milk production. As cow size or milk production increase, the herd size supported by the same feed resource decreases. If reproductive performance is constant, the bigger and heavier milking cows will have to individually wean heavier calves to produce the same total pounds of beef from the feed resource. It should be noted that when calf weight is expressed as a percentage of cow weight, the similar levels of herd production result in quite differing percentages. This "estimate of efficiency" is biased in favor of smaller cows and should be used cautiously, if at all. Total outputs minus total inputs is probably the best way to decide which type cows work best on your operation.

Table 4. Impact of Cow Size and Milk on Herd Size and Production[a]

| Cow Weight | Peak Milk | Herd Size | Calf Wt.[b] | % of Cow Wt[b] |
|---|---|---|---|---|
| 1030 | 18 | 100 | 510 | 49.5 |
| 1170 | 18 | 92 | 553 | 47.3 |
| 1320 | 18 | 86 | 596 | 45.2 |
| | | | | |
| 1170 | 24 | 84 | 605 | 51.7 |
| 1320 | 24 | 79 | 646 | 48.9 |

[a]Adapted from Fox, 1988

[b]Needed to equal production from 100 cow herd of 1030 lb cows weaning 510 lb calves. Assumes 90% calf crop for all weights and levels of milk.

## Impact of Mature Weight on Reproduction

Mature size can impact reproduction in a couple of ways. Weight at puberty is a function of mature size. As mature size potential increases, the weight needed for a heifer to begin cycling also increases. For example, if a FS 3 heifer reached puberty at 575 lb, a FS 6 heifer may need to weigh 750 lb before she starts cycling. Thus, if the selection program creates an increase in mature size potential, the replacement heifer development program will have to be adjusted accordingly to get the heifers to their heavier target weights. Perhaps more importantly, larger framed cattle are generally later maturing cattle. This means that they reach stages of physiological development, such as puberty or maturity, at older ages. Therefore, it becomes difficult for extremely large framed cattle to reach puberty in time to be bred at 13 to 15 months of age in order to calve at 22 to 24 months.

This is not to say increases in growth cannot be accomplished without increasing age at puberty. However, to improve both of these traits at once will require a strict heifer culling program and a strong selection emphasis on earlier maturing breeds and increased scrotal circumference when selecting sires.

When feed resources are restricted, the larger framed cattle are more susceptible to decreases in reproductive performance. The results of an Iowa study (Buttran and Willham, 1987) demonstrate the interaction that occurs between frame size and management conditions (Table 5). Under favorable management conditions, there were no significant differences among small, medium and large framed first calf heifers in the percentage cycling during a 42-day breeding season or in the percentage calving the following year. However, when management conditions were marginal, the large framed heifers reacted more adversely. Even though reproductive performance of both groups was depressed, the small framed heifers had both a higher percentage cycling and a higher percentage calving than the large framed heifers.

Table 5. Effects of Size and Management on Reproductive Traits of First Calf Heifers[a]

| | Favorable Management | | | Marginal Management | | |
|---|---|---|---|---|---|---|
| Trait | Small | Medium | Large | Small | Medium | Large |
| Cycling rate, % | 98.5 | 98.3 | 97.9 | 83.8 | 81.5 | 63.1 |
| Calving rate, % | 84.9 | 84.5 | 81.6 | 73.8 | 67.5 | 53.0 |

[a]Adapted from Buttran and Willham, 1987

Producers must realize that larger, higher output cattle are also higher risk cattle. Thus fleshing ability, (the ability to store energy on the body) becomes a very important trait. Big, heavy milking cows that don't have adequate body energy reserves become very susceptible to periods of stress or feed energy deficiencies.

## Impact of Frame Size on Market Potential

Frame scores are useful in determining the appropriate market weight. Table 6 lists the approximate live and carcass weights at which steers and heifers of varying frame scores will reach a market endpoint of Low Choice (approximately 30% carcass fat). It is obvious that both live and carcass weights increase dramatically as frame scores increase. It is also important to realize that heavy muscled steers and heifers will likely weigh more than is predicted in Table 6 for a given frame size.

Table 6. Relationship of Frame Size to Live Weight and Carcass and Weight at Choice Grade (30% Carcass Fat)

| | Approximate Weight at Choice Grade, lb | | | |
|---|---|---|---|---|
| | Steers | | Heifers | |
| Frame Score | Live | Carcass[a] | Live | Carcass[a] |
| 1 | 750 | 472 | 600 | 378 |
| 2 | 850 | 536 | 700 | 441 |
| 3 | 950 | 598 | 800 | 504 |
| 4 | 1050 | 662 | 900 | 567 |
| 5 | 1150 | 724 | 1000 | 630 |
| 6 | 1250 | 788 | 1100 | 693 |
| 7 | 1350 | 850 | 1200 | 756 |
| 8 | 1450 | 914 | 1300 | 819 |
| 9 | 1550 | 976 | 1400 | 882 |

[a]Assuming a dressing percent of 63% (hot carcass basis).

If the acceptable carcass weight range is 550 to 850 lb, we need to produce feeder cattle (steers and heifers) in the 4 to 7 frame score range. For a herd of small framed cows (frame scores 2 and 3), bulls with frame scores of 6 to 8 would be needed to generate the desired frame score in the offspring. However, calving difficulty could definitely be a problem in this instance of using larger mature size bulls on the small cows. For moderate framed (4 to 5 frame) cows, bulls in the 4 to 7 frame score range would be desirable. For large framed cows (6 to 7 frame score), bulls of the same frame score or smaller would be needed to produce the specified feeder cattle. If packer pressure narrows the acceptable carcass weight range, the acceptable range in frame scores for feeder cattle will also narrow and breeding programs will need to be adjusted accordingly.

## Bending the Growth Curve?

It has been suggested that an ideal situation could be created if we could "bend the growth curve" to allow for low birth weights, with rapid growth to a year of age, followed by rapid maturing preventing high mature weights. This would allow us to take advantage of high gains during the preweaning and feedlot stages while avoiding associated problems such as increased calving difficulty due to high birth weights and increased maintenance requirements due to heavier mature weights. Several methods have been suggested for making this change in growth patterns.

One is to select for increased weight within a maximum frame size for your herd. The strong correlations between weight and height may limit progress with this method. The American Hereford Association (Ludwig, 1983) reported genetic correlations between weaning weight and weaning height of .68 and between yearling weight and yearling height of .70. In these cattle, the relationship tended to be strongest in the smaller frame scores with a poorer weight to height relationship when height exceeded frame score 5.

A more direct method would be to include both yearling weight and mature weight in a selection index. Here again you are selecting against a strong positive correlation of traits, but there appear to be bulls in most breeds that will sire high growth with low to moderate mature weights. Unfortunately, few breeds provide mature weight EPD's; and even when they are available, the increased time needed to collect mature weight records on a bull's daughters proves quite disadvantageous to most producers.

Birth weights on the other hand are collected early and are also highly correlated with mature weights. Thus, selecting for low birth weights and high growth might be an effective means of "bending the growth curve". The EPD means for Angus sires (YW EPD 45 to 65) with mature weight EPD's listed in the Spring 1993 Sire Summary are shown in Table 7 grouped according to birth weight EPD. When yearling weight EPD was held between 45 and 65, the bulls with birth EPD's of 2.0 or less had mature weight and height EPD means of -1.8 and .6, respectively. In contrast, bulls in the 45 to 65 yearling EPD range with birth EPD's of 5.0 or higher had mature weight and height EPD means of 16.3 and 1.2, respectively. Thus, it appears that there is some opportunity to bend the growth curve and control mature weight by selecting concurrently for low birth weights and moderate to high growth rate.

Table 7. EPD means for yearling and mature weight and mature height for Angus sires grouped by birth EPD[a] with yearling EPD between 45 and 65 pounds.

| | --------EPD Means-------- | | | |
|---|---|---|---|---|
| BW EPD Range | BW | YW | MW | MH |
| ≤ 2 (10) | .3 | 49 | -1.8 | .6 |
| 2 - 5 (22) | 3.8 | 52 | 9.6 | .8 |
| ≥ 5 (35) | 6.7 | 52 | 16.3 | 1.2 |

[a]Bulls with yearling EPD's of 45 to 65 listed in mature weight section of 1993 Angus Spring Sire Summary.

## Matching Type to Resources

There is no one right type or kind for all situations. Under different production environments, the different cattle types will re-rank themselves in terms of production efficiency and profitability. Therefore, each producer must evaluate the type of cattle that adapts and performs most economically in their own production system. To do this, some system of evaluating inputs into the operation as well as outputs must be established.

Selection for extremes, whether it be extreme frame, extreme weight, extreme muscling or extreme milk production, is fairly easy, and rapid progress in the selected traits can be made. Remember however, that nature selects against extremes and, unless rapid change is needed, extremes in type really aren't needed, either. Single trait selection has allowed for rapid increases in growth rate; however a multiple trait selection system will be needed to get growth without the correlated selection responses.

Many factors must be considered in a multiple trait selection program designed to produce cattle that perform efficiently within their given resources and environment. It has often been said that we should "match the cow to the environment and the bull to the marketplace" to truly capture economic efficiency while meeting the needs of the consumer. For commercial cattle producers, this is best accomplished through a planned crossbreeding that properly utilizes the variety of genetics that are available to the beef industry. For seedstock producers, it is imperative to establish the role that you want your herd and breed to play in the commercial cattle production scheme. Once that role is firmly established, you must then design your breeding programs to produce cattle that meet the goals, objectives and resources of both you and your customers!

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**COMPETITIVE TOOLS IN TODAY'S PORK INDUSTRY**

Randy Stoecker

When asked to address this group I was flattered but wasn't sure about it until they agreed I could talk about pigs. Although I now live in North Carolina, I grew up on a cattle and wheat farm in Western Kansas and must say, made more money on my cattle than my pigs during my FFA years.

There is a rapid rate of change now underway in the U. S. pork industry. I will try to touch on genetics, production, research, feed manufacturing, health management, structure, environment, people and the product

The first geographical shifts in production was in Sampson County, North Carolina, which is now my home. Little chance many people would have predicted this just ten years ago. North Carolina has shifted from 7th to 6th and probably soon to be 4th in the nation.

Our office, though very nice, is typical of several family corporations in the hog business. An appropriate environment for the professional people we now employ.

GENETICS

Let's start by looking at genetics, in particular the importation of breeds with tremendous maternal and paternal characteristics.

In China their sow is carried to a boar or bred A.I. The Chinese breeds are very prolific but weak in carcass traits by our standards yet when mated to a white European Boar the result is an ugly but very prolific sow and when she is mated to an extreme muscular boar the result can be very acceptable carcasses. We are just now beginning to exploit the very extreme lines for their breed differences and the heterosis potential in crossing them. The traditional Hampshire, York, and Duroc look very much the same when compared to these lines.

Genetically improved pigs now may make up 20 to 25% of the U.S. industry and are rapidly growing in market share. Sow productivity leads the way with gains coming often from imported European white lines. Within and between line selection with now very high levels of accuracy in large closed population has developed confidence in the potential contribution of population genetics.

- Within line selection
- Between line selection
- Accuracy
- Selection for lean gain, lean conversion and carcass traits

- Selection for reproductive performance
- A.I., BLUP, large nucleus structure

Currently A.I. and Blup in these large (1 - 2000 sows) genetic nucleus herds are focused on reproductive performance and lean gain efficiency

- Lean growth, FCR
- Litter size
- Appetite
- Secondary traits
  - meat quality
  - teats, defects
  - leg quality

AND LARGE POPULATIONS

- Feed intake recording equipment - "FIRE" system
- Scanners
- Effect of large populations

The "FIRE" system along with scanners and large population monitor growth and carcass traits in the live animal.

- Feed intake curves
- Weight/growth curves
- Lean/fat ratio

This new system allows individual testing, including feed intake and growth response curves while housed in a group.

The real time ultra sound now improves the accuracy of loin muscle evaluation on live animals.

Some pigs are now gaining over 3 lbs/day throughout the growth period, i.e., 210 lbs of gain in 70 days or a slaughter age of 125 days. Current industry averages 200 to 210 days.

As some of you may know, I spent 9 years as general manager of P.I.C. and asked them for some information for this presentation.

Genetic improvement is additive if in a consistent program and here you can see an estimate of $10.00/head change in 6 years. It will take this kind of response to keep pace with poultry.

We are very excited about this new technology.

- Marker Assisted Selection
- Transgenesis
- Reproductive Technology

The marker assisted selection through a DNA probe for the stress gene is a good example.

- Use DNA for selection to complement the trait
- HAL-1843 test uses DNA
  - stress susceptibility is the trait
- More markers to be developed
  - reproduction
  - meat quality
  - disease resistance
  - color
  - etc.

Genetic bar coding pigs may not be too far away.

Transgenesis, although farther away, the insertion of new genes offer exciting possibilities if the problems can be worked out.

- Insert gene constructs
  - new (better?) balance
- Successful
- Not very efficient yet
- Slow progress

Several problems do exist.

- Regulatory
- Available genes
- Control of genes

$\cdot h^2$ / high: selection techniques
\ low: major gene?

KEEP IN TOUCH WITH RESEARCH

**Ethical Questions & Welfare Issues**

- Transgenics
- Reproduction technology
- High performance
- Economic pressure globally
- Local public opinion
- Conflict
- Dialogue

Some of these will be resolved in an emotional/political verses technical manner.

**Reproductive Technology**

- A.I., fresh/frozen
- Sexing of semen
- In vitro fertilization
- Non-surgical ET
- Cloning

Several techniques brought together could give a tremendous boost to the exploitation of genetic merit. We currently use only 2 boars as grandsires in a production pyramid of 400,000 slaughter pigs annually.

**Present & Future Performance**

The combination of normal population genetics, transgenics and enhanced reproductive technology offer prospects for large gains in performance traits in the next 20 years.

Pork production per sow is now improving and offer big improvement in the very near future.

- Maximum production/sow
  25 x 260 - 6500 lbs./yr

  Whole herd conversion
  (Hi or Low Density)
  2.7 to 2.85

  Wean to slaughter mortality....3%

- Annual output/sow farm manager
  75 to 100,000 pigs/yr

**Pressure Promotes Change - Iowa Top Third vs Bottom Third**

- $10 per cwt difference in costs
- $30 per head difference in boneless primal yield

These two factors are causing change fast.

**Best Pork Operations Are Equal to the Turkey Industry**

Whole herd feed efficiency both well under 3.0

CAPITAL/RISK/PEOPLE

**Contracting / Risk Sharing**

- Capital flow
- New investment
- Better environmental control

This tool is changing capital flow into our very capital intensive business, making new investments which offer better environment control and narrow ranges in results.

**Contractors Add to Industry's Growth**

Recently contractors have an increased rate of growth verses independent producers. Contractors have increased to 20% of the U.S. production from 9% in 1986. Contractors are being developed throughout the U.S.

**Ag Graduates**

Management people may well become the most limiting resource; however, the modern pork production segment is having improved success in attracting young people. Keeping them happy is a key.

## IN HOUSE RESEARCH

In house research has become more important to many serious producers.

Computer controlled scales weigh feed accurately and records for downloading into PC based data summaries.

In house scientists also are becoming more common.

**New Development Opportunities**

- Aerosol vaccine
- Chemical castration
- Genetically engineered masking of receptor sites
- Automated time released immune enhancers
- Pre-slaughter specialty ingredients for meat treatment/taste
- Precise ovulation prediction
- Immunological control of endocrine system, i.e., vaccination for endocrine growth mediators
- Products to increase embryonic survival
- Gastric motility control
- Simple semen sexing

This wish list of new developments are typical of the developments we lobby research departments and companies for support, because we are confident each could add a profitable bit to our business.

## BREEDING STOCK & COMMERCIAL PRODUCTION

**Three Site Production**

- 3,400 sow units
- Contract off site nursery
- Contract third site finishing

Three site production is a new development coupled with our new 3400 sow units, contract off site nurseries and third site finishers has dramatically changed our ability to grow and the quality and health of our production.

A.I. is now widely used to speed the exploitation of genetic change. This machine automatically dilutes and packages high volumes of semen reducing labor costs dramatically.

**Murphy Farms' First Outdoor Farm**

Murphy Farms started growing purchased pigs on the ground in North Carolina. The first sow farm was built in 1979 and the 3400 sow, 3 week old pig unit is now our standard commercial unit. It also has grandparents on site and grows its own replacement gilts. This concept has enabled us to grow rapidly.

INFORMATION SYSTEMS

Agrimetrics is a confidential cost and return analysis on an apples to apples basis started in poultry and now used by many serious pork producers.

Pigtales and PigCHAMP are biological event driven systems designed to report and offer diagnosis information for problem solving.

The new Proctor crate has a hydraulic arm which slows the opening of the crate as the sow lays down enabling most pigs to get out of the way.

We have off site nurseries which hold 2600 pigs for 6 weeks enabling us to fill a finisher of barrows and one of gilts all of the same health status and usually with a range of 3-4 days of age. This makes age sensitive treatment or stimulation much more effective.

**Characteristics of Modern Swine Production**

- Specialized: True regardless of unit size; trend toward less diversity in all phases of agriculture in order to improve competitive position (Experts).

Most serious producers are specializing either away from crops or focusing on just a part, i.e., farrowing or nursery, etc.

The temperature chart shows both very low outside temperatures (20 - 25 F) and optimum inside temperatures at 60± F.

NUTRITION/FEED MANUFACTURING

**Feed Intake**

Food intake, growth and feed conversions are all closely related to environmental temperature. If Iowa and the Midwest are to compete, pigs will be housed indoors.

**Refinements in Diets**

- Sex
- Environmental temperature
- Weeks of age
- Target carcass market

.. all of these factors are now common in developing diets for each sex, often 7 or 8 diets throughout the nursery to finishing stages.

**Specialized Mills**

- for scheduled swine food production only

Specialized automated computerized mills which are high volume, low cost now produce food rather than feed. A key element as we work to enhance food safety.

**Target Diet Specification to Achieve Genetic Potential for Lean Deposition with Minimum Backfat**

There are significant differences in calories, lysine, intake, growth and feed conversion of barrows and gilts which are no longer considered the same animal.

**Midwestern Grain Farmer**

Midwestern grain farmers now extract valuable sustainable nutrients from much of the confinement waste produced.

**Warmer Climates**

Warmer climates with different soils often grow lush grass which is either hayed or control grazed.

**Murphy Farms' Production Cycle**

At Murphy Farms we normally recycle waste. We produce cattle, row crops and pigs off the same farm.

**Outdoor Farm/Pigs**

New ideas are always being tried. The modern outdoor sow concept has been under test for a couple of years. It offers lower capital cost, very welfare friendly conditions with natural waste distribution, yet hot summers and best soil conditions are issues unresolved.

**Created Wetlands**

Created wetlands designed to polish lagoon water is another new idea being tested.

**Health Management vs Reaction**

- Gene deleted vaccines

- Immune system management

Both gene deleted vaccines for better test and removal programs as well as immune system management are exciting areas which are changing the way commercial producers look at and manage health issues.

**Modified Medicated Early Weaning**

1. Isolated farrowing, nursery, grower
2. Wean at 5 days
3. Medicate from birth until 10 days of age

Inexpensive health clean up is now possible with MEW.

STRUCTURE

**The Number of Hog Farms in U.S. is Declining**

| Census | Number of Farms |
|---|---|
| 1900 | 4,355,563 |
| 1920 | 4,850,807 |
| 1940 | 3,766,675 |
| 1950 | 3,011,807 |
| 1959 | 1,846,980 |
| 1969 | 532,204 |
| 1978 | 445,117 |
| 1987 | 332,760 |

With the wide range of costs and profits, our industry is predictably concentrating into fewer farms who do it very well. Current estimates are at 220,000 producers.

**Average Annual Returns in Hog Production, Iowa**

Annual returns for hog producers in the 80-91 period were weak compared to the previous decade. Walking corn to market is seldom the goal today.

**Broiler Performance**

It's always worth studying history and the competition, in this case, the broiler industry. They have become very efficient in the last 40 years doubling bird weight, in half the time, with less than 2 pounds of feed per pound of gain.

**Average Annual Returns in Broiler Production**

And after the shake out of the early 80's (77-83) they have had 10 years of continuous profit, often at your and our expense in market share. We look at this and see a hugh war chest to fight for consumer dollars.

Again by comparison, pork producers and turkey producers have not done so well.

**U.S. Hog Slaughter Facilities**

U.S. hog slaughter plants, mainly in Iowa and surrounding counties, will be tested in the next decade.

**Estimated Annual Genetic Trends for Genetic Nucleus Lines**

Genetic change worth 82¢ to $1.75 per head over 5 years depends on the target market, i.e., live verses lean cuts. Large volume oriented plants must learn to extract the value of the best animals in order to buy them and ultimately to survive.

**High Quality Carcass**

High quality carcasses wished for are now streaming into plants.

**Fat-o-Meter Probe**

Many are being evaluated by Fat-o-Meter probes which predict value. Cut out tests of consistent sources are more telling of boneless primal value.

**The Danish Automated 17 Point Probe**

The Danish automated probe is an engineer's delight but an example of the lengths to which a quality supplier will go to understand value, its location, and then exploit it.

**Boars**

Boars may soon be another competitive tool as known sources of a known age start flowing to the market. Several countries serving quality home and export markets kill boars now and gain 10 to 12% in cost advantage.

The Danes also have developed a Skatol Machine to automatically analyze a plug of fat while the carcass moves down the kill line. Other countries do this job without complex equipment.

**Optimum Economic Model**

In the past, feed mills and slaughter plants were put "where the hogs are". Green field sites where commercial pigs are wanted are real possibilities now.

**Slaughter Plants**

Currently large plants with low margin, high volume management mentality may be vulnerable to smaller more flexible plants with local high quality labor forces. They may mimic the impact of mini steel mills and their impact on the large mills of that industry. If small plants become a reality, rapid geographical shifts, much greater than those considered now, could easily occur over the next decade.

**Future Challenges**

- Environmental Issues
- Industry Competitiveness/Efficiency
- Food Safety
- Animal Rights
- Technology/Biotechnology Acceptance
- Genetic Improvement
- Dietary Role of Meat Products
- New Products
- Global Competition
- Worker Health/Safety
- Marketing Systems
- Youth Markets

There are many issues to face but progressive pork producers can take some pride of accomplishment in the important improvements and developments which have occurred in the last 5 years.

**Keys to Profitable Pork Production**

- Embrace Change
- Human Resource Development
- Science of the Pig
- Accurate, Timely Analysis

Optimum vs. Maximum or Cheap

Of all these, a modern effective approach to human resource development may well be the most challenging for many, making pork the meat of choice in the 21st century

# Boosting Competitiveness Through Total Quality Management

by: Darrell L. Wilkes, Ph.D.
Vice President, Research and Industry Information
National Cattlemen's Association

My presentation is based on three statements which I believe to be true. They are:

1. The beef industry is overwhelmed with opportunities for improvement and advancement.

2. Conventional thinking won't allow these opportunities to be realized.

3. A new way of thinking about quality can lead the beef industry to new heights.

**The Beef Industry Is In A strong Position To Begin A Quality Revolution**

Consumers spend more money on beef than on all competing meat and poultry products combined. This is an enviable market position, and it allows the beef industry to begin a quality revolution from a position of strength. While beef's current market share of consumer spending for meat and poultry is strong, it has been systematically growing weaker for nearly two decades. This is due primarily to the growth that has occurred in the poultry business. As poultry production has grown, and beef production has remained stable (for the past 15 years), beef's percentage share of the market has declined. Basic algebra.

Despite all the hype and rhetoric we hear about vegetarians, animal activitists, and other so-called left-wingers, the total meat and poultry business has grown nicely, even during the decade of the 80's. Total meat and poultry consumption in the early 80's was 210 pounds per capita per year. Many people thought the industry was mature, meaning that the total "pie" wouldn't grow. As it turned out, the animal protein industry grew by 10 percent in the 80's; going from 210 to 232 pounds per capita by the early 90's. The problem is beef did not participate in the growth. Total beef production has remained surprisingly constant at about 24 billion pounds per year for two decades.

There are many theories, and even more opinions, as to why beef has failed to participate in this growing market. Regardless of which theory you ascribe to, the bottom line is that beef has lost market share because beef's "value equation" hasn't kept up with our competition.

$$\text{Value} = \frac{\text{Benefits}}{\text{Cost}}$$

Value is a complex factor; it is part perception and it is part fact. But, over the long run, the market share for any product is determined by how well the value of the product stacks up against the value of competing products. When a product faces aggressive competition (as is the case with beef), the value equation must be pushed higher just to stay even because the competition is constantly pushing its value to a higher level.

Traditional thinking creates a paradox when people are struggling with the challenge of driving the value equation higher. Traditional thinking says that it costs more to increase benefits. Similarly, traditional thinking says that when you cut costs, you must sacrifice some benefits. In other words, traditional thinking has caused the beef industry (and many others) to become stuck in a rut. To get out of the rut, the industry needs a new way of thinking.

**Big Q - A New Way Of Thinking**

There is a new way of thinking about quality in today's world. In the old days, quality was achieved by sorting the good parts from the bad parts and selling only the good parts to the customer. The bad parts were discarded, reworked, or discounted. This is clearly inefficient, and resulted in a price premium for "high quality." Employees and suppliers were taught to believe that as long as they could get their component part to pass inspection, they had accomplished their objective. Manufacturers and producers all established acceptable defect rates, and as long as those rates were not exceeded, they considered themselves "successful." Manufacturers assumed they were producing "quality."

Then along came Dr. W. Edwards Deming. He told Japanese managers, and then American managers, that their definition of quality was WRONG. Deming said that real quality is not achieved by sorting the good from the bad and selling only the good to the customer. Instead, Deming defined quality as a process of continuous improvement wherein defects and the corresponding costs of non-conformance are systematically reduced -- forever. To achieve this goal, all participants in a business -- employees, suppliers, managers -- must have the same objective, the same vision and the same sense of pride in what they're doing. Contrast this approach with the old one where the manufacturer's objective was to get his product past the inspector, and the inspector's objective was to "catch him" trying to push defective products down the line. It was a cat-and-mouse game with no winners. When Dr. Deming first suggested to American managers that they were all wet and didn't know the definition of quality, they naturally were offended.

Then they started to listen. American automobile companies listened *carefully*, because it was Deming who had taught the Japanese how to produce better cars and at a lower cost than their American counterparts.

Dr. Deming is not an automotive engineer, and he is not an expert in the automobile business. His contribution to the Japanese automobile industry is worldrenowned, but his principles of total quality apply to any business, and have been adopted by many businesses in Japan, the United States and many other countries. He is now 90-plus-years old, and has finally been recognized as a "prophet" whose day has come.

The Deming method has resulted in tremendous achievements by some American companies. Recent winners of the U.S. Commerce Department's Malcom Baldrige Quality Award achieved impressive results: The number of defects and the time needed to provide customer service were reduced several fold. Productivity doubled. Costs were cut by 50 percent.

Stunning results? Yes, but results that are achievable by virtually any company or industry (even the beef industry) willing to acquire a new mindset -- a new way of looking at quality.

The modern concept of quality is so different from the old concept of quality that it seems inappropriate to use the same word to describe the two concepts. So, in this article, the new concept of quality will be denoted by the use of a "Big Q," and the old concept will be denoted by the traditional "little q."

**Most Companies Aren't Structured For Quality**

Most American companies are not properly structured to achieve Quality. They are segmented -- broken into departments. In the long run, department employees succeed or fail based on the company's overall performance. But that has little bearing on the way people do their jobs. On a day-to-day basis, and even a year-to-year basis, departments within a large company are judged independently. One department may be doing very well, often at the expense of another. The successful department's employees are rewarded -- even if the company itself is going down the tubes. Rather than cooperating to achieve big-picture goals of the company, departments do whatever they can to "look good on paper."

When a company adopts the new concept of Quality, the first thing it must do is dismantle the barriers to cooperation that have existed for years or decades. The company must get employees to focus on the major goals of the *entire company* and redirect all resources to accomplishing key objectives. Interdepartmental sabotage and destructive competition can't be tolerated any longer. All the time and energy that once was spent positioning one department against the other becomes focused on the goals of the company -- on Quality.

**Suppliers Become Partners**

Suppliers are viewed in a different light under a Total Quality approach. They are no longer threatened by purchasing departments that are looking for a "better deal." Companies focused on Quality generally reduce their number of suppliers, rather than increase them. They form partnerships with suppliers, who buy into the

Quality goals of the company. The relationship with suppliers is based on mutual trust and a common commitment to Quality. Many Quality-oriented companies have *single* suppliers, even for their most important components. And many Quality-oriented suppliers have only one customer.

Dickering over price becomes a thing of the past. Suppliers don't have to worry about being "low-balled" by a competitor, so they can focus on the Quality goals of the company and the relationship becomes a true "Quality Partnership."

### What About The Beef Industry?

Like most American corporations, the beef industry also is not structured to achieve Quality. Just as larger corporations have self-protective departments, the beef industry has predatory segments (cow-calf, feeder, packer, seedstock) that prey on each other. Members of one segment spend most of their time and energy trying to get the upper hand on another segment, rather than forming Quality partnerships that benefit the industry in the long run. They spend the rest of their time trying to explain why a commodity business like the beef industry can't do the same things a corporation can. Those who are tired of hearing this excuse, please read on!

The companies that won the Dept. of Commerce's 1990 Malcolm Baldrige Quality Award reduced their costs by 50 percent and increased productivity 100 percent. And these companies were already recognized as *good*. They weren't a bunch of minor-league outfits with a lot of obvious room for improvement. Surely, even greater improvements are possible in the beef industry.

### The Costs of Non-Conformance

When cattlemen are advised to reduce costs, they ordinarily think of reducing the amount of money they spend to produce their product. Many people are not grateful to get this kind of advice, because they claim they have reduced their expenses as much as they can. But there's another category of costs that are usually not considered. The costs of non-conformance. This is the cost of producing a product that doesn't meet the customer's requirements, or a product that requires "re-work" or repair before it can be marketed. These costs tend to be ignored because traditional accounting systems don't quantify them. What tends to happen, particularly in a commodity business, is that the costs of non-conformance are "absorbed" into the average price paid for the commodity. This happens over a period of years, even decades, and becomes somewhat invisible. To it's disadvantage an industry establishes "acceptable levels of non-conformance."

With the Big Q philosophy, there is no such thing as "acceptable non-conformance." Rather than accepting the non-conformance, and trying to sort it out of in the process through some kind of inspection (little q), the industry needs to find the root of the non-conformance and correct it (Big Q), until non-conformities are reduced.

Now, think back to the Value Equation. When the non-conformities are reduced, the benefit component of the equation goes up. And because the product now conforms to the requirements of the customer, the cost of re-work, waste and scrap go down. Hence, the benefits are improved and the actual costs are reduced, SIMULTANEOUSLY. The value of the output goes up, and goes up rapidly, because both parts of the equation are moving in the right direction.

### Beef's Cost Of Non-Conformance

Dr. Deming has a rule of thumb, that has been proven right time and time again, which says that a dollar amount equal to 20-30 percent of gross revenue is "lost" due to non-conformities. This rule applies to companies (or industries, like beef) that have been operating on the "little q" philosophy. For beef, this would mean that 20-30 percent of the price of a fed steer (say $850) is lost to non-conformities. That would be $170 to $225! Is this possible?

In an attempt to answer this question, NCA commissioned an audit of fed cattle in 1991. Check-off dollars paid for the audit.

The beef quality audit found an average cost of non-conformance of $279.82/hd for fed steers and heifers. Dr. Deming's rule of thumb proved to be right once again! Table I shows the break-down of the costs of non-conformance identified in the National Beef Quality Audit.

| QUALITY DEFECT | LOSS PER STEER/HEIFER |
|---|---|
| WASTE - $219.25 | |
| Excess external fat | $111.99 |
| Excess seam fat | $62.94 |
| Beef trim corrected to 20% fat | $14.85 |
| Muscling | $29.47 |
| TASTE - $28.81 | |
| Palatability | $2.89 |
| Maturity | $3.80 |
| Marbling | $21.68 |
| Gender | $0.44 |
| MANAGEMENT - $27.26 | |
| Hide defects | $16.88 |
| Carcass pathology | $1.35 |
| Liver pathology | $0.56 |
| Tongue infection | $0.35 |
| Injection sites | $1.74 |
| Bruises | $1.00 |
| Dark cutters | $5.00 |
| Grubs, blood splash, calloused | |
| ribeyes and yellow fat | $0.38 |
| WEIGHT $4.50 | |
| Carcass weight (625-825) | $4.50 |
| TOTAL | $279.82 |

There has been mixed reactions by cattlemen who see the data in Table I for the first time. Some get excited, realizing that the opportunities for improvement are numerous, and that beef can regain market share by addressing these problems. Others respond as though they have been personally insulted.

Jack Maddux, an extremely progressive cattlemen from Nebraska, put the quality audit in perspective when he said: "What if the quality audit is wrong? What if the real figure is twice the amount? What if it's half the amount? Either way, the story is the same. We can't afford it!" Jack Maddux is right. We can't afford it. Not if the beef industry is going to compete for consumer's dollars. A switch to the "Big Q" philosophy is needed, not just by cattlemen, but by those who service the needs of cattlemen -- veterinarians, bankers, food manufacturers, pharmaceutical companies, and university scientists.

**How To Get Started**

It was noted earlier that the beef industry is not structured to achieve Quality. The structure of the industry is an obstacle, but not an insurmountable one. It can be made to accommodate a Quality initiative.

Four key components are fundamental to a Quality initiative:

1. Commitment from the industry's leadership.
2. A set of "stretch" goals.
3. A new language to communicate Quality between segments of the industry.
4. Re-engineering the basic economic drivers in the beef business.

Commitment from the industry's leadership is essential. Don Smith, NCA past-president, made his commitment very clear when he delivered his acceptance speech at the 1991 NCA convention: "If we act now, by the year 1995, our industry will be perceived by the public as an industry of the highest quality and excellence, an industry that is a good and responsible steward of all types of resources, an industry that produces a truly high-quality product," Smith said. "The rewards will be great."

NCA presidents that have followed Don Smith -- Jimme Wilson and Roger Stuber -- have made the commitment to Quality.

A commitment like this from the NCA leadership is the critical first step in the right direction. But more is needed. If the industry is to declare a Quality initiative, it must put resources behind it. Dollars from the checkoff helped lay the groundwork by funding the Beef Quality Audit, the Beef Quality Assurance Education program and several other important projects. If Quality is going to be an industry priority, then it needs to be a priority of all beef industry organizations and it needs to be funded at the appropriate level.

A set of "stretch" goals also are needed. Without exception, the Baldrige Award winners set extremely ambitious goals when they declared their Quality initiatives. Their "stretch goals" seemed almost ludicrous; one company set a goal to improve Quality 10-fold in four years. They did it! Xerox set a goal of improving reliability by 4-fold. They did it!

Stretch goals force a company (industry) to pursue Quality at a breakneck rate -- a revolutionary pace. There isn't much time to ponder every detail. It sends the message that "we better start doing things differently -- *NOW*!"

To start discussion, this author would suggest these stretch goals:

* Reduce the costs of excess fat production by an order of magnitude (from $190/hd to $19/hd).

* Reduce the incidence of unacceptable toughness by an order of magnitude (from 60% to 6% for the round; 40% to 4% for the chuck; 20% to 2% for the rib and loin cuts).

* Reduce the incidence of genetic non-conformity in seedstock herds by an order of magnitude (from 40% to 4%).

The last "stretch" goal is included here to provoke seedstock producers. I estimate that about 40% of the bull calves from seedstock herds are culled, and are not considered fit for seedstock. Why? Is the genetic base of the seedstock cow herds so unpredictable, genetically speaking, that only half of the calves are fit for seedstock use? Why not cull the cows that don't consistently produce suitable offspring and replace them with cows that do? This question could be debated adinfinitum, but is included here as an example of how the Big Q philosophy challenges traditionl thinking in virtually every sector of the beef business, even the most progressive sectors.

Once Quality is defined, a new language needs to be developed to communicate Quality between different segments of the industry.

Every segment of the beef industry has a different definition of quality. For the seedstock producer, it's EPDs for growth traits and milk. For the cow-calf producer, it's weaning weight and reproduction. For the feeder, it's cost of gain. For the packer, it's dressing percentage. The retailer or restaurateur is the only one in the system who currently has to be accountable to the consumer. Retailers and restaurateurs deal with excess fat (caused by packers' definition of quality) and with toughness problems (caused by lack of EPDs for tenderness in the seedstock definition of quality).

Until stretch goals are adopted, and used to universally define Quality, then the various segments of the industry cannot communicate Quality and nothing can happen.

Economic signals that encourage producers to do things that the consumer doesn't want -- like excess fat produced for the sake of dressing percent -- need to be re-engineered so that everybody in the system is adding value, rather than just adding costs.

### Should Quality Be Job #1 For The Beef Industry?

Day-by-day, year-by-year, the beef industry continues to lose ground. Those of us in the beef industry don't like to admit it, but it's true. Today everyone is enjoying high prices and profits -- but we forget that we're the beneficiaries of a supply-driven market -- at least for the time being.

We still have strong demand and a robust industry, relatively speaking. If our goal is to compete effectively in the future against alternative products, then we should consider the need to take *bold*, *aggressive* actions. One thing for sure -- our competitors will.

# MODERN BIOLOGY TOOLS TO IMPROVE GENETIC PROGRESS

Sue K. DeNise and Roy Ax
Department of Animal Sciences, University of Arizona
205 Shantz Building, Tucson AZ 85721

The tools used by molecular biologists to study the intimate details of a cell are now being used to change the way we study genetics in cattle. Genetic prediction, using phenotypic measurements on related individuals, has been a valuable tool in selection programs. The underlying premise is that related individuals have genes in common; and, they should have some phenotypic resemblance depending on the degree of genetic determination of a trait. Some traits are almost totally determined from their environment (like reproductive traits), while other phenotypic traits are determined primarily from genes (like mature size). If we could locate the differences in DNA that cause phenotypic variation, we could predict the genetic potential of an animal with more accuracy prior to an animal exhibiting a trait and prior to a costly progeny testing program.

Molecular biology techniques allow rapid evaluation of genetic information contained in DNA. We can now determine which animals are "carriers" of certain genetic diseases, verify parentage in multiple sire breeding pastures and map locations of genes. In the future, single cells extracted from a viable embryo may be used to determine sex, health characteristics and future production levels. Producers will be able to match the genotype of an animal to best fit the environmental and market requirements of a region or management system. Feeders and packers will be able to predict the performance by genotype and price accordingly. This technology offers exciting opportunities to minimize risk and increase accuracy of mating programs.

## ALLELES AND GENES

The ultimate goal of the new genetic technology is to understand how genes interact to produce a phenotype. The first step in this procedure is to identify genes that have different forms known as alleles. It has been estimated that cattle have between 50,000 and 100,000 genes on their 30 pairs of chromosomes. Animals inherit one chromosome of a pair from their sire and one from their dam, thus they have two copies of each gene along the chromosome. Most of the genes have not even been identified as yet, but an animal may inherit two identical or two different copies of each gene.

The most common use of DNA genotyping is to identify carriers of genetic diseases. Animals that carry a defective copy of a gene usually do not exhibit any symptoms of the disease, but if mated to another carrier animal, the resulting progeny will have a chance of inheriting defective genes from both parents and may not survive. Bovine Leucocyte Adhesion Deficiency (BLAD) is a severe combined immunodeficiency disease found in Holstein cattle. This disease is caused by a mutation in the normal CD18 gene which codes for leucocyte adhesion glycoprotein. Without a normal adhesion protein, leucocytes cannot penetrate the walls of blood vessels to reach the site of infection. Animals with two mutated copies of the gene (homozygous recessive genotype) die at early ages from normally non-life threatening diseases; but animals with at least one copy of the normal gene appear healthy. Parents that are carriers have a 50% chance of each passing on the gene so progeny have a 50% chance of carrying the gene or a 25% chance of having BLAD. A genetic test is now available to determine which animals are carriers of the BLAD gene. Of the top A.I. sires originally tested, 17% of the bulls were carriers of the BLAD gene. Today, with aggressive culling practices, the frequency of carrier bulls is down to 7.2%. The genetic test combined with aggressive culling has been instrumental in helping the dairy industry to eradicate this disease. There are other genetic diseases that can now be determined using similar techniques. The genes either causing or contributing to Porcine Stress Syndrome, Hyperkalemic Periodic Paralysis in horses, and Bovine Spongiform Encephalopathy have been identified. Other genetic diseases will soon be included in the list.

## MARKER-ASSISTED SELECTION

How can you tell if progeny from a sire inherited the favorable copies of genes or unfavorable genes? This may not be so important for growth traits, which are moderately to highly heritable, but could have a major impact on traits that cannot be measured directly, like milk production in bulls or carcass traits. If a bull is heterozygous for a gene, in most cases you can determine whether his progeny inherited one form or the other from him. If a gene that contributes to a trait (known as a quantitative trait locus or QTL) is located near the "marker" gene, and is also heterozygous, then progeny inheriting one marker should perform better than progeny inheriting the other form. Using marker genes we may be able to predict which heifers from a bull will become the most productive replacements or which bulls will have genes for desired carcass characteristics. Eventually, we will be able to sequence the region to determine the exact gene that causes an effect. Efforts are underway at several research institutions to produce a set of markers that are evenly distributed across all chromosomes so that genes can be followed from parents to progeny.

## GENETIC MARKERS FOR PERFORMANCE TRAITS

There are two different approaches used to locate marker loci. Chromosomes have many regions where there are no genes. The DNA in these regions is made of the same basic molecules, but the "code" is nonsense. These regions of chromosomes often have repeating sequences that are highly variable. These regions can be "marked" with these highly variable regions of DNA. These are known as anonymous markers because the sequence presumably has no physiological effect.

Another type of marker uses a candidate gene to mark an area of a chromosome. A candidate gene has a known physiological importance to animals. For example, growth hormone gene can be considered as a candidate gene. Different forms of growth hormone may affect performance of animals for many traits, or the allele may serve as a marker for heterozygous parents. When growth hormone is given exogenously in several livestock species, nutrient repartitioning occurs. Animals convert nutrients into lean growth more efficiently than normal. Our research program has a study underway to evaluate variations in growth hormone gene structure. One promising polymorphic region has been described by our research group as GH427 (Zhang et al., 1992a,b). In preliminary studies conducted by our research group, several breeds of cattle have been used to determine the variation of growth hormone allelic forms. Animals could have an AA genotype, AB genotype or BB genotype. We have found that of the breeds tested thus far: Holstein, Angus, Hereford, Limousin, Gelbvieh, Wagyu, and Simmental; Holstein has the lowest frequency of BB genotypes (1%) and Gelbvieh has the highest frequency (21%). These diverse breeds exhibited substantial variation for the frequency of growth hormone alleles.

Milk Protein Genes. Milk is composed of a number of different types of proteins that can influence its quality as a food for suckling calves. Two of these proteins, kappa-casein and beta-lactoglobulin, have been studied extensively in Holstein cattle . The genes that code for these proteins each have two allelic forms that can easily be determined from DNA analysis. Recent studies (Cowan et al., 1992; Bovenhuis et al., 1992) have shown that these genotypes may be associated with milk component yields. Kappa-casein may be useful as a marker for protein percentage and beta-lactoglobulin may have direct effects on fat percentage. The BB genotype of kappa-casein had an increase of .08% protein over the AA genotype. The BB genotype of beta-lactoglobulin had an increase of .11% fat over the AA genotype. This information can be useful for beef cattle as well. To increase the energy density of milk more fat and protein would be advantageous. Selection for the BB of both kappa-casein and beta-lactoglobulin would be appropriate to increase protein and fat content.

Meat Tenderness. Calpain is an enzyme found in meat that breaks down proteins and it may be a primary factor in post-mortem meat tenderness. Calpastatin inhibits the action of calpain. A recent study reported by Shackelford et al.(1992) has shown a relationship between the calpain-calpastatin system and meat tenderness. They evaluated the tenderness and calpastatin activity in muscle samples of fed steers that represented 31 breed types. They reported a direct correlation between calpastatin activity and shear force (genetic correlation=.58 $\pm$ .20); thus, animals with a genetic predisposition for low calpastatin activities (thus high calpain activities) also had more tender meat. Heritability for calpastatin activity was very high (.70 $\pm$ .23) indicating that selection for low calpastatin activity would successfully influence palatability characteristics of meat.

Our laboratory has been successful in amplifying a fragment of the calpain gene located in the calcium binding region. An extensive search to locate genetic variation in this region has been unsuccessful. We have also attempted to amplify portions of the calpastatin gene, but have been unsuccessful thus far. If we can learn the controlling mechanisms of these genes, we may someday be able to tenderize muscles on the animal just prior to slaughter: thus, use a natural biological mechanism to enhance the product or select animals that will consistently have naturally occurring desirable palatability characteristics.

## CONCLUSIONS

What does the future hold? One day, embryos may be purchased that have been genetically evaluated. These embryos will be the result of planned matings to match genes. One cell from a morula will be used to determine sex and the genotype for important quantitative trait loci. Female embryos with genes predicting excellent maternal characteristics will be purchased for transfer to recipient cows to provide replacements. Male embryos, with genes identified for growth and carcass characteristics, will also be transferred to recipients to provide market animals. Feeders will be able to predict more accurately how animals will grade after a set time on feed and packers will be more confident about the quality of the product.

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## CENTRAL TEST AND GROWTH COMMITTEE

Minutes

The Central Test and Growth Committee was called to order by Chairman Ronnie Silcox at 2:15 pm, May 27, 1993. Silcox gave opening statements on the structure and role of the committee.

A panel discussion was held entitled "Optimizing Traits". The panelists included Terry Kiser, University of Georgia, W. E. Beal, Virginia Tech, and Don Boggs, South Dakota State University. Topics of discussion were to include birth weight, growth, milk, and mature size as they relate to central test programs.

Discussions were held based on questions from the audience. Topics discussed are listed below.

- Balance of traits, fleshing ability, milk and marbling
- End-products and EPDs
- Input costs as the keys to efficiency
- Age at slaughter, frame score and maturity
- Central testing and optimizing traits
  - Categorize bulls at central tests for traits. Provide more information to potential bull buyers.
  - Challenges for today's central tests
  - Modernizing targets at central tests
  - Setting parameters for bulls on tests based a certain traits (e.g., frame, growth, scrotal circumference, EPDs, etc.)
  - Composition of beef bulls at an equivalent steer composition
  - Feed efficiency and central testing
  - Indexing tested bulls

Discussion ended at 3:20 pm, followed by a 10 minute break.

The group reconvened at 3:30 pm. Silcox made announcements about three items. (1) Attendees were made aware of a listing of test stations which was recently printed by the American Beef Cattlemen, Hayes Walker. (2) EPD breed averages for use in sale catalogs will be updated in the proceedings of the meeting. Also, Silcox indicated the Genetic Prediction Committee had stated that the next copy of the BIF guidelines would have recommendations for the information appearing in the front of breed sire summaries. (3) Silcox reminded that the Growth portion of the Central Test and Growth Committee includes other programs such as steer feedouts.

Silcox asked for discussion to be held regarding the future direction of the Central Test and Growth Committee. A summary of discussions held follows.

Dan Brown (GA) commented on increasing the minimum required scrotal circumference measure on bulls completing gain tests. A discussion followed about the Breeding Soundness Examination minimum measures. Discussion continued on lack of scrotal circumference 365-d adjustment factors for use by test stations and breed differences in these factors.

James Bennett (VA) commented on the role of today's central bull test relative to goals set in the early years of central testing (improving growth rate, gains). He asked those present what they thought the role of test stations was today. What is the direction test stations should take today? Discussion continued on revitalizing central testing (Burké Healey; OK) and categorizing low birth weight bulls (Dan Brown; GA).

A discussion was held about the Alabama testing procedures and their EPD sale. Bulls are ranked using a formula developed by John Hough.

Silcox was asked to get recommendations from the Reproduction Committee on scrotal circumference adjustment factors.

Suggestions for next year's committee agenda included a summary of the various types of central bull test programs in the country (length of test, test index, etc.) and a survey of test stations and their procedures. The survey and summary would be collected under the supervision of the committee chairman, with assistance from Lori Fink (KS) and Dan Brown (GA).

Suggestions were made about changing the committee name to include "Evaluation" in the name.

The motion was made by Ike Eller (VA) to ask BIF Board of Directors for help in establishing a core committee representing users of central tests, operators, buyers, etc., to study the current and future goals of the committee and central testing. Seconded by Larry Nelson (IN). Motion passed unanimously.

Silcox stated that last year there was interest in preparing an on-farm bull test program BIF Fact Sheet. It was decided that the core committee would address this issue.

Motion was made to adjourn by Ike Eller (VA), seconded by Larry Nelson (IN) at 4:25 pm.

Respectfully Submitted,

Sally L. Northcutt

Sally L. Northcutt
Secretary

# BREED AVERAGE EPDs

Ronnie Silcox
The University of Georgia

In using EPDs it is important to realize that an animal with a zero EPD is not an average animal today. Zero is the average of all of the animals born in some base year. For Polled Hereford cattle zero is the average of all animals born in 1975, while zero for Beefmaster is the average of all animals born in 1982. Due to genetic changes in cattle since the base year, average EPDs for some traits in some breeds have moved far away from zero. Knowledge of the breed average is important in evaluating cattle.

Many breed associations publish average EPDs in the front of the sire summary. There is some variation in what average is presented. Various breeds list averages for all sires, all active sires, only sires listed in the summary, ect. In addition, most associations list average EPDs for the last calf crop or average EPDs for each calf crop by year.

Which average should you used? Since most commercial cattlemen use EPDs to buy yearling or two-year-old bulls, the average of the last calf crop is probably most logical. This allows the producer to determine how a particular animal compares to other animals of the same breed and age. The accompanying table contains average EPDs for animals born in 1991 in each breed. 1991 is used because it is the last year in which complete performance records have been analyzed. (Yearling records for all 1992 cattle have not yet been processed.)

Average EPDs listed in this table <u>do</u> <u>not</u> imply that any breed is better or worse than another. Differences are simply the result of different breeds having different base years and different genetic trends.

Additional information about distribution of EPDs within a breed and averages of other age groups is included in the front of a breed's sire summary. A copy of the current sire summary is available at no charge from the breed association.

## 1991 AVERAGE EPDs FOR EACH BREED

| | Birth Wt | Wean Wt | Yrlg Wt | Milk |
|---|---|---|---|---|
| Angus | 3.2 | 22.2 | 38.2 | 7.7 |
| Beefmaster | 0.0 | 5.3 | 9.6 | 4.5 |
| Brahman | 0.8 | 6.9 | 10.9 | 5.1 |
| Brangus | 1.5 | 16.1 | 25.9 | 0.5 |
| Charolais | 1.3 | 6.5 | 10.4 | -1.3 |
| Gelbvieh | 0.3 | 5.4 | 9.9 | 2.0 |
| Hereford | 2.2 | 25.3 | 40.3 | 6.9 |
| Limousin | 0.6 | 3.6 | 7.4 | 0.1 |
| Polled Hereford | 3.3 | 21.0 | 33.8 | 0.6 |
| Red Angus | 1.3 | 20.4 | 32.5 | 6.0 |
| Salers | 0.7 | 6.6 | 10.8 | 3.2 |
| Shorthorn | 1.8 | 11.1 | 18.3 | 1.9 |
| Simmental | 0.5 | 5.8 | 10.0 | -0.2 |

# GENETIC PREDICTION COMMITTEE MEETING

**Larry Cundiff: Chairman** **27 May '93**
**Richard Willham: Secretary**

Larry Cundiff opened the meeting at 2:20 PM on 27 May 1993 in the Grove Park Inn, Asheville, North Carolina. The general program of the meeting appeared in the BIF program. A report on the Genetic Prediction Committee called by Rick Bourden and Bruce Golden for 7:30-9:30 PM on the evening of 26 May was added to the agenda. Another addition to the program on Direct-maternal covariance for weaning weight traits by Bruce Golden was included. The presentations planned for the committee meeting will appear in the proceedings so are not reported in detail in these minutes.

Larry began the meeting by giving the additions to the afternoon program at this meeting. Larry noted he anticipated that no business meeting needs to be held.

Larry introduced Keith Bertrand to present EDITS FOR GENETIC PREDICTION ANALYSIS. Keith titled his presentation, BIF Editing Ad Hoc Committee. The purpose of this sub-committee is to come up with guidelines for editing of data used in Genetic Prediction. The edits should be breed specific but there are some general guidelines. There were no questions.

Larry introduced Bruce Cunningham to present INTERIM EDD's. Bruce presented his paper to consider interim EPD's for early selection of young animals. Multiple trait interim EPD's were defined. No discussion was proposed at this time. There were no questions.

Larry asked Rick Bourden to report on the meeting last evening. EPD's for crossbred animals were discussed. Even in purebred seedstock herds, another breed is often used on first calf heifers and progeny from these matings can be sold. Thus, there is a need for such EPD's. Red Angus breeders often make out crosses to Black Angus. An evaluation of Red Angus data using black EPD's was successful. The purpose was to examine procedures. Technical issues were raised. Rick suggested protocols to include useful parentage information on other breeds included in the data bases of breeds. A contemporary group that includes percentage information as a criteria is a problem. There were no questions. Larry called for a report next year.

Larry introduced himself to consider INTER-BREED COMPARISONS: Larry reported on his paper. Across Breed EPD's were considered. Two table types were presented - one showing results for 26 breeds using EPD's from 12 breeds to adjust to a 1991 basis. A procedure for computing across-breed EPD's relative to a specific base breed was discussed. Larry received some questions on his presentation.

Larry introduced Dale Van Vleck to present ACCURACY of INTERBREED COMPARISONS. The accuracies appear not to be as large as Dale initially thought. The accuracies are primarily determined by the experimental evaluation of breed differences rather than by the accuracies of the EPD's of individual bulls sampled. Larry complimented the work of Dale's. Larry is encouraged by the results. Questions were asked concerning across environments and this influence on the factors.

Larry called on Bruce Golden to consider DIRECT-MATERNAL COVARIANCE FOR WEANING WEIGHTS. The concern is to maximize the reliability of predictions. Discussed data quality problems. There were no questions.

Larry decided evidence presented at this meeting needs some incubation time. Therefore, there was no executive session at this year's meeting. Larry adjourned the meeting at 5:15 PM.

Richard Willham
Recording Secretary

## FURTHER COMMENTS ON DATA EDITING

Report submitted by:
J. Keith Bertrand, University of Georgia, Chairperson

**BIF EDITING AD HOC COMMITTEE MEMBERS:**

E. Poala de Rose, Agriculture Canada
Bruce L. Golden, Colorado State University
Richard L. Quaas, Cornell University

A set of questions was given to each member of the BIF Ad Hoc Data Editing Committee. The following is a summary of the responses to the questions. The members of the committee are at institutions that conduct Genetic Evaluations for Beef breeds in the U.S. and Canada.

1) **Should an acceptability window for weigh date be provided when forming contemporary groups for traits like weaning and yearling weight?**

Response: The window should be identified as up to three days. However, the breeder should use management group designations or pasture codes to differentiate between differently managed groups of calves that are weighed on the same day.

Response: A single weigh day must be used to designate a contemporary group. Breeders with too many calves to weigh on one day can report one weigh date for the entire set of calves. The problem with a window is that it is not a trivial task to assign contemporary groups when a string of weigh dates a few days apart are encountered.

Response: While producers are encouraged to weigh all the calves in a contemporary group on the same day, a 10-day window in used in excluding data from the national evaluation. This window should ideally be reduced. It is recommended that calves within a contemporary group be within a 60 day age range. However, ranges of up to 90 days are acceptable for data entering the national evaluation.

2. **What is the minimum number of calves that are necessary to form a valid contemporary group?**

Response: Two calves

Response: Producers are encouraged to maintain group size at or above five calves (of the same breed and sex). It is recommended that calves from groups containing less than five animals not be indexed. Our national evaluation used to also require a minimum group size of 5. However, after researching the subject, we concluded that moving to a minimum of 2 (of the same sex and breed) had little impact on the proofs. The information on two-calf groups is obviously useful for genetic evaluation, although not perhaps ideal. The accuracy calculation considers the size of the contemporary group in which each record was made.

3. **After standard range edits, should records within each contemporary group be eliminated that are outside a set number of standard deviation units from the contemporary group mean?**

Response: We do not currently eliminate outliers within contemporary groups. However, this approach is under discussion. It could provide an equitable method of eliminating "doubtful" data. While we would like to conduct an examination of the impact various criteria would have on our data base, we feel that 4 standard deviations would be the most likely criteria to impose.

Response: Records are eliminated that have a within contemporary group ratio below 60 or above 140.

Response: A method we have used is to compute the sire EBVs within contemporary group using a simple selection index. If the distance between the lowest and highest sire EBV within a contemporary group is greater than some amount then all the data for the contemporary group are printed. The data are then inspected to determine their suitability. Decisions as to what to remove and what to keep are determined on a case by case basis.

Response: We truncate rather than eliminate completely.

4) **Should central test station data be allowed in an NCE data base? What should be the contemporary group for central test station data?**

Response: Central test station data should be utilized, but only if there two or more are calves from the same breed, herd and weaning contemporary group at a single test station.

Contemporary groups should always be hierarchical. That is, weaning contemporary groups should be a subset of birth groups and yearling (scrotal, etc.) groups should always be a subset of weaning groups.

Response: We have examined the issue of bull test data in detail. We feel that test station data should not be put into a national evaluation if records on two or more calves which have been contemporaries since birth are submitted. Rather we believe that records on the entire contemporary group from the station should be submitted. This requires the program to handle different contemporary grouping for calves during the pre- and post-weaning phases. More specifically, the reforming of contemporary groups across herds must be undertaken, not just the subdivision of pre-weaning groups within a herd. We are in the process of implementing this system. A pilot run is currently under way. The system appears to be running smoothly, although the proper identification and matching of animals from the herd and test station data bases has been a challenge.

Response: Central test records are eliminated for some of the breeds we work with. For others, central test station data is allowed if at least two calves from the same herd are in the central test station at the same time. Yearling contemporary groups are then formed using the weaning contemporary group plus the usual post-weaning contemporary group information.

5. **Should direct sire connectedness across contemporary groups be checked and the largest connected data set be retained for analysis?**

Response: Direct sire connectedness across weaning weight contemporary groups is checked. However, disconnected contemporary groups will be retained if they contain progeny from a sire or son of a bull in the main connected data set.

Response: Sire connectedness is checked across birth contemporary groups.

Response: Direct sire connectedness should not be a requirement for all data sets. Representation by sires' sons and maternal grand sires can provide good connectedness. Having weak connectedness would probably be much less of an error than the potential bias introduced by having too severe a connectedness requirement.

Response: We believe that a connectedness check should be undertaken and unconnected data removed from the analysis. As described at last year's meeting, the national evaluation used sires and sons of sires to build a connected data set. We also assess connectedness between years, within a herd, using dams.

6. **Should birth weight contemporary groups be examined to ensure that records are not identical (ie., check to see if there is variation within the contemporary group as an indicator that the weights were actually measured and not "eye balled").**

Response: It is a good idea to check birth information to ensure that variation exists within each contemporary group. It is not something we currently do, but we will consider its implementation. Of course, this check will not eliminate eye-balling, as many breeders submit different "eye ball" for each calf. (Witness the large numbers of "round number" weights such as 80, 85, 90, 95... in the data.)

Response: Yes, we currently conduct this check.

7) **What is the preferred method for forming birth weight contemporary groups? When forming contemporary groups for birth weight, should season be restricted to a set number of days?**

Response: We recommend forming birth contemporary groups on herd-year-season management code. The management code for birth can be used to designate calves from cows that were recently purchased, etc. The season restriction should probably be just fall versus spring born. However, we do analyze one data set that uses tighter seasons.

Response: Our season definition for birth weight is Jan-June and July-December. That's probably too long, though we didn't know what to choose that wouldn't split some valid groups. This way we split only a few that calve Dec-Jan. Using moving windows for each herd is a good idea but when we tried to come up with an algorithm to clump birth dates we failed to find a satisfactory procedure. (Same problem will be encountered with a window for WWt & YWt; easier said than done.) Allowing the breeder to specify calving season sounds good but I doubt many associations would be willing to change their who data base structure to allow it...its costly to add fields. Also we still have to deal with the bulk of data already collected.

Response: We do not believe that all calves born in the same calving season should form one contemporary group. We encourage contemporary group age ranges of 60 days, although ranges of up to 90 days are allowed. If the breeding season is longer than 90 days, the calf crop must be split into different contemporary groups based on age. The breeder is encouraged to undertake this division himself. At present, there is no season effect in our genetic model. We have never researched the impact of including/excluding one.

Response: We examine each breed separately to determine the months when the majority of their calves are born. Seasons are then determined from this information. Usually seasons are either in intervals of three or four months.

8) **Which management codes or data types cause data to be eliminated from genetic evaluation programs?**

Response: We recommend that the phrase "management code" be used to designate management treatment. Rather than asking the breeder to form contemporary groups as some breed associations do, they should ask the breeders to designate animals that are managed together. For example, if a breeder has a group of show cattle that he is giving preferential treatment then he could use a letter "A" next to their registration/performance information to indicate they were managed together. The same breeder might use "B" and"C" to designate animals that were from different pastures. This strategy requires a substantial amount of education of the breeders but works well for several breed organizations. Contemporary groups can then be formed by concatenating these codes to the other contemporary group information.

In the case of creep versus not creep we recommend that the breeders indicate this explicitly. This particular management practice can have effects that we may want to do a more complete accounting of in the future (heterogeneous variance, etc.). We do divide contemporary group on creep information if available.

We do not currently recommend using twin data no matter how it is raised. Breeders should be encouraged to indicate method of rearing for future use.

We currently do not use ET data but breeders should be encouraged to designate it for future use and to allow us to identify foster dams from genetic dams.

We do use pedigree information from twin and ET data. We also do not rely exclusively on the twin or ET designation to identify these individuals. We also examine records with a common dam in a single contemporary group and a common dam within a single age of dam.

Response: All management codes go into CG definition (WW or post-W gain). For WWt there is a separate pasture code which is also part of the CG definition. There is a separate field for type of birth; we keep only single births.

Response: Twin data is eliminated. Embryo transfer data is eliminated from some breeds but retained for others provided the breed of recipient, age and identification of recipient cow is known. Data from show cattle are not eliminated but are grouped together in a separate contemporary group.

## INTERIM EXPECTED PROGENY DIFFERENCES

Bruce E. Cunningham, Ph.D.
American Simmental Association
Bozeman, MT

Most of the breed associations with performance recording programs have developed genetic evaluation systems to describe genetic differences that exist within their respective breeds. These National Cattle Evaluation (NCE) programs provide Expected Progeny Differences (EPD) for sires, dams, and non-parents on a routine basis, either once or twice a year. The NCE programs use performance records from the breeds' data banks and describe those records using some version of the Animal Model to obtain estimates of transmitting ability.

Many breeders cannot wait until the next NCE run to make their selection and marketing decisions. For calves that are recorded between the NCE cutoff dates, we need to provide estimates of genetic merit that are comparable within the breed. We could rank these calves based on two sources of information: within-herd performance or pedigree index (average of parents' EPDs). If we rank based on the within-herd ratio, we cannot make comparative decisions about animals from different herds. The pedigree index does provide the means of ranking animals from different herds but we cannot decide between animals that have the same rank based on pedigree. Using the within-herd performance and the pedigree index from the most recent NCE, we can calculate an interim EPD in much the same manner as the non-parent backsolution using the reduced animal model.

The interim EPD can be illustrated as follows: $EPD = 1/2EPD_s + 1/2EPD_d + 1/2MS$ where MS is the mendelian sampling effect. In order to calculate a non-parent or interim EPD, we need to obtain an estimate of the mendelian sampling value. Wilson and Willham (1988) described how to calculate single-trait interim EPDs using the animals' within-herd performance and the current EPDs of the parents. In table 1, the adjusted deviations are shown for birth weight, weaning weight, and yearling weight. These deviations are used in the interim EPD calculations to estimate the mendelian sampling effect. The contemporary group average (represented by the **bold** characters) is adjusted for the average genetics of the sires and dams represented in that contemporary group. For weaning weight and yearling weight, we need to adjust the group average for the dams' average milking ability ($\mathbf{2*EPD_{D,MK} + PE_D}$). The deviation for each trait represents what cannot be explained by the adjusted group mean and the contributions from the calf's parents to it's own record. These deviations will be regressed to provide an estimate of mendelian sampling for each trait.

Using the within-herd deviations, we can compute interim EPDs using a single-trait (ST) or a multiple trait (MT) approach. For ST-interim EPDs, the calf's adjusted deviation is regressed by a value equal to $1/(2 + 2*d^{-1}*(1-h^2/h^2))$ where $d^{-1}$ is equal to 2 if both parents are known; 4/3 if one parent is known;1 if neither parent is known; and $h^2$ is the heritability of the trait. This regressed value is added to the calf's pedigree index and becomes the interim EPD. If data for a trait is not available, the estimate of the mendelian sampling effect is zero. The multiple-trait procedure uses information on the recorded traits to adjust the EPDs for all evaluated traits. The available deviations are weighted by a set of values that are determined by the genetic and environmental (co)variances, the combination of available traits, and the number of identified parents in the NCE. If a group of calves are recorded with only birth weights, their birth deviations will be used to adjust their weaning weight, yearling weight, and milk pedigree indices. For a trait(s) in which a record does not exist, the mendelian sampling will be estimated using the correlated information from the recorded traits.

A survey was undertaken of several of the breed associations with NCE programs to determine how interim EPDs are presented to their breeders (Table 2.). They were asked: 1) Are interim EPDs provided?; 2) Are ST or MT interim EPDs calculated?; 3) How is the accuracy of the interim EPD presented?; 4) Will some animals have a combination of non-parent and interim EPDs?; and 5) How many times a year is the NCE program ran for your breed? All the breed associations except one provide interim EPDs as a part of normal record processing. Presently, the American Polled Hereford Association is calculating pedigree indices using the parents' EPDs from the current breed evaluation. Most of the breed offices are providing ST-interim EPDs. The Salers and Simmental Associations have a MT-interim EPD system for all weight traits. The American Hereford Association is calculating MT-interim values for weaning weight, yearling weight, and maternal milk.

Six of the breeds provide an accuracy symbol to distinguish between animals with only pedigree information and animals with own performance and pedigree information. If an animal has a pedigree index only, it will receive a P or an I for an accuracy. Animals with a record in addition to the pedigree index will receive a $P^+$ or an $I^+$ for an accuracy. Two Associations provides numeric values for the interim accuracies. The American Angus Association uses a combination of symbols and numbers for the accuracies of their interim EPDs. The symbols are I and $I^+$, and they are used to indicate whether or not the EPD of a Angus calf is an interim calculation. The American Simmental Association provides a numeric value for the accuracy of it's interim EPD.

Nine of the eleven breeds accommodate a combination of interim and non-parent EPDs. If animals have a trait(s) recorded after the current NCE has been done, an ST-interim EPD will be calculated and substituted for the calf's non-parent EPD for that trait(s). For example, if a group of Limousin calves are recorded with birth weights and weaning weights, NALF will provide a set of interim EPDs for each calf. Once the next Limousin NCE is performed, those calves will have a set of non-parent EPDs. At a later date, the breeder supplies yearling weights on that group of calves. An ST-interim EPD will calculated for yearling weight and be substituted for the calves' non-parent yearling weight EPDs. The Brangus and Simmental Associations do not update a non-parent EPD in the office once a calf becomes part of the national evaluation. Any new data will used to calculate new non-parent EPDs in the next evaluation run.

## Discussion

The procedure for calculating the interim EPDs needs to be very similar to the calculations used for non-parent EPDs from the breed's National Cattle Evaluation.

The primary difference between the Interim EPDs and the non-parent EPDs is the estimation of the adjusted contemporary group average. In the NCE using a reduced animal model, the contemporary group averages are estimated along with the solutions of the parents. For interim EPDs, the contemporary group averages are calculated by using parent information from the previous evaluation and adjusting the average weight of the calves in each group for the average contribution by the parents in those groups. Also, there can be some differences in the contemporary groups created in the Association office compared to the breed-wide evaluation program.

The use and defining of interim accuracy should be determined by each Association and it's members. The NCE program provides BIF accuracies for sires, dams, and non-parents. The accuracies for interim EPDs can be computed using a function of the parents' accuracies and an adjustment for the use of an animal's own record. There has been some research regarding the computation of interim accuracies using the parents' prediction error variances obtained from the NCE. There does not appear to be an advantage either way to using a letter designation or a numeric value for presenting the interim accuracy. Many breeders realize that the accuracies of the EPDs for a bull or heifer calf are going to be low because the limited information. The use of a letter designation is very simple and easy to understand by the breeders. The numeric value does provide some measure of the accuracy levels of the parents used to produce the mating. It would seem that Associations need to weigh the effort required to re-educate their members against any perceived gain from changing their presentation of interim accuracies.

How well does the interim EPD compare to the subsequent non-parent evaluation in ranking animals? Wilson and Willham (1989) indicated the rank correlations would be the highest when 1) both parents are evaluated in the NCE; 2) the animal is reared in a contemporary group where the majority of sires and dams have been evaluated by the NCE program; and 3) no major changes have been made in the procedures used in the next NCE run. It would be interesting to see the comparative rank of calves based on the interim values compared to the non-parent EPDs from the various breeds. We are planning to compare the ranking of Simmental calves based on the two methods sometime following the completion of our Fall 1993 evaluation.

Should we use the interim EPD in the calculation of interim values for any offspring? The Angus Association does not use interim EPDs of parents to calculate the interim EPDs of their progeny. I believe that this is the correct approach. The interim EPD is designed to be a preliminary estimate of a calf's transmitting ability prior to the next evaluation. However, we do have animals, primarily produced using embryo transfer, that were not evaluated directly in the NCE. These animals will have progeny recorded before a future NCE run. If the only information that we have on these animals is their pedigree information, should their pedigree indices be treated as interim EPDs or as EPDs produced from the NCE? Using results from the current NCE run, the pedigree index of an unevaluated animal is the best estimate of the animal's genetic potential. If we were to include those animals in the relationship matrix of the animal model equations, we would obtain the same results as when we calculate pedigree indices at the Association office.

Table 1. Adjusted Deviations for Interim EPDs

Birth Weight:

$$DEV_{BWT} = BWT - (\mathbf{CG} - \mathbf{EPD_S} - \mathbf{EPD_D}) - EPD_S - EPD_D$$

Weaning Weight:

$$DEV_{WWT} = WWT - (\mathbf{CG} - \mathbf{EPD_S} - \mathbf{EPD_D} - \mathbf{2{*}EPD_{D,MK}} - \mathbf{PE_D}) - EPD_S - EPD_D - EBV_{D,MK} - PE_D$$

Yearling Weight:

$$DEV_{YWT} = YWT - (\mathbf{CG} - \mathbf{EPD_S} - \mathbf{EPD_D} - \mathbf{2{*}EPD_{D,MK}} - \mathbf{PE_D}) - EPD_S - EPD_D - EBV_{D,MK} - PE_D$$

Table 2. Summary of Interim EPD Procedures by Breed

| Breed | Interim EPDs | ST or MT | Accuracy | Combination I & NP | # of Evaluations |
|---|---|---|---|---|---|
| Angus | Yes | ST | Numeric | Yes | 2 |
| Brangus | Yes | ST | Symbolic | No | 2 |
| Charolais | No | | | | 1 |
| Gelbvieh | Yes | ST | Symbolic | Yes | 2 |
| Hereford | Yes | MT | No | Yes | 1 |
| Limousin | Yes | ST | Symbolic | Yes | 2 |
| P. Hereford | No | | | | 2 |
| Red Angus | Yes | ST | Symbolic | Yes | 1 |
| Salers | Yes | MT | Symbolic | Yes | 1 |
| Shorthorn | Yes | MT | No | Yes | 1 |
| Simmental | Yes | MT | Numeric | No | 2 |

Table 3. Examples of The Use of Interim Accuracies

| Breed | Birth Weight | Weaning Weight | Yearling Weight | Milk |
|---|---|---|---|---|
| Limousin | .37 | P | P | P |
| Gelbvieh | .32 | .20 | I+ | .11 |
| Angus | .28 | .25 | I .07 | .12 |
| Simmental | .32 | .27 | .24 | .16 |

# BREED COMPARISONS ADJUSTED TO A 1991 BASIS USING CURRENT EPD'S[1,2]


Larry V. Cundiff

Roman L. Hruska U.S. Meat Animal Research Center
Agricultural Research Service
U.S. Department of Agriculture, Clay Center, NE 68933


## INTRODUCTION

Breed characterization experiments have provided valuable information to cattlemen planning crossbreeding programs to use heterosis and optimize performance levels for important bioeconomic traits. However, comparisons made in the 1970's may not be directly comparable to comparisons from more recent experiments, because breeds have changed significantly during this time span. Estimates of genetic trend in expected progeny differences (EPD's) indicate that some breeds have placed major emphasis on growth to weaning and yearling ages, while others have placed primary emphasis on calving ease and maintaining or reducing birth weight. Still other breeds have emphasized maternal performance (milk). Recent research using data from the Germplasm Evaluation (GPE) program at the U. S. Meat Animal Research Center (MARC) has demonstrated that within breed EPD's can be used to adjust breed comparisons for genetic trends and sire sampling (Notter and Cundiff, 1991; Nunez-Dominguez et al., 1993). At the 1992 BIF meeting the Genetic Prediction Committee decided to present a breed table adjusting breed means for genetic trends and sire sampling using current EPD's. This report presents results of a recent analysis of data for twelve breeds using current EPD's to adjust breed comparisons to a 1991 all animal (non parent) basis.

## PROCEDURE

Birth weight (n = 4,272), 200-day weaning weight (n = 4,099), and 365-day yearling weight (n = 3,842) obtained on F1 calves by 11 or 12 sire breeds mated to Hereford and Angus dams produced in the Germplasm Evaluation Program at the U.S. Meat Animal Research Center, Clay Center, Nebraska were analyzed. Although, twenty six breeds have been evaluated to date in the GPE Program, only breeds with current national genetic evaluations were included in the analysis. Also, only progeny of sires with EPD's available from the most recent 1993 genetic evaluations for each

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[2]Appreciation is expressed to Gordon Hays, Wade Smith, Dave Powell, and their staff for operations support provided to the project, to Darrell Light for data analysis, and to Deborah Brown for secretarial support.

respective breed were included in the current analysis. Data on 200-day weaning weight of three-breed-cross calves (n = 6,315) produced by mating F1 females (n = 1,486) to unrelated sire breeds were used to estimate breed differences adjusted for genetic trends in maternal weaning weight and net maternal (milk) EPD's.

Table 1 shows the number of sires and progeny used in the analysis of birth weight, and the time period when breeds were used in the GPE program. Twelve breeds were included in the analysis for birth weight. Maine Anjou EPD's were available only for birth weight and weaning weight. The number of progeny and sires were somewhat greater for weaning weight than birth weight because EPD's were available for additional sires in several breeds. For the analysis of maternal weaning weight, the number of maternal grandsires, F1 dams and three-breed cross progeny by each breed of maternal grandsire, and the period of time when these breeds were used in the GPE program are shown in Table 2.

The analytical procedures used were essentially the same as those of Notter and Cundiff (1991). The model for traits on $F_1$ progeny included effects of dam breed, cow age, birth year, sex, and sire breed. Cow ages were coded as 2, 3, 4, $\geq$5 years of age. Estimates of sire breed effects were obtained by least-squares analyses for the different traits. Then a subsequent analysis was performed for each trait which included the regression of calf performance on the sire EPD for that trait. Breed differences were adjusted to a 1991 base for each (ith) breed as follows:

$$\text{Adjusted 1991 Mean} = \text{Breed mean at MARC} + b\left[\text{1991 Breed mean EPD} - \text{Mean EPD of bulls used at MARC}\right]$$

where for each (ith) breed,

Breed mean at MARC = Estimates of sire breed effects from the least squares analysis (EPD not included as a covariate in the model), and

b = pooled within breed regression coefficient of calf performance on the EPD of the sire for the respective trait (lb/lb EPD, from second analysis including EPD as covariate).

Similarly, two models were used for the analyses of maternal weaning weights. Model 1 included the effects of cycle (C), age of dam (A) (2-yr old, $\geq$3-yr old), cycle X age of dam (CA), birth year nested in CA, sex, grandsire breed, granddam breed, and sire breed nested in CA. In model 2, the previous model was augmented with covariates for the simultaneous continuous effects of both the milk and direct weaning weight EPD's of the maternal grandsire. The following equation was used to adjust weaning weight of each maternal grandsire breed (ith) at MARC for sire sampling and genetic trend to the 1991 base year:

$$\text{Adjusted 1991 Mean} = \text{Mean at MARC for the ith breed}$$
$$+ b_{ww}\left[\begin{matrix}\text{1991 Mean Breed} \\ \text{Wn Wt EPD}\end{matrix} - \begin{matrix}\text{Mean WW EPD of sires} \\ \text{used at MARC}\end{matrix}\right]$$
$$+ b_{Milk}\left[\begin{matrix}\text{1991 Mean Breed} \\ \text{Milk EPD}\end{matrix} - \begin{matrix}\text{Mean Milk EPD of} \\ \text{sires used at MARC}\end{matrix}\right]$$

where,

$b_{WW}$ = pooled within breed regression coefficient of calf weaning weight on the direct weaning weight EPD of the maternal grandsire (lb/lb), and

$b_{Milk}$ = pooled within breed regression coefficient of calf weaning weight on the milk EPD of the maternal grandsire (lb/lb).

## RESULTS AND DISCUSSION

Pooled within breed regressions (response in lb/lb EPD) were 1.08 for birth weight, .89 for weaning weight (direct) and 1.45 for yearling weight. These results are reasonably close to the theoretical expectation that a pound of performance in F1 crosses will result from each one pound of EPD of the sire, especially for birth weight and weaning weight. For yearling weight, Nunez-Dominguez et al. (1993) found the regression for steers (1.57) to be higher than for heifers (1.18). Possibly the heritability of yearling weight is greater for steers at MARC than for heifers at MARC, and higher for steers at MARC than for bulls or heifers produced in purebred herds involving diverse North American environments. Previous results have indicated higher heritability for steers than for bulls.

Mean EPD's of the sires from the most recent genetic analysis for the sires used at MARC are shown for each breed Table 3. Mean 1991 EPD's (all animal non-parent) from the most recent (1993) genetic evaluations of each breed are also shown in Table 3. Breed averages for progeny produced at MARC were adjusted for the difference between the average EPD of sires used at MARC (Table 3) and the 1991 average EPD for each breed (Table 3) using the appropriate pooled within breed regression coefficients and equations reported above. Thus, the breed means presented in Table 4 for birth weight, weaning weight, yearling weight, total maternal weaning weight (.5 direct + Milk), and net maternal weaning weight (milk) compare breeds on a 1991 basis. The year, 1991, was chosen as the base because yearling weight data were available on calves born in 1991 in the most recent genetic evaluations for each breed. Use of a more recent birth year would require extrapolation to a time when data were not yet available for yearling weight.

When sire breed means for birth weight, weaning weight and yearling weight were adjusted to a 1991 basis, the differences between breeds were smaller than estimates made earlier in the 1970's. For example, the range between Hereford-Angus and Charolais crosses by original sires used in the seventies was 11.2 lb, but the difference between current Hereford-Angus and Charolais crosses by sires born in the mid 1980's was 6.1 lb (see Cundiff et al., 1993, elsewhere in these proceedings). The latter estimate corresponds very closely to estimates adjusted to a 1991 (Table 4) between Charolais and the mean of Hereford and Angus sired progeny (6.8 lb). Similar trends have resulted for weaning weight and yearling weight. These results are consistent with genetic trend estimates for EPD's within breeds which indicate that breeds formerly of smaller size have placed primary emphasis on growth to weaning and yearling ages while breeds of largest size have placed relatively more emphasis on reducing increases in birth weight to improve calving ease.

Pooled within breed regressions (lb/lb) of calf weaning weight on direct weaning weight, and milk EPD's were .50 and 1.10, respectively. These estimates are also remarkably similar to the expected values of .5 for direct weaning weight, 1.0 for milk. Breed means for milk are estimated by an indirect procedure, just as EPD's for milk are estimated within breeds. Values for milk are computed as

$$\text{Milk} = (MW_i - MW) - (1/2)(W_i - W)$$

where $MW_i$ and MW are the mean for the ith breed and the mean overall breeds for maternal weaning weight (sire breed's daughters), respectively, and $W_i$ and W are the mean for the ith breed and the mean overall breeds for weaning weight (direct, sire breeds progeny), respectively.

The estimates of breed differences correspond reasonably closely to estimates from previous reports between reciprocal crosses of diverse biological types in previous studies (e.g., Pahnish et al., 1969; Gregory et al., 1978; Alenda et al., 1980). Current estimates for sire breeds transmitting ability for maternal effects expressed by their daughter (milk) are expected to be 1/2 the difference between reciprocal crosses.

The present estimates (1993) are more consistent with expectations based on previous experimental results than the estimates reported at the BIF meeting a year ago (Nunez et al., 1992) or those reported earlier by Notter et al. (1991). The present estimates involve a much larger data set for most breeds (Table 2) than corresponding numbers from last years analysis (Nunez et al., 1992):

| Breed | Maternal grandsires | Dams | Prog. |
|---|---|---|---|
| Angus | 20 | 86 | 357 |
| Hereford | 19 | 89 | 395 |
| Polled Hereford | 14 | 74 | 316 |
| Charolais | 33 | 119 | 538 |
| Limousin | 20 | 150 | 766 |
| Simmental | 27 | 152 | 796 |
| Gelbvieh | 11 | 77 | 439 |
| Shorthorn | 17 | 29 | 60 |
| Salers | 20 | 45 | 89 |

Many of the sires with known maternal EPD's were born in the mid 1980's and their daughters were born at MARC from 1986 to the present. Significant information on maternal performance of daughters is just now being added to the data base at MARC. Also, accuracy of maternal and Milk EPD's from each breed for sires used at MARC were greater for this years analysis than for previous analyses because significant information on maternal performance of the sires daughters is also just now being added to the data base of each breed. EPD's were available to include Brahman and Pinzgauer for the first time this year. The estimates for Brahman and Pinzgauer are expected to improve as additional data becomes available at MARC and in their respective breed data bases.

Across breed EPD's. The means presented in Tables 3 and 4 can be used to estimate across breed EPD's adjusted to a genetic base of 1991. Conversion factors can be added to EPD's of individuals in any given breed to compare directly to EPD's of some base breed. The adjustment factors can be calculated as follows:

$$A_i = (M_i - M_b) - (E_i - E_b)$$

Where:

$M_i$ = 1991 mean for ith breed (Table 4),
$M_b$ = 1991 mean for base breed (i.e., Angus, Table 4),
$E_i$ = Average 1991 EPD for ith breed (Table 3), and
$E_b$ = Average 1991 EPD for base breed (i.e., Angus, Table 3),

For example, in case of birth weight, using Charolais as the ith breed and Angus as the base breed:

$$A_i = (86.0 - 77.6) - (0.94 - 3.20)$$
$$= 10.7$$

Thus, the value of 10.7 should be added to Charolais EPD's to compare directly to Angus EPD's for birth weight.

The conversion factors obtained in this manner are useful only for adjusting EPD's to a common breed base. The conversion factors alone, can not be used to compare breeds, because the base (within breed EPD = 0) for different breeds is fixed at different points in time. However, if the conversion factors are added to the mean EPD of each breed (e.g., 1991 means in Table 3), the differences between breeds will equate to the differences between corresponding breed means in Table 4. This procedure was used to obtain the conversion factors used to estimate across breed EPD's in recent articles in Beef Today (e.g., Effertz 1993a, 1993b). In the Beef Today articles, Angus was chosen arbitrarily as the base breed, but any other breed or the average of all breeds could have been chosen as the base for across breed comparisons.

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TABLE 1. NUMBER OF SIRES WITH EPD'S FOR BIRTH WEIGHT, PROGENY PER SIRE BREED, AND TIME PERIODS WHEN THESE BREEDS WERE USED IN THE GPE PROGRAM

| | Number | | Cycle | | | | |
|---|---|---|---|---|---|---|---|
| | | | I | II | III | IV | V |
| Sire Breed | Sires | Prog. | (1970-72) | (1973-74) | (1975-76) | (1986-90) | (1992-94) |
| Angus | 61 | 675 | X[a,b] | X[a] | X[a] | X[a,e] | X[e,f] |
| Hereford | 36 | 516 | X[a,b] | X[a] | X[a] | X[a,e] | X[e,f] |
| P. Hereford | 27 | 262 | X[a,b] | X[a] | X[a] | X[a,e] | X[e,f] |
| Charolais | 57 | 523 | X[b] | | | X[e] | |
| Limousin | 20 | 378 | X[b] | | | | |
| Simmental | 28 | 411 | X[b] | | | | |
| Gelbvieh | 25 | 382 | | X[c] | | | |
| Maine Anjou | 15 | 174 | | X[c] | | | |
| Brahman | 19 | 195 | | | X[d] | | X[d,f] |
| Pinzgauer | 11 | 394 | | | X[d] | X[e] | |
| Shorthorn | 25 | 178 | | | | X[e] | |
| Salers | 27 | 184 | | | | X[e] | |

[a]Reference sires used in Cycle I, II, III, and IV.
[b]Sires used for first time in Cycle I.
[c]Sires used for first time in Cycle II.
[d]Sires used for first time in Cycle III.
[e]Sires used for first time in Cycle IV.
[f]Sires used for first time in Cycle V.

TABLE 2. NUMBER OF MATERNAL GRANDSIRES WITH EPD'S, DAMS AND PROGENY BY BREED OF MATERNAL GRANDSIRE, AND TIME PERIOD WHEN CALVES WERE BORN

| Breed | Number | | | |
|---|---|---|---|---|
| | Maternal grandsires | Dams | Prog. | Birth Year of Calves |
| Angus | 39 | 248 | 1083 | 1972-82, 1988-92 |
| Hereford | 34 | 210 | 861 | 1972-82, 1988-92 |
| Polled Hereford | 21 | 109 | 443 | 1974-82, 1988-92 |
| Charolais | 50 | 175 | 724 | 1972-79, 1988-92 |
| Limousin | 20 | 150 | 766 | 1972-79 |
| Simmental | 27 | 152 | 796 | 1972-79 |
| Gelbvieh | 25 | 142 | 592 | 1975-82 |
| Maine Anjou | | | | 1975-82 |
| Brahman | 6 | 37 | 186 | 1977-82 |
| Pinzgauer | 11 | 112 | 471 | 1977-82, 1988-92 |
| Shorthorn | 22 | 66 | 161 | 1988-92 |
| Salers | 25 | 85 | 232 | 1988-92 |

TABLE 3. MEAN EPD'S OF SIRES USED AT MARC AND 1991 ALL ANIMAL NONPARENT MEAN EPD'S FROM MOST RECENT EVALUATION (SPRING 1993) FOR EACH BREED

| | | | | | | | Maternal | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Birth weight | | Weaning weight | | Yearling weight | | Weaning weight | | Milk | |
| Breed | MARC | 1991 | MARC | 1991 | MARC | 1991 | MARC | 1991 | MARC | 1991 |
| P. Hereford | 1.74 | 3.30 | 5.3 | 21.0 | 9.7 | 33.8 | .8 | 11.1 | 1.0 | .6 |
| Hereford | 0.20 | 2.17 | 7.9 | 25.3 | 9.0 | 40.3 | 2.3 | 19.5 | -1.3 | 6.9 |
| Angus | 1.08 | 3.20 | 7.0 | 22.2 | 10.7 | 38.2 | 3.1 | 18.8 | 1.3 | 7.7 |
| Shorthorn | 1.27 | 1.80 | 8.2 | 11.1 | 16.6 | 18.3 | 11.7 | 7.5 | 7.3 | 2.0 |
| Brahman | 0.88 | 0.49 | 4.6 | 4.2 | 6.8 | 7.5 | 1.2 | 4.9 | .5 | 2.7 |
| Simmental | 0.52 | 0.50 | -12.5 | 5.8 | -22.0 | 10.0 | -8.2 | 2.7 | -2.0 | -.2 |
| Limousin | -.46 | 0.60 | -6.4 | 3.6 | -9.6 | 7.4 | -3.5 | 1.9 | -.2 | .1 |
| Charolais | 1.45 | 0.94 | 3.8 | 2.5 | 6.3 | 3.6 | .5 | -.6 | -.5 | -1.8 |
| Maine Anjou | 2.45 | 0.50 | 4.1 | 4.3 | 4.5 | 7.3 | * | * | * | * |
| Gelbvieh | -1.46 | 0.30 | -1.8 | 4.4 | -3.5 | 8.2 | -1.2 | 4.2 | .0 | 2.0 |
| Pinzgauer | -.08 | -1.10 | -6.4 | -.5 | -12.7 | -1.0 | 7.3 | -.5 | 9.4 | -.3 |
| Salers | 1.20 | 0.70 | 8.0 | 6.6 | 12.5 | 10.8 | 9.3 | 6.5 | 6.2 | 3.2 |

*EPD's not available.

TABLE 4. SIRE BREED MEANS ADJUSTED TO 1991 MEAN EPD

| Breed | Birth weight lb | Weaning weight lb | Yearling weight lb | Maternal Weaning weight lb | Maternal Milk lb |
|---|---|---|---|---|---|
| P. Hereford | 80.3 | 450 | 806 | 453 | -40 |
| Hereford | 81.4 | 442 | 800 | 473 | -16 |
| Angus | 77.6 | 441 | 810 | 480 | -8 |
| Shorthorn | 83.5 | 461 | 832 | 506 | 8 |
| Brahman | 87.8 | 447 | 744 | 517 | 26 |
| Simmental | 86.0 | 471 | 860 | 523 | 20 |
| Limousin | 83.1 | 450 | 798 | 480 | -13 |
| Charolais | 86.0 | 458 | 819 | 494 | -3 |
| Maine Anjou | 87.8 | 458 | 826 | * | * |
| Gelbvieh | 87.3 | 465 | 822 | 523 | 22 |
| Pinzgauer | 82.4 | 440 | 783 | 487 | -1 |
| Salers | 80.9 | 464 | 830 | 505 | 6 |

*EPD's not available.

# BREED COMPARISONS IN THE GERMPLASM EVALUATION PROGRAM AT MARC[1,2]

Larry V. Cundiff, Ferenc Szabo[3], Keith E. Gregory, R. M. Koch,
M. E. Dikeman[4], and J. D. Crouse

Agricultural Research Service
U.S. Department of Agriculture
Roman L. Hruska U.S. Meat Animal Research Center
Clay Center, Nebraska 68933

## Introduction

Breed differences in performance characteristics are an important genetic resource for improving efficiency of beef production. Diverse breeds are required to exploit heterosis and complementarity through crossbreeding and new composite breeds and to match genetic potential with diverse markets, feed resources and climates. This report presents results from the Germplasm Evaluation Program at the Roman L. Hruska U.S. Meat Animal Research Center (MARC) to characterize breeds of cattle representing diverse biological types for bioeconomic traits that influence quantity and value of production.

## Germplasm Evaluation Program

Table 1 shows the mating plan for the first four cycles of the Germplasm Evaluation Program. Topcross performance of 26 sire breeds have been evaluated in $F_1$ calves out of Hereford, Angus or crossbred dams. Hereford-Angus reciprocal crosses were produced in each cycle of the program. Some of the Angus and Hereford sires used

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[3]F. Szabo, a visiting scientist from the Pannon University of Agriculture, Keszthely, Hungary, assisted with data analysis.

[4]M. E. Dikeman, Professor of Meat Science, Kansas State University, assisted with collection of carcass data at Kansas State University in 1971-1977 and at MARC in 1986-1991.

in cycle I, were repeated as reference sires in cycle II, III and IV to provide ties for analysis of data pooled over all four cycles.

In cycle I, 32 Hereford (Horned and Polled), 35 Angus, 33 Jersey, 27 South Devon, 20 Limousin, 26 Charolais, and 27 Simmental sires were used by artificial insemination (AI) to produce progeny in 1970-1972. In cycle II, 16 of the Angus sires and 16 of the Hereford sires (reference sires repeated from Cycle I) and 16 Red Poll sires, 11 Brown Swiss sires (7 imported Braunvieh sires from Switzerland, 4 domestic), 11 Gelbvieh, 18 Maine Anjou, and 20 Chianina sires produced progeny in 1973-74. In cycle III, 13 Hereford and 14 Angus sires (reference sires repeated from cycle I) and 17 Brahman, 6 Sahiwal, 9 Pinzgauer, and 7 Tarentaise sires produced progeny in 1975-1976. In Cycle IV, semen from 14 Angus and 11 Hereford (reference sires repeated from Cycle I, born from 1963-1970), 30 current Angus (born 1982-1984), 32 current Hereford (14 horned and 18 polled, born 1982-1984), 29 Longhorn, 24 Piedmontese, 31 Charolais, 29 Salers, 31 Galloway, 22 Nellore, and 26 Shorthorn bulls produced progeny in 1986-1990. About 200 calves were produced by each sire breed. In cycle IV, following an AI period of about 45 days, one or two bulls each of Charolais, Gelbvieh, and Pinzgauer breeds were used each year by natural service in single-sire breeding pastures for about 21 days. These breeds were used in clean-up matings to increase ties to previous cycles and facilitate pooling of results over all four cycles.

Calves were born in the spring, beginning in March each year. Male calves were castrated within 24 hours of birth. Calves were creep fed (usually whole oats) from mid July or early August until weaning, usually in October (except in September, 1974 due to drought conditions). Following a postweaning adjustment period of about 25 to 40 days, steers were fed separately by sire breed in replicated pens for about 200 days. Averaged across years and feeding periods, the diet contained 1.27 MCal ME/lb, 12.8% crude protein, and 9.2% digestible protein. Representative samples of steers were slaughtered serially each year, in 3 to 4 slaughter groups spanning 56 to 84 days. The steers were slaughtered in commercial packing plants. Hot carcass weights were obtained and used to estimate dressing percent (100 X carcass weight/final live weight). After a 24-hour chill, USDA yield grade (fat thickness, ribeye area, estimated % kidney fat) and quality grade (marbling, maturity) data were obtained. The right side of each carcass was fabricated into boneless, retail product (including all steaks, roasts and lean trim {trimmed to 25% fat basis}), fat trim, and bone. Retail product, fat trim, and bone from the right side was doubled to estimate retail product yield from the carcass in terms of weight and as a percentage of cold carcass weight.

All $F_1$ females were retained to evaluate growth, age at puberty, reproduction and maternal performance through mature ages. Heifers, managed to be bred as yearlings and calve first at 2 years of age, were fed a diet of approximately 50% corn silage and 50% alfalfa or grass haylage plus protein or mineral supplement. Estrus was checked visually twice daily from an average age of about 250 days until the middle of the breeding season at about 420 days of age. Date at puberty was defined as date at first observed estrus confirmed by a subsequent estrus observed within 45 days. Females were mated to produce three-breed cross progeny. In cycle I, females were bred by AI to Hereford, Angus, Devon, Holstein and Brahman bulls to produce their first calves as 2-year-olds, by AI to Hereford, Angus, Gelbvieh, Maine Anjou, and Chianina sires to produce their second calves as 3-year-olds, and by natural service to Brown Swiss sires for their subsequent calves. In cycle II, females were bred by AI to Hereford, Angus, Santa Gertrudis and Brahman bulls to produce their first calves as 2-year-olds, and by natural service to Simmental sires for their subsequent calves. In cycles III and IV, females were bred by natural service to Red Poll sires to produce their first calves as 2-year-olds and to Simmental sires to produce subsequent calves through at least seven years of age.

Data from two-breed $F_1$ crosses (Phase 2 progeny out of Hereford and Angus dams, Table 1) were analyzed with mixed model procedures (Harvey, 1985) considering appropriate fixed effects (e.g., birth year, cow age, sex, breed of sire, breed of dam, and breed of sire X breed of dam) and random effects (sire nested within breed of sire to test breed of sire and residual variance to test other fixed effects). Data for Devon, Brangus, Santa Gertrudis, and Holstein crosses (phase 3, three-way crosses out of $F_1$ dams, Table 1) were pooled with data from the separate analysis for two-breed $F_1$ crosses by adding the average difference from contemporary Hereford and Angus sired three-way crosses to the mean of Hereford-Angus reciprocal $F_1$ crosses from the pooled analysis of phase 2 progeny.

Breed group means are presented for $F_1$ crosses grouped into seven biological types based on relative differences (X lowest, XXXXXX highest) in growth rate and mature size, lean-to-fat ratio, age at puberty and milk production (Table 2). Although straightbred Hereford and Angus were produced, their results are not presented because they did not have the benefit of heterosis. Thus, breed group means for all traits are for $F_1$ crosses that benefit from effects of heterosis, averaged over both Hereford and Angus dams. Means for current samples of Hereford, Angus and Charolais sires (sires born since 1983) are estimated separately from those by original sires (born in 1970 or earlier).

## Results

Breed group means are presented in Table 3 for gestation length, unassisted births (for cows calving at 4 years of age or older), calf survival from birth to weaning, birth weight and 200-day weaning weight. Data for unassisted births are for cows calving at 4 years of age or older to conform to cow ages available in all cycles. This was necessary because cow age X breed of sire interaction effects were significant for unassisted births in analysis of cycle I data and no 2-year-old cows were included in cycles II, III and IV and no 3-year-old cows were included in cycles II and III of the program. There were significant differences among breeds for all birth and weaning traits. Breeds with the heaviest weights at birth and weaning tended to have more calving difficulty than those with lower growth potential. Calf survival tended to be lower in breeds requiring more assistance at birth.

Breed group means for postweaning average daily gain, final weight, dressing percent, marbling score (slight = 400 to 499; small = 500 to 599) and percentage grading USDA Choice or higher are shown in Table 4. Breed group means for carcass weight, fat thickness, rib eye area, and kidney-pelvic-heart fat percentage (estimated and actual) are presented in Table 5. Breed group means for retail product, fat trim and bone presented as a percentage of carcass weight are presented in Table 6. Weight of retail product, fat trim and bone adjusted to the average slaughter age of 450 days are also presented in Table 6. There were significant differences among all sire breeds for carcass and meat traits. Breeds that ranked highest for percentage retail product tended to have lower levels of marbling. Progeny by current sires versus progeny by original sires of the Hereford and Angus breeds indicate that live weights and retail product, fat trim and bone weights have increased significantly at a constant age. However, carcass composition (retail product, fat trim and bone expressed as a percentage of carcass weight) and other carcass traits have not changed in Herefords and Angus between the late 1960's and the mid 1980's.

Breed group means are presented in Table 7 for 400-day and 550-day weight, percent expressing puberty, age at puberty, and pregnancy rate. Actual age at puberty is for heifers expressing a first estrus (ranging from 58.5 to 100%). Adjusted age at puberty is adjusted to a 100 percent expression basis assuming an underlying normal distribution. Breed group means differed significantly for all growth and puberty traits of heifers. Heifers sired by bulls of breeds with large mature size (e.g., Charolais, Chianina) tended to be older at puberty than heifers sired by bulls of breeds with smaller mature size (Hereford, Angus). However, the relationship between mature size and age at puberty can be offset by associations with milk production. Breeds which have been selected for milk production reach puberty earlier than breeds of similar mature size and lean growth potential that do not have a history of selection for milk production (e.g., Braunvieh, Gelbvieh, Holstein, Simmental, and Salers versus Charolais and Chianina). Also, the Bos indicus breeds (Brahman, Sahiwal, and Nellore), which were older than all other breeds in age at puberty, appear to have been subjected to selection pressures that set them apart from Bos taurus breeds for age at which they exhibit their first estrus. Although age at puberty differed significantly among breeds, conception rate in yearling heifers did not differ consistently between breed groups reaching puberty at the oldest ages from those breed groups reaching puberty at the youngest ages. For example, conception rate of Brahman and Sahiwal cross heifers was very high in spite of their older age at puberty. Heifers in all breed groups were grown and developed under dry lot conditions on a moderately high energy diet (about 1.0 Mcal metabolizable energy [ME] per lb) and conception rate was not limited by variation observed among breed groups in age at puberty. Heifers developed more slowly on diets with lower energy density, have been shown to exhibit puberty at significantly older ages and have lower conception rates when exposed to breeding as yearlings than heifers developed more rapidly.

Breed group means for reproduction and maternal traits of $F_1$ females are shown in Table 8. It should be emphasized that results for females produced in cycle IV of the program are preliminary (i.e., females born in 1990 have only been evaluated as 2-year-olds, females born in 1989 have been evaluated as 2- and 3-year-olds,..., females born in 1986 have been evaluated as 2- through 6-year-olds). Means for traits such as conception rate, percentage calf crop born and weaned, and percentage calvings unassisted are likely to change as additional data accumulate. The relationship between birth weight and unassisted calvings is much lower when evaluated as a maternal trait in $F_1$ daughters than when evaluated directly in $F_1$ progeny (Table 3) of diverse breeds. For example, progeny of Chianina, current Charolais, Salers, Maine Anjou, Braunvieh, and Shorthorn dams were relatively heavy at birth but above average in unassisted births. Also, progeny of Hereford-Angus cross females by current sires were heavier than those by original sires but calving assistance was similar. Females by Bos indicus sire breeds (Brahman, Sahiwal and Nellore) and by Jersey and Longhorn sires had progeny with relatively light birth weights and excelled in calving ease. Breed group differences in weaning weight of progeny are strongly associated with genetic potential for growth and milk production of the diverse biological types.

No one breed excels in all traits that are important to beef production. Crossbreeding systems that exploit heterosis and complementarity and match genetic potential with market targets, feed resources and climates provide the most effective means of breeding for production efficiency.

TABLE 1. SIRE BREEDS USED IN THE FIRST FOUR CYCLES OF THE GERMPLASM EVALUATION PROGRAM AT THE ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER

| Cycle I (1970-72) | Cycle II (1973-74) | Cycle III (1975-76) | Cycle IV (1986-90) |
|---|---|---|---|
| F1 crosses from Hereford or Angus dams (Phase 2) | | | |
| Hereford | Hereford | Hereford | Hereford |
| Angus | Angus | Angus | Angus |
| Jersey | Red Poll | Brahman | Longhorn |
| S. Devon | Braunvieh | Sahiwal | Salers |
| Limousin | Gelbvieh | Pinzgauer | Galloway |
| Simmental | Maine Anjou | Tarentaise | Nellore |
| Charolais | Chianina | | Piedmontese |
| | | | Charolais |
| | | | Gelbvieh |
| | | | Pinzgauer |
| 3-way crosses out of F1 dams (Phase 3) | | | |
| Hereford | Hereford | | |
| Angus | Angus | | |
| Brahman | Brangus | | |
| Devon | Santa Gertrudis | | |
| Holstein | | | |

[a]Hereford and Angus sires originally sampled in 1969, 1970 and 1971 (born in 1963-1970) were used throughout Cycles I, II, III and IV. In Cycle IV, a new sample of Hereford and Angus sires produced in 1982, 1983, and 1984 were used and compared to the original Hereford and Angus sires.

TABLE 2. BREEDS GROUPED INTO BIOLOGICAL TYPES FOR FOUR CRITERIA[a]

| Breed group | Growth rate and mature size | Lean to fat ratio | Age at puberty | Milk production |
|---|---|---|---|---|
| Jersey (J) | X | X | X | XXXXX |
| Longhorn (Lh) | X | XXX | XXX | XX |
| Hereford-Angus (HAx) | XXX | XX | XXX | XX |
| Red Poll (R) | XX | XX | XX | XXX |
| Devon (D) | XX | XX | XXX | XX |
| Shorthorn (Sh) | XXX | XX | XXX | XXX |
| Galloway (Gw) | XX | XXX | XXX | XX |
| South Devon (Sd) | XXX | XXX | XX | XXX |
| Tarentaise (T) | XXX | XXX | XX | XXX |
| Pinzgauer (P) | XXX | XXX | XX | XXX |
| Brangus (Bn) | XXX | XX | XXXX | XX |
| Santa Gert. (Sg) | XXX | XX | XXXX | XX |
| Sahiwal (Sw) | XX | XXX | XXXXX | XXX |
| Brahman (Bm) | XXXX | XXX | XXXXX | XXX |
| Nellore (N) | XXXX | XXX | XXXXX | XXX |
| Braunvieh (B) | XXXX | XXXX | XX | XXXX |
| Gelbvieh (G) | XXXX | XXXX | XX | XXXX |
| Holstein (Ho) | XXXX | XXXX | XX | XXXXX |
| Simmental (S) | XXXXX | XXXX | XXX | XXXX |
| Maine Anjou (M) | XXXXX | XXXX | XXX | XXX |
| Salers (Sa) | XXXXX | XXXX | XXX | XXX |
| Piedmontese (Pm) | XXX | XXXXXX | XX | XX |
| Limousin (L) | XXX | XXXXX | XXXX | X |
| Charolais (C) | XXXXX | XXXXX | XXXX | X |
| Chianina (Ci) | XXXXX | XXXXX | XXXX | X |

[a]Increasing number of X's indicate relatively higher values.

TABLE 3. SIRE BREED OF CALF BREED GROUP
MEANS FOR BIRTH AND WEANING TRAITS

| Breed group | Number calves born | Gestation length days | Unassisted births % | Survival to wean. % | Birth weight lb | 200-day weight lb |
|---|---|---|---|---|---|---|
| Jersey | 301 | 282.0 | 101.8 | 94.0 | 66.1 | 408 |
| Longhorn | 200 | 286.8 | 97.9 | 91.4 | 66.1 | 406 |
| | | | | | | |
| Orig. HAx | 1177 | 283.2 | 94.8 | 95.7 | 75.2 | 432 |
| Curr. HAx | 102 | 283.1 | 92.7 | 91.5 | 80.4 | 458 |
| Red Poll | 212 | 284.6 | 99.9 | 95.7 | 75.7 | 426 |
| Devon | 139 | 283.3 | 94.0 | 96.0 | 75.4 | 445 |
| Shorthorn | 181 | 284.0 | 97.6 | 91.9 | 82.4 | 460 |
| Galloway | 172 | 285.7 | 95.8 | 92.9 | 76.4 | 429 |
| | | | | | | |
| South Devon | 240 | 286.0 | 90.0 | 90.3 | 79.7 | 435 |
| Tarentaise | 199 | 287.0 | 93.4 | 94.0 | 81.1 | 446 |
| Pinzgauer | 595 | 285.2 | 92.0 | 93.7 | 84.0 | 445 |
| | | | | | | |
| Brangus | 119 | 284.7 | 93.8 | 94.7 | 77.4 | 439 |
| Santa Gertrudis | 109 | 285.2 | 93.2 | 93.7 | 82.3 | 443 |
| Sahiwal | 321 | 293.7 | 91.3 | 94.1 | 84.1 | 432 |
| Brahman | 343 | 290.9 | 88.6 | 92.6 | 89.0 | 460 |
| Nellore | 196 | 293.0 | 92.7 | 91.4 | 86.6 | 474 |
| | | | | | | |
| Braunvieh | 260 | 284.1 | 94.5 | 95.1 | 82.7 | 453 |
| Gelbvieh | 438 | 285.6 | 94.1 | 91.0 | 83.8 | 456 |
| Holstein | 143 | 281.0 | 92.6 | 93.8 | 78.1 | 450 |
| Simmental | 421 | 286.4 | 89.2 | 88.8 | 84.9 | 458 |
| Maine Anjou | 218 | 284.8 | 79.4 | 88.9 | 88.0 | 456 |
| Salers | 189 | 284.8 | 95.2 | 91.7 | 80.9 | 464 |
| | | | | | | |
| Piedmontese | 200 | 287.2 | 92.5 | 91.1 | 80.2 | 452 |
| Limousin | 387 | 288.1 | 91.8 | 90.8 | 80.6 | 443 |
| Orig. Charolais | 404 | 286.2 | 83.5 | 85.8 | 86.4 | 461 |
| Curr. Charolais | 90 | 285.8 | 86.8 | 89.5 | 86.5 | 479 |
| Chianina | 238 | 286.7 | 88.4 | 89.3 | 86.9 | 459 |

TABLE 4. BREED GROUP MEANS FOR GROWTH AND CARCASS TRAITS OF STEERS

| Breed group | Number | Average daily gain lb | Final weight lb | Dress. pct. % | Marb-ling[a] sc | USDA Choice % |
|---|---|---|---|---|---|---|
| Jersey | 130 | 2.35 | 1008 | 59.8 | 618 | 82.3 |
| Longhorn | 92 | 2.19 | 960 | 60.6 | 526 | 56.6 |
| Orig. HAx | 539 | 2.51 | 1068 | 61.1 | 551 | 74.5 |
| Curr. HAx | 34 | 2.74 | 1152 | 61.2 | 543 | 70.7 |
| Red Poll | 109 | 2.35 | 1025 | 60.9 | 535 | 61.8 |
| Devon | 55 | 2.32 | 1034 | 60.7 | 517 | ---- |
| Shorthorn | 95 | 2.73 | 1156 | 61.0 | 566 | 74.7 |
| Galloway | 75 | 2.39 | 1032 | 61.2 | 529 | 58.1 |
| South Devon | 95 | 2.63 | 1091 | 61.4 | 554 | 72.6 |
| Tarentaise | 102 | 2.49 | 1079 | 61.1 | 510 | 49.3 |
| Pinzgauer | 226 | 2.55 | 1090 | 60.0 | 540 | 61.4 |
| Brangus | 52 | 2.49 | 1067 | 60.9 | 531 | 59.1 |
| Santa Gertrudis | 62 | 2.62 | 1109 | 61.7 | 538 | 58.1 |
| Sahiwal | 140 | 2.30 | 1028 | 61.6 | 492 | 42.8 |
| Brahman | 126 | 2.49 | 1098 | 62.1 | 482 | 39.7 |
| Nellore | 97 | 2.44 | 1094 | 63.3 | 505 | 44.0 |
| Braunvieh | 116 | 2.60 | 1109 | 60.6 | 518 | 59.4 |
| Simmental | 172 | 2.73 | 1148 | 60.5 | 510 | 63.4 |
| Holstein | 72 | 2.59 | 1089 | 59.1 | 497 | ---- |
| Gelbvieh | 212 | 2.66 | 1129 | 60.8 | 507 | 45.2 |
| Maine Anjou | 106 | 2.72 | 1147 | 61.5 | 501 | 49.5 |
| Salers | 77 | 2.70 | 1148 | 61.4 | 515 | 44.5 |
| Piedmontese | 80 | 2.49 | 1086 | 62.7 | 510 | 41.7 |
| Limousin | 173 | 2.49 | 1080 | 61.7 | 477 | 43.8 |
| Orig. Charolais | 175 | 2.77 | 1160 | 61.1 | 528 | 64.7 |
| Curr. Charolais | 43 | 2.89 | 1219 | 61.0 | 523 | 58.9 |
| Chianina | 114 | 2.63 | 1124 | 61.6 | 448 | 27.5 |

[a]Slight = 400 to 499, Small = 500 to 599, etc.

TABLE 5. BREED GROUP MEANS FOR CARCASS TRAITS OF STEERS

| Breed group | Number | Carcass weight lb | Fat thickness in | Rib eye area sq in | Kid. pelv. & heart fat estimated % | Kid. pelv. & heart fat actual % |
|---|---|---|---|---|---|---|
| Jersey | 130 | 603 | 0.44 | 10.32 | 4.92 | 5.43 |
| Longhorn | 92 | 582 | 0.37 | 10.74 | 3.52 | 4.20 |
| | | | | | | |
| Orig. HAx | 539 | 654 | 0.62 | 10.85 | 3.16 | 3.38 |
| Curr. HAx | 34 | 707 | 0.63 | 11.19 | 3.26 | 3.24 |
| Red Poll | 109 | 626 | 0.52 | 10.67 | 3.86 | 4.33 |
| Devon | 55 | 637 | 0.53 | 10.69 | 3.33 | ---- |
| Shorthorn | 95 | 707 | 0.49 | 11.08 | 3.42 | 3.71 |
| Galloway | 75 | 633 | 0.48 | 11.28 | 3.13 | 3.44 |
| | | | | | | |
| South Devon | 95 | 672 | 0.50 | 11.33 | 3.72 | 4.14 |
| Tarentaise | 102 | 660 | 0.42 | 11.22 | 3.95 | 4.29 |
| Pinzgauer | 226 | 655 | 0.43 | 11.28 | 3.50 | 3.82 |
| | | | | | | |
| Brangus | 52 | 653 | 0.54 | 10.35 | 3.26 | ---- |
| Santa Gertrudis | 62 | 683 | 0.57 | 10.45 | 3.26 | ---- |
| | | | | | | |
| Sahiwal | 140 | 634 | 0.52 | 10.81 | 3.32 | 3.42 |
| Brahman | 126 | 683 | 0.53 | 11.10 | 3.60 | 3.61 |
| Nellore | 97 | 695 | 0.49 | 11.33 | 3.47 | 3.71 |
| | | | | | | |
| Braunvieh | 116 | 673 | 0.41 | 11.65 | 3.35 | 4.42 |
| Gelbvieh | 212 | 686 | 0.39 | 12.00 | 3.40 | 3.62 |
| Simmental | 172 | 695 | 0.37 | 11.87 | 3.27 | 3.73 |
| Holstein | 68 | 661 | 0.40 | 10.75 | 2.74 | ---- |
| Maine Anjou | 106 | 705 | 0.38 | 12.28 | 3.11 | 3.37 |
| Salers | 77 | 707 | 0.41 | 11.96 | 3.40 | 3.57 |
| | | | | | | |
| Piedmontese | 80 | 683 | 0.31 | 13.19 | 3.03 | 3.35 |
| Limousin | 173 | 667 | 0.39 | 12.28 | 3.26 | 3.54 |
| Orig. Charolais | 175 | 710 | 0.37 | 12.39 | 3.19 | 3.63 |
| Curr. Charolais | 43 | 747 | 0.36 | 12.56 | 3.39 | 3.53 |
| Chianina | 114 | 692 | 0.32 | 12.43 | 2.89 | 3.02 |

TABLE 6. BREED GROUP MEANS FOR CARCASS TRAITS OF STEERS[a]

| Breed group | Number | Retail product % | Fat trim % | Bone % | Retail product lb | Fat trim lb | Bone lb |
|---|---|---|---|---|---|---|---|
| Jersey | 130 | 66.9 | 20.7 | 12.4 | 389 | 121 | 72.1 |
| Longhorn | 92 | 69.4 | 18.0 | 12.6 | 390 | 103 | 71.0 |
| Orig. HAx | 539 | 67.1 | 21.0 | 12.0 | 422 | 135 | 75.2 |
| Curr. HAx | 34 | 67.2 | 20.4 | 12.3 | 461 | 141 | 84.1 |
| Red Poll | 109 | 67.4 | 20.1 | 12.5 | 407 | 124 | 75.0 |
| Devon | 55 | 68.5 | ---- | ---- | 419 | ---- | ---- |
| Shorthorn | 95 | 67.0 | 20.1 | 12.9 | 456 | 139 | 88.2 |
| Galloway | 75 | 69.7 | 17.8 | 12.5 | 426 | 110 | 76.0 |
| South Devon | 95 | 68.1 | 19.6 | 12.3 | 441 | 130 | 79.4 |
| Tarentaise | 102 | 69.2 | 18.3 | 12.4 | 441 | 119 | 78.9 |
| Pinzgauer | 226 | 69.3 | 17.7 | 13.0 | 437 | 114 | 82.0 |
| Brangus | 52 | 66.8 | ---- | ---- | 421 | ---- | ---- |
| Santa Gertrudis | 62 | 67.3 | ---- | ---- | 443 | ---- | ---- |
| Sahiwal | 140 | 69.2 | 18.5 | 12.3 | 424 | 115 | 75.2 |
| Brahman | 126 | 69.2 | 18.3 | 12.5 | 456 | 123 | 82.0 |
| Nellore | 97 | 69.2 | 18.4 | 12.4 | 465 | 125 | 82.7 |
| Braunvieh | 116 | 69.5 | 17.2 | 13.4 | 449 | 116 | 86.3 |
| Gelbvieh | 212 | 70.2 | 16.8 | 13.0 | 463 | 113 | 85.5 |
| Holstein | 68 | 71.8 | ---- | ---- | 478 | ---- | ---- |
| Simmental | 172 | 70.1 | 16.5 | 13.4 | 469 | 115 | 89.1 |
| Maine Anjou | 106 | 70.1 | 16.4 | 13.5 | 477 | 113 | 91.2 |
| Salers | 77 | 70.0 | 17.1 | 12.9 | 478 | 117 | 88.1 |
| Piedmontese | 80 | 73.4 | 14.3 | 12.3 | 485 | 94 | 80.4 |
| Limousin | 173 | 71.5 | 15.9 | 12.6 | 459 | 106 | 81.0 |
| Orig. Charolais | 175 | 71.1 | 16.0 | 12.9 | 486 | 113 | 88.3 |
| Curr. Charolais | 43 | 70.2 | 16.4 | 13.4 | 506 | 118 | 96.3 |
| Chianina | 114 | 71.9 | 13.9 | 14.2 | 479 | 96 | 94.0 |

[a]Estimates of retail product weight and percentage for Devon, Brangus, Santa Gertrudis and Holstein sired progeny were obtained from multiple regression prediction equations reported by Crouse and Dikeman (1976; J. Anim. Sci. 42:584).

TABLE 7. BREED GROUP MEANS FOR GROWTH AND PUBERTY TRAITS OF HEIFERS

| Breed group | Number | 400-day weight lb | 550-day weight lb | Puberty expressed % | Age at puberty days | Preg. rate % |
|---|---|---|---|---|---|---|
| Jersey | 114 | 650 | 735 | 97.4 | 317 | 88.4 |
| Longhorn | 82 | 633 | 742 | 82.0 | 370 | 90.9 |
| Orig. HAx | 414 | 706 | 799 | 92.2 | 365 | 87.9 |
| Curr. HAx | 55 | 747 | 850 | 97.3 | 366 | 80.1 |
| Red Poll | 93 | 672 | 768 | 90.2 | 353 | 83.6 |
| Devon | 67 | 711 | 805 | 93.0 | 364 | 89.4 |
| Shorthorn | 73 | 769 | 867 | 95.8 | 359 | 89.0 |
| Galloway | 76 | 688 | 777 | 95.1 | 365 | 80.7 |
| South Devon | 118 | 726 | 813 | 96.0 | 352 | 84.5 |
| Tarentaise | 83 | 713 | 821 | 97.6 | 358 | 94.4 |
| Pinzgauer | 209 | 736 | 839 | 94.5 | 343 | 93.9 |
| Brangus | 63 | 735 | 823 | 92.2 | 385 | 85.5 |
| Santa Gertrudis | 41 | 739 | 838 | 90.0 | 391 | 92.7 |
| Sahiwal | 86 | 657 | 780 | 92.3 | 427 | 102.0 |
| Brahman | 101 | 733 | 865 | 93.5 | 439 | 94.3 |
| Nellore | 82 | 727 | 846 | 58.5 | 412 | 89.9 |
| Braunvieh | 129 | 720 | 826 | 90.0 | 346 | 91.6 |
| Gelbvieh | 185 | 725 | 836 | 87.1 | 341 | 87.4 |
| Holstein | 50 | 750 | 863 | 92.2 | 347 | 94.8 |
| Simmental | 155 | 749 | 844 | 94.4 | 360 | 86.4 |
| Maine Anjou | 88 | 753 | 861 | 90.6 | 370 | 92.8 |
| Salers | 90 | 763 | 873 | 101.0 | 365 | 89.0 |
| Piedmontese | 89 | 703 | 805 | 98.2 | 348 | 95.5 |
| Limousin | 155 | 717 | 797 | 88.0 | 391 | 83.7 |
| Orig. Charolais | 126 | 744 | 849 | 87.0 | 393 | 81.0 |
| Curr. Charolais | 36 | 781 | 903 | 96.3 | 361 | 79.0 |
| Chianina | 94 | 734 | 854 | 83.8 | 400 | 84.0 |

TABLE 8. BREED GROUP MEANS FOR REPRODUCTION AND MATERNAL PERFORMANCE OF CROSSBRED COWS

| | | | | | | 200 day weight | |
|---|---|---|---|---|---|---|---|
| Breed group | Number births | Born % | Weaned % | Calvings unassisted % | Birth wt lb | per calf weaned lb | per cow exposed lb |
| Jersey | 628 | 90 | 84 | 93 | 79 | 493 | 417 |
| Longhorn | 266 | 95 | 86 | 94 | 82 | 465 | 399 |
| | | | | | | | |
| Orig. HAx | 1,685 | 91 | 84 | 87 | 86 | 475 | 401 |
| Curr. HAx | 169 | 88 | 79 | 87 | 88 | 504 | 399 |
| Red Poll | 461 | 90 | 79 | 86 | 89 | 502 | 396 |
| Devon | 242 | 91 | 85 | 91 | 87 | 476 | 405 |
| Shorthorn | 183 | 93 | 87 | 90 | 94 | 529 | 460 |
| Galloway | 240 | 87 | 78 | 90 | 84 | 460 | 357 |
| | | | | | | | |
| South Devon | 603 | 88 | 85 | 85 | 91 | 492 | 419 |
| Tarentaise | 369 | 91 | 85 | 90 | 88 | 524 | 445 |
| Pinzgauer | 508 | 93 | 85 | 87 | 91 | 509 | 432 |
| | | | | | | | |
| Brangus | 238 | 90 | 86 | 86 | 87 | 495 | 425 |
| Santa Gertrudis | 170 | 90 | 82 | 94 | 84 | 504 | 413 |
| | | | | | | | |
| Sahiwal | 431 | 95 | 89 | 98 | 76 | 502 | 446 |
| Brahman | 519 | 94 | 86 | 99 | 83 | 539 | 463 |
| Nellore | 254 | 93 | 83 | 97 | 79 | 523 | 434 |
| | | | | | | | |
| Braunvieh | 681 | 92 | 85 | 92 | 91 | 534 | 454 |
| Gelbvieh | 429 | 95 | 87 | 89 | 90 | 533 | 464 |
| Holstein | 171 | 93 | 92 | 85 | 92 | 535 | 492 |
| Simmental | 872 | 89 | 83 | 83 | 91 | 521 | 433 |
| Maine Anjou | 468 | 94 | 86 | 89 | 96 | 522 | 449 |
| Salers | 263 | 92 | 86 | 92 | 90 | 527 | 453 |
| | | | | | | | |
| Piedmontese | 294 | 93 | 84 | 84 | 88 | 498 | 417 |
| Limousin | 851 | 89 | 82 | 88 | 88 | 484 | 397 |
| Orig. Charolais | 693 | 88 | 80 | 85 | 93 | 503 | 403 |
| Curr. Charolais | 264 | 89 | 80 | 91 | 91 | 507 | 404 |
| Chianina | 475 | 93 | 86 | 92 | 95 | 523 | 454 |

## 1991 AVERAGE EPD's FOR EACH BREED

For selection of breeding stock, it is important to know how EPD's for an individual animal compare to the current breed average. Mean non-parent expected progeny differences (EPD's) are tabulated for each breed. These are useful for making comparisons within breeds. They cannot be used to compare different breeds because EPD's are estimated from separate analyses for each breed. The means are for all calves born in 1991 from the 1992 genetic evaluations. The 1991 calves were chosen because limited data were available on 1992 calves in the 1992 genetic evaluations.

### 1991 ALL ANIMAL NON-PARENT MEAN EPD'S FROM 1992 GENETIC EVALUATIONS

| Breed | Birth wt | Wean. wt | Yrlg. wt | Maternal Milk | Maternal Total | Yrlg. ht | Scrot. circ. | Calving ease Direct | Calving ease Maternal |
|---|---|---|---|---|---|---|---|---|---|
| | lb | lb | lb | lb | lb | in | cm | % | % |
| Angus | 3.2 | 22.2 | 38.2 | 7.7 | | | | | |
| Beefmaster | .2 | 5.0 | 11.0 | 4.8 | | | | | |
| Brahman | .49 | 4.25 | 7.50 | 2.74 | | | | | |
| Brangus | 1.5 | 16.1 | 25.9 | .52 | 8.6 | | | | |
| Charolais | .94 | 2.54 | 3.64 | -1.85 | -.58 | | | | |
| Chianina | | -.9 | | | -.6 | | | | |
| Gelbvieh | .3 | 4.4 | 8.2 | 2.0 | 4.2 | | | 100.5[a] | 101.2[a] |
| Hereford | 2.17 | 25.29 | 40.34 | 6.89 | 19.53 | .61 | .19 | | |
| Limousin | .6 | 3.6 | 7.4 | .1 | | | | | |
| Maine Anjou | .5 | 4.3 | 7.3 | | | | | | |
| P. Hereford | 3.3 | 21.0 | 33.8 | 0.6 | 11.1 | | .02 | | |
| Pinzgauer | -1.1 | -.5 | -1.0 | -.3 | | | | | |
| Red Angus | .36 | 17.4 | 27.2 | 7.5 | | | | | |
| Salers | 0.7 | 6.6 | 10.8 | 3.2 | 6.5 | | | | |
| Shorthorn | 1.8 | 11.1 | 18.3 | 2.0 | | | | | |
| Simmental | .5 | 5.8 | 10.0 | -.2 | 2.7 | | | 1.0[a] | 1.8[a] |

[a]For Simmental, calving ease is percentage unassisted births in first calf heifers. For Gelbvieh, calving ease is a ratio (%) of calving ease scores in first calf heifers.

| Agriculture Canada - Spring 1993<br>Mean EPDs for Calves Born in 1991 (Base Adjusted) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | TRAIT | | | | | | |
| BRD | N | CE | BW | WG | YG | M-EC | M-BW | M-WG |
| HE | 28297 | 0.0 | -0.1 | -0.1 | -0.4 | 0.0 | 0.0 | 0.0 |
| MS | 939 | 0.1 | -0.1 | 0.1 | -0.2 | -0.1 | 0.0 | 0.0 |
| CH | 29529 | 0.0 | 0.1 | 0.0 | -0.1 | 0.0 | 0.0 | 0.2 |
| AN | 12999 | 0.1 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | -0.1 |
| LM | 18295 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | -0.1 | 0.0 |
| GV | 475 | 0.0 | 0.2 | 1.5 | 2.4 | 0.0 | 0.0 | -0.7 |
| BD | 1927 | 0.0 | 0.0 | -0.1 | -0.2 | 0.1 | 0.0 | -0.1 |
| SM | 32944 | 0.0 | -0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 |
| TA | 322 | -0.1 | 0.0 | 0.3 | 0.5 | 0.0 | 0.0 | -0.1 |
| SA | 1163 | -0.1 | 0.1 | 0.5 | 0.7 | 0.0 | 0.0 | -0.1 |
| PZ | 20 | -0.9 | 0.3 | -2.9 | -3.5 | 0.3 | 0.1 | 2.3 |
| MA | 886 | 0.0 | 0.0 | 0.2 | -0.2 | 0.0 | 0.0 | -0.2 |
| GA | 225 | 0.0 | 0.2 | -0.5 | -1.1 | 0.0 | 0.0 | 0.6 |
| CA | 76 | 0.0 | 0.0 | -2.0 | -3.6 | 0.0 | 0.0 | 1.1 |

**Breed codes**
HE=Hereford, MS=Shorthorn, CH=Charolais, AN=Aberdeen Angus, LM = Limousin, GV=Gelbvieh, BD=Blonde D'Aquitanine, SM=Simmental, TA=Tarentaise, SA=Salers, PZ=Pinzgauer, MA=Maine Anjou, GA=Galloway, CA=Chianina.

**Trait codes**
CE=Calving Ease, BW=Birth weight, WG=Weaning gain, YG=Yearling gain, M-EC=Maternal calving ease, M-BW=Maternal birth weight, M-WG = Maternal weaning gain.

# ACCURACY OF INTER-BREED COMPARISONS

L. D. VAN VLECK
Roman L. Hruska U.S. Meat Animal Research Center, ARS-USDA
A218 Animal Sciences, University of Nebraska, Lincoln, 68583-0908

## WITHIN BREED ACCURACY

The two usual measures of reliability for genetic evaluations are accuracy and confidence ranges. Accuracy is usually defined as the correlation between predicted and true value, $r_{TI}$ or $r_{G\hat{G}}$ (r will be used here). The Beef Improvement Federation manual of guidelines, however, defines accuracy as:

$$ACC^* = 1 - \sqrt{\frac{\text{Prediction Error Variance}}{\sigma_a^2}}$$

where $\sigma_a^2 = \sigma_g^2$ is the additive genetic variance when predicting additive value or $\sigma_a^2 = \sigma_s^2 = \sigma_g^2/4$ for a sire model.

If the prediction error variance (PEV) is exact, this formula reduces to:

$$ACC^* = 1 - \sqrt{1 - r^2}$$

The confidence range on genetic value given the prediction of genetic value depends on the standard error of prediction (SEP) which is the square root of prediction error variance. Prediction error variance is obtained from the appropriate diagonal element of the inverse of the coefficient matrix for the evaluation equations -- the mixed model or BLUP equations. An algebraic identity is that

PEV = $(1 - r^2)\sigma_g^2$ for the animal model prediction of genetic value or

PEV = $(1 - r^2)\sigma_s^2$ where $\sigma_s^2 = \sigma_g^2/4$ is the sire component of variance for predicting progeny differences (i.e., transmitting ability). The 68% confidence range for true PD given the EPD is:

$$EPD \pm t\sqrt{(1 - r^2)\sigma_s^2} \quad \text{with } t = 1.$$

For an 80% range, t = 1.28; 90% range, t = 1.65; and for a 95% range, t = 1.96 (approximately 2).

Although the preceding procedures are usually taught, both are based on an often neglected assumption. A basic principle of animal breeding is that only differences in breeding values or progeny differences can be predicted. Accuracies and confidence ranges for prediction of differences between animals can be computed but are possibly more confusing.

For example, $EPD_1$ - $EPD_2$ predicts the difference in progeny of bulls 1 and 2 when the bulls are mated to a random group of cows. The variance of the prediction error of the difference is:

$V[(EPD_1 - EPD_2) - (PD_1 - PD_2)]$ which can be rewritten as:

$V[(EPD_1 - PD_1) - (EPD_2 - PD_2)]$ where $PD_1$ - $PD_2$ is the true difference in progeny differences (transmitting abilities), i.e., $EPD_1$ - $EPD_2$ is the predicted difference between progeny of the two bulls, and thus, $(EPD_1 - EPD_2) - (PD_1 - PD_2)$ is the error of predicting the progeny difference between bulls 1 and 2.

The idea of prediction error is not difficult to understand but does involve a difference. The idea of the prediction error (a difference) of a difference is somewhat more difficult to explain. Perhaps for this reason evaluations are usually expressed as a difference from a "zero" animal. The "zero" animal is not always well described but almost invariably is an "average" animal of some kind -- the average of some base group of animals. Thus, the prediction is:

$EPD_1 - \overline{EPD}_{BASE}$, e.g., $\overline{EPD}_{BASE}$ is the 'zero' bull, because $\overline{EPD}_{BASE}$ is forced to be zero by the evaluation procedure.

The prediction error variance of this difference is:

$$V[(EPD_1 - PD_1) - (\overline{EPD}_B - \overline{PD}_B)].$$

Fortunately,

$V(\overline{EPD}_B - \overline{PD}_B) \sim 0$ with a large base group such as those born in 1990.

The variance of prediction error of the difference is approximately:

$V(EPD_1 - PD_1) + 0 \sim (1 - r_1^2)\sigma_s^2$ for an EPD; which is the usual form of PEV and accuracy for an individual animal as published.

## INTER-BREED ACCURACY

Comparison of bulls of different breeds may require a return to the basic principle that only differences are predictable. In this discussion, the adjustment for breed constants described by Notter and Cundiff (BIF 1989 and JAS 1991) will be used. The principles apply even more simply with joint evaluation of breeds with connected data sets. If $B_{ij}$ is the estimable difference between breeds **i** and **j**, then the predicted interbreed difference between bull ik of breed **i** and bull $j\ell$ of breed **j** is:

$$\hat{u}_{ik} - \hat{u}_{j\ell} = B_{ij} + EPD_{ik} - EPD_{j\ell},$$

which is the difference between the two within-breed predicted differences ($EPD_{ik} - EPD_{j\ell}$) plus an estimated constant ($B_{ij}$) for any two animals of breeds **i** and **j** born in a common base year, for example, 1990. Because $B_{ij}$ is an estimated constant, the prediction error variance of the interbreed comparison is:

$$V[(B_{ij} + (EPD_{ik} - PD_{ik}) - (EPD_{j\ell} - PD_{j\ell})].$$

With the MARC basis of comparison (Notter and Cundiff, 1989) $EPD_{ik}$ and $EPD_{j\ell}$ are from independent breed evaluations so that covariance ($EPD_{ik}$ - $PD_{ik}$, $EPD_{j\ell}$ - $PD_{j\ell}$) will be zero. With a joint evaluation of the breeds, that covariance will likely be near zero. Then the PEV becomes $V(B_{ij}) + (1 - r^2_{ik})\sigma^2_s + (1 - r^2_{j\ell})\sigma^2_s$ which can be used to form a confidence range on $\hat{u}_{ik} - \hat{u}_{j\ell}$ around $B_{ij} + EPD_{ik} - EPD_{j\ell}$. Note that the usual idea of accuracy does not fit well for inter-breed comparisons. What is needed is $V(B_{ij})$. For a joint evaluation including breeds **i** and **j**, $V(B_{ij})$ will come from the + ii, + jj, - ji, and - ij elements of the inverse of the mixed model coefficient matrix.

The $V(B_{ij})$ is a little more complicated for the Notter-Cundiff procedure because the $B_{ij}$ are a combination of breed comparisons at the USDA Meat Animal Research Center (MARC) and average EPD's from independent National Cattle Evaluations for the different breeds.

The basic adjustment is comparison of breed **i** with Angus, breed a. Let

$E_i$ = mean EPD for breed **i** for a base year, say 1990,

$E_a$ = mean EPD for breed **a** for a base year, 1990,

$M_i$ = MARC constant for breed **i** adjusted to the 1990 base, and

$M_a$ = MARC constant for breed **a** adjusted to the 1990 base.

Then the basic adjustment as a difference from breed **a** is sometimes written:

$$A_i = - [(E_i - E_a) - (M_i - M_a)].$$

To avoid the leading minus, rewrite as:

$$A_i = (M_i - M_a) - (E_i - E_a).$$

Let

$MARC_i$ be the unadjusted MARC constant for breed **i** and

$P_i$ be the average EPD of MARC bulls based on non-MARC progeny as published for breed **i**.

The Notter-Cundiff adjustment to a common year for breed **i** is:

$$M_i = MARC_i + b_i (E_i - P_i).$$

Estimates of the regression coefficient of MARC progeny on the breed EPD, $b_i$, vary somewhat by breed and trait but in many cases are not greatly different from the theoretical value of b = 1, which will be used in the following approximations.

Then

$$M_i = MARC_i + (E_i - P_i) \text{ and } M_a = MARC_a + (E_a - P_a).$$

Substitute $M_i$ and $M_a$ into $A_i$:

$$A_i = [(MARC_i + E_i - P_i) - (MARC_a + E_a - P_a) - (E_i - E_a)]$$

and the $E_i$ and $E_a$ drop out with

$$A_i = (MARC_i - MARC_a) - (P_i - P_a)$$

which is the difference between MARC solutions for the two breeds minus the difference in average EPDs for MARC bulls evaluated and reported by the breed registries **i** and **a**. Now note that with b = 1, the adjustment to the basis of breed **a** does not depend on the base year. The variance of $A_i$ depends only on MARC animals; $MARC_i$ and $MARC_a$ from animals at MARC and $P_i$ and $P_a$ from bulls used at MARC but with breed evaluations based on non-MARC progeny.

**Why not differences from breed a?**

Why not express evaluations of bulls of each breed as $\hat{u}_{ik} = A_i + EPD_{ik}$ ? All evaluations would be relative to a "zero" bull of breed **a**. For ranking there is no theoretical problem. The inter-breed rankings are comparable but in theory something more is needed for PEV and accuracy for inter-breed comparisons than the within breed accuracies.

The $V(\hat{u}_{ik}) = V(A_i) + (1 - r_{ik}^2)\sigma_s^2$ seems reasonable enough until **i** = **a**, i.e., an evaluation for a bull of breed **a**. Because $A_a$ by definition is zero, then also $V(A_a) = 0$ and

$$V(\hat{u}_{ak} - u_{ak}) = 0 + (1 - r_{ak}^2)\sigma_s^2.$$

But for a bull of breed **j**, $V(\hat{u}_{j\ell} - u_{j\ell}) = V(A_j) + (1 - r_{j\ell}^2)\sigma_s^2.$

The constraint of $A_a = 0$ may prevent comparison of PEV for individual bulls not of breed **a** with bulls of breed **a** if $V(A_i)$ is large. A more appropriate procedure may be to go back to the basic PEV of differences between progeny of two bulls of the same or different breeds.

Obviously;

$$A_i - A_j = (MARC_i - MARC_j) - (P_i - P_j) = (MARC_i - P_i) - (MARC_j - P_j).$$

Let $A_i - A_j$ be $B_{ij}$.

To compare EPD's for bulls from breeds **i** and **j**;

$$\hat{u}_{ik} - \hat{u}_{j\ell} = (A_i + EPD_{ik}) - (A_j + EPD_{j\ell})$$
$$= B_{ij} + (EPD_{ik} - EPD_{j\ell}).$$

This prediction of progeny difference allows examination of PEV of bulls within or between breeds. When **i** = **j**, the comparison is within breed so that $B_{ii} = 0$ and

$$\text{PEV of difference} = (1 - r_{ik}^2)\sigma_s^2 + (1 - r_{i\ell}^2)\sigma_s^2 = (2 - r_{ik}^2 - r_{i\ell}^2)\sigma_s^2.$$

The PEV of an inter-breed comparison is:

$$V(B_{ij}) + (2 - r_{ik}^2 - r_{j\ell}^2)\sigma_s^2$$

with $V(B_{ij})$ a constant for the PEV of comparisons between any two animals of breeds **i** and **j**.

### APPROXIMATION TO $V(B_{ij})$

An approximation to $V(B_{ij})$ can be derived assuming each of the $n_i$ MARC sires of breed **i** has the same $r_i^2$ in the breed evaluation (i.e., average $r^2$). The terms in $V(B_{ij}) = V(MARC_i - MARC_j - P_i + P_j)$ are:

$$[V(MARC_i) + V(MARC_j) - 2\,COV(MARC_i, MARC_j)] \quad (1)$$

$$+ [V(P_i) + V(P_j) - 2\,COV(P_i, P_j)] \quad (2)$$

$$- 2\,[COV(MARC_i, P_i) + COV(MARC_j, P_j)] \quad (3)$$

$$+ 2\,[COV(MARC_i, P_j) + COV(MARC_j, P_i)] \quad (4)$$

Line (1) is the variance of the contrast between solutions for breed **i** and breed **j** from analysis of only MARC data.

The apparent variance of the contrast may be different when either

a) only progeny of bulls with breed registry EPD's are in the analysis or

b) all progeny of those breeds of sires are in the analysis whether the sire has an EPD or not, and when either

c) ordinary least squares (LSE) with sire breeds in the model is used or a

d) mixed model procedure with random sires nested in breed of sire is used.

For the approximation, analyses combining alternatives a) and c) were assumed.

Line (2): Let $P_i$ be the unweighted average of EPD's of $n_i$ MARC bulls of breed **i** and $r^2_{ik}$ be associated with bull **k** of breed **i**, so that $V(P_{ik}) = r^2_{ik}\,\sigma^2_s$.

If as assumed,

$$COV(P_{ik}, P_{ik'}) = 0,$$

then,

$$V(P_i) \sim (\sum_k r^2_{ik})(\sigma^2_s / n_i^2), \quad \text{and if } r^2_{ik} = r^2_i \text{ for all bulls, } V(P_i) \sim (r^2_i/n_i)\sigma^2_s.$$

If $P_i$ is the weighted average of EPDs with weights, $m_{ik}$ = number of progeny of bull ik in MARC analysis,

$$V(P_i) \sim [(\sum_k m^2_{ik}\, r^2_{ik})/(\Sigma m_{ik})]\sigma^2_s.$$

If $r^2_i = r^2_{ik}$ and with $COV(P_i, P_j) = 0$, line (2) becomes:

$$(r^2_i/n_i + r^2_j/n_j)\sigma^2_s.$$

Line (3): Let,

$N_i$ = number of animals of breed **i** in MARC analyses,

$m_{ik}$ = number of progeny at MARC of bull **k** of breed **i**

$n_i$ = number of bulls of breed **i** at MARC with an EPD included in $P_i$.

If perfect adjustment for fixed factors in the MARC analysis is assumed,

$$COV(MARC_i, P_i) \sim [(\sum_k m_{ik} r^2_{ik})/(N_i n_i)]\sigma^2_s$$

If $r^2_{ik} = r^2_i$, $m_{ik} = m_i$ and $N_i = n_i m_i$, then:

$$COV(MARC_i, P_i) \sim V(P_i) = (r^2_i/n_i)\sigma^2_s \text{ so that}$$

line (3) is: $-2\,(r^2_i/n_i + r^2_j/n_j)\sigma^2_s$ whereas line (2) is $(r^2_i/n_i + r^2_j/n_j)\sigma^2_s$.

Line (4) is assumed zero.

With the simplifying assumptions:

$$V(B_{ij}) \approx V(MARC_i - MARC_j) - V(P_i) - V(P_j)$$

$$\approx V(MARC_i - MARC_j) - (r_i^2/n_i + r_j^2/n_j)\sigma_s^2$$

Thus, the adjustment for genetic trend reduces the approximate variance of the breed contrast by a fraction $(r_i^2/n_i + r_j^2/n_j)$ of the sire component of variance.

The adjustment for genetic trend is important for inter-breed comparison of EPD's, but is the adjustment very important for PEV of the comparison? In fact, are $V(MARC_i - MARC_j)$ and $V(B_{ij})$ importantly different from zero?

Data for creation of the 1991 (1993 BIF proceedings) breed adjustments were used to obtain $V(MARC_i - MARC_j)$. Averages of $r^2$ by breed were taken from Núñez-Dominguez et al. (1993). The 1993 BIF data set was used to estimate $\sigma_s^2$ = 200 $lb^2$ and $\sigma_e^2$ = 2400 $lb^2$ for substitution into the equation for $V(B_{ij})$ and to multiply $(\sigma_e^2 + \sigma_s^2)$ by elements of the inverse of the LSE to obtain $V(MARC_i - MARC_j)$. Four breeds with varying average $r^2$ (.89, .84, 1.00 and .99) and number of sires (36, 61, 20 and 25) were chosen to illustrate $V(B_{ij})$ and $V(MARC_i - MARC_j)$.

**Table 1. Comparison of $V(B_{ij}) = V(MARC_i - MARC_j) - (r_i^2/n_i + r_j^2/n_j)\sigma_s^2$ (below diagonal) with $V(MARC_i - MARC_j)$ (above diagonal) for weaning weight with $\sigma_s^2$ = 200 $lb^2$ and $\sigma_e^2$ $lb^2$ = 2400 $lb^2$.**

| Breed: | 2 | 3 | 7 | 10 |
|---|---|---|---|---|
| 2 | - | 9.07 | 16.98 | 14.49 |
| 3 | 1.36 | - | 16.79 | 13.91 |
| 7 | 2.03 | 4.03 | - | 24.17 |
| 10 | 1.58 | 3.19 | 6.21 | - |

Tentative conclusions from Table 1 are that the variances of the breed contrasts are likely to be of little importance in the PEV of inter-breed comparisons and that the reduction in PEV due to adjusting for genetic trend may be somewhat important but would not be difficult to approximate. Importance or lack of importance of $V(B_{ij})$ in PEV can be seen by examining PEV for differences in EPD's for pairs of bulls within a breed or of bulls from different breeds. PEV for sets of two bulls with equal $r^2$ were examined for two sets of two breeds with extremes of $V(B_{ij})$ for different values of within breed $r^2$. Apparent standard errors of prediction of difference $(SEP = \sqrt{PEV})$ were calculated as:

$$SEP = \sqrt{K + (2 - r_{ik}^2 - r_{j\ell}^2)\sigma_s^2} \quad .$$

For the weaning weight illustration $\sigma_s^2 = 200 \text{ lb}^2$ and $K = 0$ for within breed PEV, $K = V(MARC_i - MARC_j)$ and $K = V(B_{ij})$ as taken from Table 1 for breeds 7 and 10 and for breeds 2 and 3. The SEP are shown in Table 2.

**Table 2. Apparent standard errors of prediction (lb) for differences in weaning weight EPD's, $[K + (2 - r^2_{ik} - r^2_{j\ell})\sigma^2_s]^{.5}$**

| | | -K- | | |
|---|---|---|---|---|
| $r^2_{ik}$ | $r^2_{j\ell}$ | Within breed | $V(MARC_i - MARC_j)$ | $V(B_{ij})$ |
| | | i = breed 7, j = breed 10 | | |
| 1.00 | 1.00 | 0 | 4.9 | 2.5 |
| .75 | .75 | 10.0 | 11.1 | 10.3 |
| .50 | .50 | 14.1 | 15.0 | 14.4 |
| .00 | .00 | 20.0 | 20.6 | 20.2 |
| | | i = breed 2, j = breed 3 | | |
| 1.00 | 1.00 | 0 | 3.0 | 1.2 |
| .75 | .75 | 10.0 | 10.4 | 10.1 |
| .50 | .50 | 14.1 | 14.5 | 14.2 |
| .00 | .00 | 20.0 | 20.2 | 20.0 |

In all cases shown in Table 2, the calculated SEP are nearly the same whether the contrast variance from the least squares analysis at MARC or the variance of the contrast adjusted for the average EPD's is used. The SEP that account for the estimates of breed constants in most cases are only slightly larger than the standard errors of prediction of differences for bulls of the same breed. Another issue is whether the least squares analysis (LSE) provides the correct variance for breed contrasts. The answer is no, but the difference is not very important.

## VARIANCE OF BREED CONTRASTS UNDERESTIMATED BY LSE

Except for balanced data (equal number of sires and progeny per sire for all breeds) variances of the least squares contrasts are underestimated. Table 3 shows the apparent variances of contrasts for breeds 2, 3, 7 and 10 from least squares (LSE) and the mixed model (MME) analyses which included random uncorrelated sires within sire breed with sire variance of 200 $lb^2$ and residual variance of 2400 $lb^2$. The LSE analysis fails to consider the sire variation and distribution of progeny by sire. The $V(MARC_i - MARC_j)$ from MME could also be adjusted by subtracting $V(P_i) + V(P_j)$. But, even with no adjustment for $V(P_i)$ and $COV(MARC_i, P_i)$, the apparent standard errors based on MME will be only slightly larger than those in Table 2.

**Table 3. Apparent variances of contrasts between solutions for breed effects from LSE (above diagonal) with sire breed in model and from MME (below diagonal) with sire within sire breed also in the model for weaning weight with $\sigma_s^2 = 200\ lb^2$ and $\sigma_e^2 = 2400\ lb^2$.**

| BREED: | 2 | 3 | 7 | 10 |
|---|---|---|---|---|
| 2 | - | 9.07 | 16.98 | 14.49 |
| 3 | 25.01 | - | 16.79 | 13.91 |
| 7 | 40.23 | 38.52 | - | 24.17 |
| 10 | 34.28 | 31.47 | 50.23 | - |

The estimates of breed constants with the one exception of breed 1 were similar for LSE and MME as shown in Table 4.

**Table 4. Solutions for breed constants as a difference from breed 3 obtained from LSE and MME for weaning weight (lb).**

| | Solutions from | |
|---|---|---|
| Breed | MME | LSE |
| 1 | 19.1 | 7.6 |
| 2 | -1.3 | -.3 |
| 3 | 0 | 0 |
| 4 | 26.6 | 28.2 |
| 5 | 19.9 | 22.0 |
| 6 | 26.2 | 28.1 |
| 7 | 13.9 | 16.0 |
| 8 | 30.7 | 32.1 |
| 9 | 30.2 | 31.8 |
| 10 | 30.7 | 34.4 |
| 11 | 2.1 | 7.4 |
| 12 | 31.0 | 34.6 |

## BACK TO COMPARISONS TO A BASE BREED

The small contribution of the variance of breed contrasts (adjusted or not adjusted) to the standard error of prediction of the difference between PD of bulls of different breeds reopens the question of how important is $V(A_i)$. Values of $\{V[A_i + (EPD_{ij} - PD_{ik})]\}^{.5}$ are shown in Table 5 for different $r^2$ for individual bulls of breeds 2, 7, 10 and breed 3 (the base breed **a**). In this illustration, $V(A_i) = V(B_{ia}) = V(MARC_i - MARC_a) - V(P_i) - V(P_a)$. The table shows that the SEP for base breed bulls are not much smaller than for non-base breed bulls. In fact, except for $r^2$ near 1.0, the differences in SEP for EPD adjusted to basis of breed **a** would not be noticeable.

**Table 5. Standard errors of prediction (lb) for prediction equal to breed adjustment to breed a basis plus within breed EPD ($A_i + EPD_{ik}$), for weaning weight with $\sigma_s^2 = 200\ lb^2$ and $\sigma_e^2 = 2400\ lb^2$: $[V(A_i) + (1 - r_{ik}^2)\sigma_s^2]^{.5}$**

| | $r^2$ | | | |
|---|---|---|---|---|
| Breed = i | 1.0 | .75 | .5 | 0 |
| 2 | 1.2 | 7.2 | 10.1 | 14.2 |
| 7 | 2.0 | 7.4 | 10.2 | 14.3 |
| 10 | 1.8 | 7.3 | 10.2 | 14.3 |
| 3=a | 0 | 7.1 | 10.0 | 14.1 |

**WHAT TO REPORT ?**

The following options are listed for discussion:

Inter-breed EPD's can be constructed from a table of breed constants adjusted for genetic trend. Educational programs should re-emphasize that only expected differences between progeny of bulls can be predicted. Calculation of the expected progeny differences between pairs of bulls rather than between a bull and a 'zero' bull should be encouraged.

Standard errors of prediction (and accuracies) for within breed evaluations should be reported. Methods to explain standard errors of prediction error of differences for within breed evaluations should be developed. Those principles can be extended to inter-breed comparisons making use of tables of variances of breed contrasts. Those tables would require obtaining or approximating the inverse block of mixed model equations corresponding to breed solutions for combined breed analyses or inverse blocks corresponding to breed constants from the MARC analyses. Variances of contrasts for MARC breed constants can be modified for number of bulls of each breed and the average of (weighted or unweighted) correlations between predicted and true progeny differences. The modification, however, does not seem very important but leads to a smaller apparent standard error of prediction for inter-breed comparisons. Other important questions are whether variances of the breed contrasts from MARC analyses are importantly underestimated from using ordinary least squares and whether mixed model analyses with MARC sires considered as random effects within sire breeds would lead to more appropriate variances of breed contrasts and estimates of breed differences.

An alternative approach is to conclude that the variances of breed contrasts are not importantly different from zero when used in prediction error variances of inter-breed comparisons. In that case, the easy concept of adjusting within breed EPD's of individual bulls to a base breed could be followed. Then the prediction error variance could be applied either to the difference between pairs of bulls ignoring the variance of breed contrasts or to EPD's of individual bulls as differences from a 'zero' bull of the base breed as is now done.

Obviously, a lot of educational work may be needed. How much will depend on which, if any, of these suggestions are deemed desirable to implement.

## SUMMARY

A table for adjusting estimated progeny differences (EPD) to a base year and base breed basis depends on analyses of records of progeny of bulls at the Meat Animal Research Center that have other progeny to provide within breed EPDs. The MARC estimates of breed differences are adjusted by the difference between the average EPD's of MARC bulls and the average EPD for the base year for that breed. Two related questions are: 1) What are the confidence ranges for the adjustments and 2) What are the accuracies of the inter-breed EPD's? Application of standard statistical principles and some statistical algebra shows, 1) that the apparent confidence ranges for the breed adjustments are not large, 2) that the apparent confidence ranges are substantially underestimated, 3) that the correct confidence ranges also are not large, 4) that the usual measures of accuracy cannot be applied to inter-breed comparisons, 5) that standard errors of prediction used in calculating confidence ranges for inter-breed comparisons are much less affected by variance of the adjustment factors than by the within breed accuracies for the two bulls being compared. Alternatives of predicting differences between bulls of the same or different breeds or between a bull of any and an average bull of a base breed are discussed in terms of confidence ranges. Although theoretically the most correct alternative, a major educational effort would be required to explain confidence ranges on expected differences in progeny of two bulls of different breeds. Confidence ranges on the expected difference in progeny of a bull and the average bull of a base breed for a base year can be explained with only a slight extension of principles currently taught.

## References

Notter, D. R. 1989. EPD's for use across breeds. Proc. Beef Improvement Federation Research Symposium and 21st annual meeting. p 63. Nashville, TN.

Notter, D. R. and L. V. Cundiff. 1991. Use of EPD's to adjust results of breed evaluation experiments for sire sampling and genetic trend. J. Anim. Sci. 69:4763.

Núñez-Dominguez, R., L. D. Van Vleck, and L. V. Cundiff. 1993. Within breed EPD's for multibreed comparisons for growth traits in crossbred cattle. J. Anim. Sci. 71:000.

Systems Committee Meeting
Minutes
1993 Annual Conference
Asheville, North Carolina

The meeting was called to order by Chairman, Jim Gibb, at 2:10 P.M. , on May 28, 1993.

Chairman Gibb gave an introduction to those in attendance on the intent and purpose of the Systems Committee. Following that, an overview of the meeting agenda was given with the chairman noting that two agenda items were dispensed of. Because Lee Leachman gave a review of the current status of commercial cow-calf SPA during the BIF general session, there was no need for further update. Chairman Gibb further noted a presentation on economic values for traits from the research community was not yet ready.

First, on the agenda was an update on SPA-Purebred (PB). Lee Leachman, Chairman of the NCA/IRM subcommittee working on this, reported several contributions from breed associations, the Beef Breeds Council and others had been received to further this effort and put it in a field test mode. He indicated to attendees an opportunity to participate and encouraged such. Seedstock producers interested in running an analysis under the pilot project should contact Dan Kniffen at the NCA office in Denver, Colorado. Texas A & M has prepared initial software to do the SPA-PB analysis.

Discussion ensured related to the ease of using both SPA Cow-Calf and SPA-PB. Leachman reported that NCA is encouraging private sector development of software that utilizes the SPA guidelines.

Leachman suggested that SPA summary data be included each year in the BIF meeting proceedings. No committee action was taken on the suggestions.

Next, Don Boggs, South Dakota, reported on the development, printing and sales of the IRM Desk Record book. This was a joint effort between South Dakota State University Extension Service, the Bootstraps IRM Group in South Dakota and University of Nebraska Extension, in conjunction with NCA. The desk record was developed to help producers collect records that can be plugged into the SPA cow-calf analysis. Boggs gave an overview of the books sections and relayed to attendees the system flexibility. He indicated Moormans Manufacturing had underwritten part of the printing of the IRM Desk Record, and that copies could be purchased from NCA for $10.00 each. Interested producers should contact Dan Kniffen at NCA headquarters. Boggs concluded his presentation by indicating the desk record was also available through South Dakota State and that other states could get camera-ready copy which included no company endorsements.

Next, Chariman Gibb introduced the agenda item: Should BIF monitor end-product target goals?" He quickly reviewed the positive impacts that the National Beef Quality Audit had made with the industry. Then he reported that discussion between himself and Systems Committee Secretary Strohbehn had led to the conclusion the audit did not give either the commercial or seedstock sectors clearly defined end-product target goals, and that these would be desirable in achieving the Total Quality Management objective as outlined by Dr. Darrell Wilkes of NCA. He then introduced Daryl Strohbehn, Iowa State University, who reported on an End-Product Target Survey conducted by Strohbehn and Gibb. (see the attached report following the minutes.)

Following the survey report findings, Strohbehn and Gibb presented a recommendation for BIF consideration. It was as follows:

### Recommendations to the BIF Board

> Based on the results of this initial survey with meat and beef specialists, BIF should seek the submission of proposals to do a national beef industry survey that identifies end-product targets. This survey should be done every 2 to 3 years, reported at the annual convention and made public through the popular press and BIF affiliate organizations. All segments of the beef industry should be surveyed and proper interpretation of each segments data set be done to provide meaningful targets for all production facets. The BIF board should appoint a subcommittee consisiting of personnel from meat science, animal breeding, ag economics, food service, packing, meat purveying, and the seedstock, commercial and feedlot sectors.

Comments and discussion ensued on the report and recommendation. Three basic elements were brought up. First, a survey of this type should also be tied with scientific research based information. Second, consumer input via beef retailers and other sources should be included, and third, there should be identification of different target niches. The supply necessary to meet those demands should be documented.

Burke Healy pointed out three other beef industry sponsored studies were underway, and that the results of these might influence what could be included in an end-product target survey. Committee consensus, however, suggested these target goals were too important to the industry and to not delay starting the processes necessary to bring about a survey of this type.

Tom Chrystal, Iowa, moved to submit the Strohbehn and Gibb recommendation to the BIF board with one amendment. His amendment was a market information specialist be added to the subcommittee in charge of the suvey. Robert Scarth seconded the motion. Motion passed.

Chairman Gibb's final agenda item was to retrieve ideas from attendees on future directions for the Systems Committee. Ideas suggested were:

*Analysis of environmental influence in SPA data.
*Analysis of length of breeding season in SPA data.
*Influence of herd size in SPA data.
*How end-product target goals relate to different production systems, breeding programs and environmental settings.
*How do we modify current production systems according to end-product target specifications?
*Development of resource lists of available computer programs for cow-calf record keeping.
*How can carcass data collection be encouraged, feedback mechanisms be improved upon, and establishment of reward systems for packers that help achieve this priority?
*Encourage research on identification systems that replace hot-iron branding.

Following the idea brainstorming session, Chairman Gibb adjourned the meeting at 4:15 P.M.

Respectfully submitted,

Daryl R. Strohbehn
Secretary, Systems Committee

# End-Product Target Survey

**A Report to the BIF Systems Committee**
**1993 Annual Conference**
**Asheville, NC**

**Daryl R. Strohbehn & Jim Gibb**
**Iowa State University & American Gelbvieh Association**

In 1992 the National Cattlemen's Association in coordination with Colorado State University and Texas A&M University performed a National Beef Quality Audit. Face to face interviews were done in addition to beef cooler surveys at several major packing locations across the U.S.

The aggregated concerns of purveyors, restaurateurs and retailers are shown below along with the top 10 concerns expressed by packers. Many of the concerns get back to the genetics that make up the slaughter mix. Excessive external fat, too large ribeyes, low overall uniformity, low overall cutability, insufficient marbling, excessive carcass weight, and low palatability are concerns that can be addressed with genetic inputs.

| Aggregated Concerns of Purveyors, Restaurateurs & Retailers | Top 10 List of Concerns - Packers |
|---|---|
| 1. Excessive external fat | 1. Frequent defects in hides. |
| 2. Too high incidence of injection-site blemishes | 2. Too high incidence of injection-site blemishes |
| 3. Too large ribeyes/loineyes | 3. Excessive carcass weights |
| 4. Excessive seam fat | 4. Too many bruises |
| 5. Low overall uniformity | 5. Reduced quality due to implant use |
| 6. Low overall cutability | 6. Too many liver condemnations |
| 7. Too many dark cutters | 7. Too few U.S. Choice carcasses |
| 8. Low overall palatability | 8. Too many YG4's & YG5's |
| 9. Too frequent bruise damage | 9. Lack of uniformity of live cattle & carcasses |
| 10. Insufficient marbling | 10. Too many dark cutters |

While the National Beef Quality Audit does an excellent job of identifying concerns and problems, it leaves the seedstock sector without concrete target goals on which to base breed improvement programs. The question is "Does the beef industry need specific end-product target goals to shoot at or not?" Discussion between BIF Systems Committee Chairman Jim Gibb and Committee Secretary Daryl Strohbehn concluded with the thought that this might be desirable for the industrty and that BIF would serve as an excellent independent organization to accomplish the task. With this in mind, an initial survey instrument was written and the committee chairman and secretary decided to survey meat and beef specialists across the country as an initial reactionary piece of work.

The survey instrument utilized (see Appendix A pages 1 & 2) was sent to approximately 45 specialists across the U.S. Two specification target areas were selected, "Retail/Institutional" and "White Tablecloth". Additionally, the specialists surveyed were asked to comment on survey content, proposed target groups, frequency of administration, reporting method and other items of their concern.

## Results of Survey

### Comments

It appears based on comments (see Appendix B) received from those specialists responding that the idea of a national survey of this type is needed. However, concern was expressed that only two targets is limiting and the industry has more niches than this. Most agreed the survey should be brief and easy to fill out, but that a fluctuation in type would be necessary for the various industry segments.

In a letter accompanying the survey it was suggested a similar survey should go to packers, purveyors, retailers, restaurateurs, and producers. Most agreed with this list, but more clearly defined the other industry segments, such as purebred breeders, commercial cow-calf producers, feedlots, state cattlemen's associations, National Association of Meat Purveyors, sale barns and other marketing channels. Doing this broad base would enable industry segment contrasts and education.

The reporting method received only a few comments, but it appears doing it at the BIF convention is appropriate and put the information in the proceedings. One person indicated to make sure the information got to the popular press, while another suggested summarizing and sending to all aspects of the beef chain.

How often this survey should be done met with a wide degree of opinion. One person felt annually, while another felt every 5 years, fitting with the generation interval of cattle was most appropriate. Others suggested every 2 to 3 years.

At least a couple of comments related to box beef yeilds, cutting losses due to quality defects, and emphasizing beef from a "retail" case standpoint.

Table 1. Average "Ideals" for 27 Survey Responses

# Specifications For End-Product Targets

*BIF Systems Committee Survey of U.S. Meat and Beef Specialists*

## Retail/Institutional Target "Ideals"

| Trait | Ave. (+/- S.D.) | Low | High |
|---|---|---|---|
| Live weight | 1159 (+/- 52) | 1050 | 1300 |
| Hot carcass weight | 718 (+/- 40) | 650 | 820 |
| Rib eye area (sq.in.) | 13.2" (+/- 1.1) | 11.0" | 16.0" |
| Fat cover (13th rib) | .29" (+/- .08) | .10" | .40" |
| % KPH fat | 1.7% (+/- .8) | 0.0% | 3.0% |
| USDA Yield Grade | 2.0 (+/- .4) | 1.1 | 2.5 |
| Marbling score | 1036 (+/- 53) | 975 | 1200 |
| USDA Quality Grade | 1041 (+/- 61) | 950 | 1150 |

## White Tablecloth Target "Ideals"

| Trait | Ave. (+/- S.D.) | Low | High |
|---|---|---|---|
| Live weight | 1153 (+/- 47) | 1050 | 1275 |
| Hot carcass weight | 709 (+/- 37) | 600 | 750 |
| Rib eye area (sq.in.) | 12.8" (+/- 1.2) | 11.0" | 16.0" |
| Fat cover (13th rib) | .34" (+/- .11) | .10" | .60" |
| % KPH fat | 1.9% (+/- .8) | 0.0% | 3.0% |
| USDA Yield Grade | 2.3 (+/- .4) | 1.0 | 3.0 |
| Marbling score | 1179 (+/- 78) | 1000 | 1350 |
| USDA Quality Grade | 1194 (+/- 82) | 1050 | 1450 |

**Marbling Score Codes**

| | |
|---|---|
| Slight | 900 to 990 |
| Small | 1000 to 1090 |
| Modest | 1100 to 1190 |
| Moderate | 1200 to 1290 |
| Sl Abundant | 1300 to 1390 |
| Md Abundant | 1400 to 1490 |
| Abundant | 1500 to 1590 |

**Quality Grade Codes**

| | |
|---|---|
| Select | 900 to 990 |
| Choice$^-$ | 1000 to 1090 |
| Choice$^o$ | 1100 to 1190 |
| Choice$^+$ | 1200 to 1290 |
| Prime$^-$ | 1300 to 1390 |
| Prime$^o$ | 1400 to 1490 |
| Prime$^+$ | 1500 to 1590 |

**End-Product Target Goals**

A total of 27 survey responses were received. A few were incompletely filled out, thus in respect to some traits only a partial data set was obtained. Interpretation of the data was a challenge at times. In the marbling scores and quality grades some extrapolation was necessary. For instance, when a survey indicated the "Ideal" quality grade was $Ch^-$, it was assumed this should be entered as a midpoint $Ch^-$. Therefore, with the scoring system used this was entered as a score of 1050. When evaluating minimums and maximums similar extrapolations were done, except that the lowest and highest scores were utilized, respectively.

Table 1 gives a synopsis of the responses on what the "Ideal" beef animal should have from a carcass perspective. While the averages look reasonable, it is suggested by the standard deviations, lowest and highest values for the traits that there is not complete agreement on what an "Ideal" beef animal should have for carcass traits. For instance, while the average for "Ideal" hot carcass weight is 718 lbs, the standard deviation suggests two-thirds of the respondants felt it should lie somewhere between 678 and 758 lbs. Ribeye area had an average "Ideal" size of 13.2 sq. in., but the standard deviation suggests between 12.1 and 14.3 is the popular area. One response said 11.0 sq. in. was "Ideal" while another response thought 16.0 sq. in. was best. Two-thirds of the responses thought "Ideal" quality grade lies between high Select and the low part of average Choice, with mid-point low Choice being the average response.

"White Tablecloth" specifications had similar variation in the responses. On average respondants thought this end-product should be smaller in carcass weight, could be lower in cutability, but needed to be about one and one-half marbling scores higher in quality. There was complete agreement that this end-product should be higher quality. But there was mixed opinion on what size animal this product should come from. Fifty-two percent of the respondants thought there should be no difference in size between "White Tablecloth" and "Retail/Institutional" cattle. However, 26 percent thought they should be larger in live and carcass weight, while 22 percent thought they should be smaller. Most thought ribeye area in "White Tablecloth" cattle should be equal to or smaller than "Retail/Institutional" cattle, but there were two responses that indicated larger.

Table 2 and 3 give the minimums and maximums for traits and the variation for each of these traits. Like "Ideal" averages, there is a great deal of variation in what the respondants thought in relationship to the boundaries on the two end-product targets.

Table 3. Average "Maximums" for 27 Survey Responses

# Specifications For End-Product Targets

*BIF Systems Committee Survey of U.S. Meat and Beef Specialists*

## Retail/Institutional Target "Maximums"

| Trait | Ave. (+/- S.D.) | Low | High |
|---|---|---|---|
| Live weight | 1299 (+/- 87) | 1175 | 1500 |
| Hot carcass weight | 826 (+/- 64) | 750 | 1000 |
| Rib eye area (sq.in.) | 15.2" (+/- 1.5) | 13.0" | 20.0" |
| Fat cover (13th rib) | .50" (+/- .16) | .15" | 1.00" |
| % KPH fat | 3.0% (+/- .5) | 2.0% | 4.0% |
| USDA Yield Grade | 3.1 (+/- .4) | 2.0 | 4.0 |
| Marbling score | 1248 (+/- 164) | 1000 | 1590 |
| USDA Quality Grade | 1267 (+/- 139) | 1090 | 1590 |

## White Tablecloth Target "Maximums"

| Trait | Ave. (+/- S.D.) | Low | High |
|---|---|---|---|
| Live weight | 1273 (+/- 68) | 1150 | 1400 |
| Hot carcass weight | 804 (+/- 42) | 750 | 900 |
| Rib eye area (sq.in.) | 14.5" (+/- 1.4) | 13.0" | 20.0" |
| Fat cover (13th rib) | .57" (+/- .17) | .15" | 1.00" |
| % KPH fat | 3.1% (+/- .5) | 2.0% | 4.0% |
| USDA Yield Grade | 3.4 (+/- .5) | 2.0 | 4.0 |
| Marbling score | 1435 (+/- 134) | 1000 | 1590 |
| USDA Quality Grade | 1439 (+/- 105) | 1150 | 1590 |

| Marbling Score Codes | |
|---|---|
| Slight | 900 to 990 |
| Small | 1000 to 1090 |
| Modest | 1100 to 1190 |
| Moderate | 1200 to 1290 |
| Sl Abundant | 1300 to 1390 |
| Md Abundant | 1400 to 1490 |
| Abundant | 1500 to 1590 |

| Quality Grade Codes | |
|---|---|
| Select | 900 to 990 |
| Choice$^-$ | 1000 to 1090 |
| Choice$^O$ | 1100 to 1190 |
| Choice$^+$ | 1200 to 1290 |
| Prime$^-$ | 1300 to 1390 |
| Prime$^O$ | 1400 to 1490 |
| Prime$^+$ | 1500 to 1590 |

Table 2. Average "Minimums" for 27 Survey Responses

# Specifications For End-Product Targets

*BIF Systems Committee Survey of U.S. Meat and Beef Specialists*

## Retail/Institutional Target "Minimums"

| Trait | Ave. (+/- S.D.) | Low | High |
|---|---|---|---|
| **Live weight** | 1030 (+/- 54) | 925 | 1100 |
| **Hot carcass weight** | 621 (+/- 29) | 550 | 680 |
| **Rib eye area** (sq.in.) | 11.1" (+/- .7) | 10.0" | 12.5" |
| **Fat cover** (13th rib) | .18" (+/- .09) | .0" | .35" |
| **% KPH fat** | 1.1% (+/- .6) | 0.0% | 2.0% |
| **USDA Yield Grade** | 1.1 (+/- .4) | 0.0 | 1.7 |
| **Marbling score** | 957 (+/- 34) | 875 | 1100 |
| **USDA Quality Grade** | 970 (+/- 51) | 900 | 1150 |

## White Tablecloth Target "Minimums"

| Trait | Ave. (+/- S.D.) | Low | High |
|---|---|---|---|
| **Live weight** | 1035 (+/- 64) | 925 | 1150 |
| **Hot carcass weight** | 631 (+/- 41) | 550 | 725 |
| **Rib eye area** (sq.in.) | 11.0" (+/- .9) | 9.0" | 12.5" |
| **Fat cover** (13th rib) | .23" (+/- .10) | .00" | .40" |
| **% KPH fat** | 1.2% (+/- .7) | 0.0% | 2.5% |
| **USDA Yield Grade** | 1.3 (+/- .7) | 0.0 | 2.5 |
| **Marbling score** | 1078 (+/- 69) | 1000 | 1250 |
| **USDA Quality Grade** | 1090 (+/- 71) | 1000 | 1200 |

**Marbling Score Codes**

| | |
|---|---|
| Slight | 900 to 990 |
| Small | 1000 to 1090 |
| Modest | 1100 to 1190 |
| Moderate | 1200 to 1290 |
| Sl Abundant | 1300 to 1390 |
| Md Abundant | 1400 to 1490 |
| Abundant | 1500 to 1590 |

**Quality Grade Codes**

| | |
|---|---|
| Select | 900 to 990 |
| $Choice^-$ | 1000 to 1090 |
| $Choice^o$ | 1100 to 1190 |
| $Choice^+$ | 1200 to 1290 |
| $Prime^-$ | 1300 to 1390 |
| $Prime^o$ | 1400 to 1490 |
| $Prime^+$ | 1500 to 1590 |

## Summary

Respondants to the survey, with the exception of one, believed a national survey identifying end-product targets would be advantageous to the beef industry. Furthermore, industry target concensus would help build uniformity and help in breeding program development both in the seedstock and commercial sectors.

Comments indicated the survey should have brevity for ease and quickness of doing, it should go further in relationship to physical characteristics of meat products, and that the survey questions should be designed to the characteristics most important to the industry segment being surveyed. Respondants agreed that all industry segments should be surveyed and the popular frequency would be every 2 to 3 years.

There was a great deal of diversity in opinion among the beef and meat specialists as to what the "Ideal" carcass specifications should be. For the "Retail/Institutional" target, the average "Ideal" hot carcass weight was 718 lbs, but the respondants ranged from 650 to 820 lbs. Other carcass traits for both the "Retail/Institutional" and "White Tablecloth" targets had similar range in "Ideal" values. This wide difference may be due to misinterpretation of the survey objective, but it is more likely that there is a wider degree of opinion in the beef industry than generally thought.

Respondants on average felt there was little difference between "Retail/Institutional" and "White Tablecloth" from a live and hot carcass weight standpoint. They were willing to accept lower cutability, but quality grade needed to be one and one-half marbling scores higher on average.

## Recommendations to the BIF Board

Based on the results of this initial survey with meat and beef specialists, BIF should seek the submission of proposals to do a national beef industry survey that identifies end-product targets. This survey should be done every 2 to 3 years, reported at the annual convention and made public through the popular press and BIF affiliate organizations. All segments of the beef industry should be surveyed and proper interpretation of each segments data set be done to provide meaningful targets for all production facets. The BIF board should appoint a subcommittee consisting of personel from meat science, animal breeding, ag economics, food service, packing, meat purveying, seedstock, commercial and feedlot sectors.

Appendix A, page1

# Specifications For End-Product Targets

*Beef Improvement Federation Survey of U.S. Meat and Beef Specialists*

## "Retail/Institutional" Target

| Trait | "Ideal" | Min | Max |
|---|---|---|---|
| Live weight | _____ | _____ | _____ |
| Hot carcass weight | _____ | _____ | _____ |
| Rib eye area (sq.in.) | _____ | _____ | _____ |
| Fat cover (13th rib) | _____ | _____ | _____ |
| % KPH fat | _____ | _____ | _____ |
| USDA Yield Grade | _____ | _____ | _____ |
| Marbling score | _____ | _____ | _____ |
| USDA Quality Grade | _____ | _____ | _____ |

## "White Tablecloth" Target

| Trait | "Ideal" | Min | Max |
|---|---|---|---|
| Live weight | _____ | _____ | _____ |
| Hot carcass weight | _____ | _____ | _____ |
| Rib eye area (sq.in.) | _____ | _____ | _____ |
| Fat cover (13th rib) | _____ | _____ | _____ |
| % KPH fat | _____ | _____ | _____ |
| USDA Yield Grade | _____ | _____ | _____ |
| Marbling score | _____ | _____ | _____ |
| USDA Quality Grade | _____ | _____ | _____ |

*Optional*

**Name:** ______________________________

**Address:** ______________________________

**Town:** ______________________________

**State:** ____________ **Zip:** ____________

**Profession/Industry Affiliation** ____________

*Return Address:*
Daryl R. Strohbehn
109 Kildee Hall, ISU
Ames, IA 50011

**Appendix A, page 2**

# COMMENTS

*Survey Content:* ______________________________

______________________________

______________________________

______________________________

______________________________

______________________________

*Targeted Groups:* ______________________________

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*Frequency of Administration:* ______________________________

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*Reporting Method:* ______________________________

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*Other:* ______________________________

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## Appendix B

# COMMENTS

## Survey Content:

Retailers and Purveyors may not relate to live and carcass traits as quickly as to boxed meat weight and grade. This information may not mean much as there is little to base decisions on. The demands in the market place would be a better measure, i.e., what weight and grade of cut do you order for the different markets.

Quality Grade - range of cut size. Purveyor's specifications; discounts. Do they tenderize product, if so, what do they tenderize - Quality Grades; Primals.

I think it covers things very well. We could perhaps add two other items - age and frame size. Also, could we add muscle score?

The survey should be conducted from sales departments in packing companies and retail outlets to find what type of beef, grades, cuts, trim levels, etc. is selling.

Probably complete enough to get a preliminary feel for what various groups are thinking and yet narrow enough so that a consensus can be reached.

The content of the survey is fine. I certainly would be cautious in the interpretation and utilization of this data. Even had I had more time to put a great deal of thought into my response, I am not sure I would give a good guideline for the industry. Actually I don't think anyone can. The industry must develop a sensitive marketing and pricing system that will be responsive to consumer demands and send the correct signals to the production segment. There are many niches in the beef market. It would be dangerous to try to direct the entire production toward two markets as this survey does. I may have misinterpreted the objective of this survey, but I don't think you can accomplish what you are after with a survey. A well designed and thought out market study may be what is needed.

Looks good, except I couldn't remember marbling scores, besides if you have quality grade listed, do you really even need marbling scores?

You may want to break out retail and institutional -- Many retail stores will have Select, Choice and Prime Grades displayed in their meat cases. Institutions may purchase Select grades for their needs, plus their subprimal weights may be greater than those of a retail store.

Okay. Short & concise

I'd like to see the same survey sent to purveyors and retailers to compare results. Things like maximum REA are important only relative to portion size. They are in a better position to evaluate.

Include evaluation of boxed beef in this survey since a good many packers, purveyors, retailers handle both - and most people hate surveys.

Include slaughter age (months).

Tenderness will likely be measured and used to segregate beef products in the future. I don't think even the "white-tablecloth" beef will be immune to tremendous pressure to reduce trim fat.

Should include primal/subprimal cut weights and trim level desired by purveyors, retailers and restaurants.

## Targeted Groups:

Putting retail and institutional (Food Service would probably be a better term) in the same class is a mistake. Even the retail may have different segments. (High quality retail verses low cost-high volume retail).

Purveyors; packers, retailers

Purebred breeders, commercial cow-calf producers, feedlots, packers, purveyors and retailers.

Any and all segments of the beef industry that is selling beef to consumers.

State cattleman's associations, National Association of meat Purveyors, Sale barn and other cattle marketing channels i.e. packer buyers.

As listed

Those listed in the April 22nd letter seem appropriate - what about the export market?

Ask processing plant managers. State meat specialists have mailing lists.

Only use producers to contrast differences and highlight need for education; focus on packers, purveyors and retailers.

OK

Packers, Purveyors, Retailers, and Restaurateurs.

## Frequency of Administration:

Minimum of once a year.

Perhaps it could be based on the generation interval in cattle–every 5 or 6 years.

Once per year should be adequate to see what trends are developing.

This could be useful in a time frame of every 5 years when considering generation interval.

Two years.

Every three years.

Once a year.

Yearly.

Every two years?

Every 3 years

## Reporting Method:

Comments are very important.

Purveyors, packers and retailers.

Report survey results at BIF. Annual meeting and include it in the proceedings.

Popular press beef magazines such as DJ, Beef, Beef Today, Natl. Cattleman, also Food Business, Meat and Poultry and Meat Processing, Cattle Buyer's Weekly.

BIF

Summarize and send to all aspects of the beef chain.

## Other

When value-based marketing comes to the beef industry, most of these questions will be answered by the marketing system. Value-based marketing may be closer than we think!

I think this is an excellent idea for BIF to start looking at beef from a "retail" case standpoint to determine the types of cattle we should be producing.

Carcass maturity or live animal age could be a factor. I'd be interested in others' thoughts on calf feeding vs. yearling fed cattle and marbling requirements there in. Also conformation may be a part of the equation when considering the diversity of muscle within and between breeds and the fact that muscle to bone ratio may be not be reflected by Yield Grade number.

Daryl and Jim: Good luck with this project. I think your goal is very appropriate. We need to identify the targets for each segment and hopefully those targets will be reasonably similar, especially from a cutability standpoint.

Can we get some feedback on quality – number of unacceptable portions or something like that – to further drive for assurance of quality.

Consider: boxed Yield and/or cutting loss for food service and retail.

Should seek information on postmortem environment/technology, such as ideal electrical stimulation, chilling rate, vaccum aging time, cooking temperature for steaks in restaurants, etc.

# LIVESTOCK ULTRASOUND TRAINING AND CERTIFICATION
# JUNE 2-5, 1993

Doyle E. Wilson and Gene Rouse

Iowa State University, in conjunction with the Beef Improvement Federation and the National Swine Improvement Federation, will host a livestock ultrasound training and certification program June 2-5, 1993. This will be the third US beef ultrasound certification program and the first US swine training and certification program. Trainees attending the program will have the opportunity to certify in both species. Certification in beef will be for B-mode (real-time) scanning only. Certification in swine will be for either A-mode or B-mode scanning.

## Certification Officials

The conduct of the beef training and certification training will be under the auspices of a designated group of BIF Certification Officials. This group includes representation from various breed associations, USDA and universities. The BIF Officials will meet formally the evening of June 2 to review all planned procedures and make last minute schedule and process adjustments as deem appropriate. Members of this group will serve as timers and official overseers during the certification program. The BIF Certification Officials will establish the certification criteria. Members of this group include:

Keith Bertrand, University of Georgia
John Crouch, American Angus Association
Ronnie Green, Texas Tech University
Mark Thallman, Texas A&M University
John Hough, American Polled Hereford Association
Gene Rouse, Iowa State University
Don Schiefelbein, North American Limousin Foundation
Doyle Wilson, Iowa State University
Jim Wise, Livestock and Standardization Branch, USDA

## Certified-Reference Technicians

Certification criteria will be established after two currently certified-reference technicians have ultrasonically measured the test animals and their results compared to carcass measurements. The two reference technicians will be scanning the cattle on June 1 which is two days before the trainees are scheduled to collect their measurements. Certification criteria will be established after comparision of the reference technician ultrasound measurements with the carcass measurements. This will allow for adjusting criteria levels consistent with degree of fat cover and any other cattle type effect that could influence standard error of prediction.

The test animals are ISU research feedlot steers that will be ready for market at the time of the certification program. The animals will average 14 months of age and will have been on feed since October 1992. The cattle are crossbred and will exhibit variation in both external fat and ribeye area typical of midwestern feedlots. The two certified-reference technicians are Ken Gill, Ackworth, IA, and Dale Miller, Beef Marketing Specialist, N. Carolina State Univ.

The test animals will be slaughtered the night June 3 and graded the afternoon of June 4. Carcass data will be collected independently by two qualified graders. Jim Wise, Livestock and Standardization Branch, USDA, will be one grader. The second carcass grader is yet to be identified. An average 12-13th rib fat thickness and 12-13th ribeye area between the two graders will be used to establish the "official" carcass measurements for each carcass. The carcass measurements will be made on the right half which is the same side that the scanned. Individual grader fat measurements and ribeye measurements which differ by more than .10 inches and .5 square inches, respectively, on any given carcass will be resolved jointly by the two graders.

**Schedule of Activities**

A very brief schedule of activities for the training and certification program follows:

June 1 (Tue)

Reference technicians scan 50 research steers
Two groups of 20 head selected for certification
Certification Officials meet to review program

June 2 (Wed)

Trainees arrive Rhodes Research Farm
View facilities and receive training and instructions

June 3 (Thu)

Trainees scan 20 head (and repeat scan)
Interpret images and turn in data
Cattle slaughtered at Monforts in Des Moines
Scan data keyed into PC RTU/Stat Program

June 4 (Fri)

Trainees take written examination
Joint beef/swine symposium, trade show and banquet
Carcasses graded
Carcass data keyed and results computed
Certification Officials meet to review results

June 5 (Sat)

Trainees view carcasses in cooler
Trainees given certification results

## Certification Facilities/Equipment

Iowa State University beef research facilities and cattle resources are being used to support the training and certification activities. Personnel support is being provided by the Department of Animal Science, ISU Continuing Education, Meat Science Group, Rhodes Research Farm personnel, Extension Livestock Field Specialists and Animal Science graduate students. The facilities are under roof and include six squeeze chutes provided by Palco. The chutes have fold down side gates, and the scanners will be working the right side of the animal (as facing the animal head on). The chutes will be arranged in a single line arrangement separated by 6 feet of alley space. Trainee technicians are required to provide their own scanning and image interpretation hardware and software. This includes ultrasound equipment, transducer, transducer guide, VCR, tape, etc.

There will be ISU personnel available to assist each trainee in freezing and recording on VCR tape the collected images. Electricity to each chute will be provided by ISU in addition to couplant vegetable oil. There is a separate office building at the farm that can be used by trainee technicians to set up their image interpretation equipment. This facility will accommodate up to 12 trainee technicians at any one time. A sign up roster will be available for the use of this facility. It is perfectly permissible, however, for the trainees to interpret their images in their hotel room or elsewhere.

## Certification Process

The certified-reference technicians will scan 50 head of animals, plus repeat scan the same animals. BIF Officials will observe the scanning by the reference technicians and note any animal with a severe disposition problem and/or other major scanning problem. If such animals are identified, they will be eliminated from the group of test animals. The BIF Officials will identify 40 animals to be used for the certification program. These 40 head will be divided into two groups of twenty in a random manner. Half of the trainee technicians will be assigned to scan one group of 20 head; the other trainee technicians will scan the remaining 20 head. Two groups of 20 head are being used to minimized stress on the animals.

Each test animal is tattooed and ear tagged, but each will be pre-assigned two alias identifications. The first time the animal is processed through the chute system it will carry one alias on the right hip; the second time through the chute it will carry the second alias. Trainee technicians must use the alias identification. Any trainee technician caught making a record of ear tag numbers will be automatically disqualified from further participation in the certification process and escorted from the premises of the Rhodes Research Farm.

Twenty (20) test animals will move sequentially through the chutes at approximately 8 minute intervals for a group of six (6) trainees. This should allow each technician trainee approximately 3.5 minutes to obtain the necessary scan information for each animal. The 8 minute interval may be lengthened if there are cases where trainees will be sharing equipment. In order to save time, is seems to be prudent to allow these trainees to collect their images (on individual trainee tapes) at the same time rather than during a different cycle. Up to 24 trainee technicians will be accommodated on a first come, first serve basis.

### Certification Statistics

Each trainee technician will have their scanning measurements summarized, compared to the carcass measurements and receive three statistical measures of competency. The statistical measures are:

Standard error of prediction (primary statistic)

$$SEP = \sqrt{\sum_i \sum_j \frac{(u_{ij} - c_i - B)^2}{n-1}}$$

Standard error of repeated measures

$$SER = \sqrt{\sum_i \frac{(u_{i2} - u_{i1})^2}{n_2}}$$

Technician bias

$$B = \sum_i \sum_j \frac{u_{ij} - c_i}{n}$$

where,

$c_i$ = the carcass measurement for the $i^{th}$ animal

$u_{ij}$ = the $j^{th}$ RTU measurement on the $i^{th}$ animal

$n_1$ = the no. of animals scanned

$n_2$ = the no. of animals repeat scanned

$n = n_1 + n_2$

Each individual measurement taken by the trainee technician will be used in computing their SEP. The first measurement and repeat measurement will not be averaged.

### Written Examination

On the morning of June 4 trainee technicians will be taking a written examination. This examination is patterned after the one used at the previous Texas A&M certification. There are two parts to the examination:

1. Multiple Choice questions (25)

2. Scan interpretations/anatomy identification questions(20)

One of the objectives of the training session on June 2 will be to cover a majority of the information that the trainees will be tested on is this examination. A study guide prepared by Dr. Jim Stouffer in 1988 is under review and may be updated and made available to the trainees.

## Registration

Prior registration is required to participate in the training and certification program. Each trainee technician must pay a $200 registration fee that will partially defray the event expenses. Livestock trainee technicians certifying in both beef and swine are assessed a registration fee of $250. Registrants are required to provide their own transportation to Des Moines or Ames. There are vans available during the training/certification program to help transport people from and to the Des Moines Airport and to the Rhodes Research Farm. Registrants will also be required to pay for their own hotel accommodations and some meals. The registration fee covers the symposium being held on June 4 with noon lunch and the evening banquet meal. The symposium and evening banquet is open to all non-trainees for the price of $75.

## Financial Support

The trainee technician registrations will not cover the expenses of this event. Many thanks to the organizations that have willingly and enthusiastically made this event possible through their financial contributions. These organizations include:

Beef Improvement Federation
American Angus Association
National Association of Swine Records
National Pork Producers Association
Iowa Pork Producers Association
Middle America Network

# INSTRUMENT GRADING - DEVELOPMENT OF AN ULTRASOUND BASED GRADING SYSTEM

Dr. Doug Parrett, co-investigator; University of Illinois
Dr. J. Novakofski and Dr. W. D. O'Brien, principal investigators; University of Illinois

This multi-year project is in Phase I of a four Phase initiative. This project is based on an interdisciplinary effort involving research scientists from the University of Illinois, Mayo Clinic Foundation (MN) and the Riverside Research Institute (NY). The overall goal for Phase I is to assess a variety of ultrasound technologies and methods of analysis in order to determine the best possible method for predicting meat quality and yield of lean. The project was started March 1, 1992.

Briefly, year one objectives had to construct an ultrasound test instrument, to collect a wide range of ultrasound signal data from 12 cattle, to collect quality and yield data, to analyze the acoustic data at all the laboratories involved and to make a preliminary comparison between acoustic and conventional measures in terms of potential to predict quality and yield.

Construction of the high powered ultrasound instrument was completed and preliminary scans collected on 5 cattle to bring the unit on-line. Full scanning protocols (horizontal & vertical scans) were then completed on 12 cattle both hide-on, hide-off cold. Over 200 megabytes of data were collected on the cattle.

Carcass measurements and comprehensive cutout data were collected on the 12 cattle scanned to determine lean yield. Taste panel evaluation and Warner-Bratzler shear measurements were completed on steaks from these cattle which had been aged 0, 7 and 14 days to evaluate meat quality.

Measuring fat thickness by ultrasound has become pretty well automated. A major portion of the analysis is to also measure tenderness and other meat quality parameters. Two texture analysis approaches are being investigated: Markovian analysis and Run-length statistics to randomly measure fineness, coarseness, smoothness, granulations, etc. and to quantify these measurements. Although results are limited, several acoustic parameters correlate with yield of closely trimmed, boneless lean cuts as highly as do fat thickness, longissimus muscle area or the USDA yield grade.

Correlations developed from only 12 cattle must be viewed with considerable caution. With this in mind, the correlations of taste panel tenderness and shear measures with one acoustic parameter is considerably better than marbling or USDA quality grade. Although very preliminary, this is a promising result since previous research has shown it is difficult to find predictors for meat quality.

Year two of Phase I will consist almost entirely of data collection and analysis from 120 animals.

BIF Reproduction Committee
Minutes
May 28, 1993, Asheville, North Carolina

The meeting of the Reproduciton Committee was brought to order at 2:15 by Bruce E. Cunningham, Chairman. Chairman Cunningham reviewed the list of agenda items then introduced the first speaker, David Notter.

David Notter of VPI addressed the topic of Genetic Evaluation of Reproductive Traits, noting that this topic appears to come up every five years for discussion but very little has been done to date. He opened his presentation with a discussion of the ideal scenario for collecting reproductive data from cows. The ideal situation was a fixed calving season, natural service with several breeding pastures per year, cows stay with same bull, no estrus manipulation, and breeders report all exposures. The use of AI tends to complicate the ideal situation by the temptation to use estrus synchronization. The service sire effect includes the effect of semen handling and the inseminator. Difficult to breed cows tend to be exposed to a different bull or clean up bull. Dr. Notter indicated that we can use individual (1st service) conception rate if all inseminators are known. This trait has some management value but the genetic value is dubious.

In order to collect useful reproductive date, we would need to go to an inventory based data reporting scheme where we have one record per cow per year, includes accurate information on reproductive/culling status, service sires identified, duration of breeding season, and all AI breeding dates recorded. The value of this information would be useful for identifying management problems and to evaluate male fertility whether from AI or natural service. Dr. Notter presented an analysis of data from a purebred herd that served as an excellent example of what could be possible if the industry wished to evaluate sires for female fertility.

He introduced Bruce Tier who is involved with the Group Breedplan evaluation in Australia. Dr. Tier discussed with the audience what is being done regarding reproduction in Australia. This year, Group Breedplan will be providing a genetic evaluation for Angus that has Estimated Breeding Values for Days to Calving. This analysis includes scrotal circumference as a correlated trait. The heritabilities were 8% for days to calving and 40% for scrotal circumference with the genetic correlation to be -.30. The question was brought up regarding what they do with non-calving cows in the analysis? Currently, the Breedplan analysis assigns non-calvers the average calving date of the last 1/4 of the calving season.

In the following discussion, Dr. Notter felt it was important to survey the breed associations and see what type of information was available for analyzing reproductive traits. Based on comments from some of the breed association representatives, some of the associations have in place or are going to some type of inventory based recording program. There was some discussion with respect to the use of scrotal circumference as an indicator trait for female reproduction. While being related to age at puberty in heifers, Dr. Notter indicated that the genetic relationship is not very strong with traits such as calving date. Also he indicated that the heritability estimates of 1st calving date from Angus and Simmental data were comparable in magnitude to estimates of calving ease. Given the size of the heritability for 1st and 2nd calving dates, we could rank bulls based on information from daughters with some degree of accuracy.

Bringing the discussion to an end, Chairman Cunningham requested a motion from the committee to form a subcommittee that would survey the breed associations to 1)determine how they record information on reproduction and to 2) identify large herds that could be recording useful reproductive information. The motion was made by Randy Roberson and seconded by Larry Olson. The motion was approved by voice vote.

Dr. Bob Schalles gave a preliminary report on growth of scrotal circumference in beef bulls. The objectives of the study were to determine scrotal circumference growth curve and age adjustments of young beef bulls of various genotypes, and determine the relationship between scrotal circumference at weaning and yearling ages. The data was collected from over 4,500 bulls by 38 cooperating ranches and bull test stations. These efforts produced over 13,000 scrotal circumference measurements. After editing the data, ten of the 27 breeds represented had sufficient data to be included in the preliminary analysis and accounted for over 4,200 of the bulls. The breeds represented were Angus, Red Angus, Brangus, Charolais, Gelbvieh, Hereford, Polled Hereford, Limousin, Salers, and Simmental. The average age at the time three measurements were taken was approximately 205, 305, and 375 days. There were differences between breed averages and rate of scrotal circumference growth. At yearling age, Gelbvieh, Simmental, and Red Angus had the largest with Salers and Limousin having the smallest scrotal circumference. The Simmental, Angus and Polled Hereford breeds had the fastest growth rate between first and third measurement while the Brangus, Red Angus and Hereford had the slowest growth rate. Dr. Schalles indicated the final analysis is underway and a final report will presented next year.

Chairman Cunningham presented an overview of the revised Breeding Soundness Examination as approved by the Society of Theriogenology. Chairman Cunningham said that the new guidelines are quite different from the old BSE guidelines. The new exam places minimum threshold standards on scrotal circumference, sperm motility, and sperm morphology along with a renewed emphasis on the physical examination of the bull. In order to receive a satisfactory evaluation, a bull must meet the minimum requirements for physical soundness, scrotal circumference, sperm morphology, and sperm motility. If a bull cannot meet all four thresholds, it will receive an unsatisfactory evaluation or a classification deferred if a bull could benefit from further retesting at a later date. A detailed description of the criteria for scrotal circumference, sperm morphology, and sperm motility can be found in Appendix A. Following discussion of the changes in the breeding soundness exam, Chairman Cunningham informed the audience that the committee would be meeting next year in Iowa and he hoped that he would see everyone there.

The meeting was adjourned at approximately 4:00 P.M.

Respectfully Submitted,

Bruce E. Cunningham
Chairman

## Appendix A
## New Guidelines for the Breeding Soundness Examination
(*Spitzer, et al., 1993* )

Scrotal Circumference: Minimum Recommendations

| Age | SC (cm) |
|---|---|
| < 15 months | 30 |
| >15 to 18 months | 31 |
| >18 to 21 months | 32 |
| >21 to 24 months | 33 |
| >24 months | 34 |

Sperm Morphology: 70% Normal Cells
Sperm Motility: 30% individual motility and/or "Fair" gross motility

| Mass Activity (Gross) | Rating | Individual |
|---|---|---|
| Rapid Swirling | Very Good (VG) | >70% |
| Slower Swirling | Good (G) | 50-69% |
| Generalized Oscillation | Fair (F) | 30-49% |
| Sporadic Oscillaiton | Poor (P) | <30% |

Individuals who are interested in obtaining a complete description of the Revised Breeding Soundness Exam should contact the Society of Theriogenology at the following address:

Society of Theriogenology
Don Ellerbee, Executive Director
Association Offices
2727 West 2nd
P.O. Box 2118
Hastings, Nebraska 68902
(402/463-0392)

# RELATIONSHIP BETWEEN YEARLING SCROTAL CIRCUMFERENCE AND MEASURES OF FEMALE REPRODUCTION IN ANGUS CATTLE

D. R. Notter, L. G. McFadden and J. A. G. Bergmann
Virginia Polytechnic Institute and State University

Data for the study came from the Nichols Farms Angus herd. The data on males included scrotal circumference measurements taken on 1,917 yearling bulls born between 1978 and 1991. The mean scrotal circumference was 38.8 cm with a standard deviation of 3.0 cm. Data on females came from 1,773 first and second calving records of 979 cows born between 1975 and 1987. Only animals calving at both their first and second opportunities were included in the data. Calving dates were expressed as deviations from the mean calving date for each calving year and cow age. The mean calving date was approximately April 18 with a range of about 80 d. Mean calving rates for first-calf heifers were about 83%. No consideration was taken in the calving date analyses of animals that failed to calve; however, future analyses will attempt to combine records of open cows with calving date records to produce an overall fertility index as suggested by Notter and Johnson (1987). Across both sexes, 259 sires were represented in the data.

Heritability estimates were calculated for yearling scrotal circumference and adjusted yearling weight of males and for calving rate (0 or 1) as a 2-year-old and for first, second and third calving dates of females. Scrotal circumference was adjusted for either age at measurement or actual yearling weight at measurement and first calving date was adjusted for age at the start of breeding. Variance components used to calculate heritabilities were estimated using an animal model and derivative-free REML (Meyer, 1989). Pedigree information was restricted to that provided by the sires and dams of measured animals.

Resulting heritability estimates, with their standard errors are shown below:

| Trait | Heritability ± S.E. |
|---|---|
| Adjusted yearling weight | .36 ± .05 |
| Scrotal circumference | |
| Age-adjusted | .23 ± .06 |
| Weight-adjusted | .22 ± .06 |
| Calving rate, 2-yr-old | .02 ± .04 |
| First calving date | .18 ± .08 |
| Second calving date | .11 ± .07 |
| Third calving date | .04 ± .09 |

The heritability of adjusted yearling weight was fairly typical of values currently in use in National Cattle Evaluation. However, the heritabilities of scrotal circumference in this herd were much lower than those from experimental herds. In four experimental studies of Hereford cattle, the heritability of scrotal circumference has ranged from .40 to .49 (Neely et al., 1982; Bourdon and Brinks, 1986; Nelsen et al., 1986; Smith et al., 1989a). Estimates of the heritability of scrotal circumference from across-herd analyses of field data or from analysis of test station data have generally exceeded .35 (Latimer et al., 1982; Knights et al., 1984; deRose et al., 1988; Kriese et al., 1991), although deRose et al. (1988) reported a heritability of only .27 ± .16 in a sample of station-tested Angus bulls and Kriese et al. (1991) reported a heritability of .16 in Brangus field data. Meyer et al. (1990) reported heritabilities for scrotal circumference of .26 to .53 for a combination of Australian industry and experimental data involving three breed groups. In particular, Knights et al. (1984) reported a heritability of scrotal circumference of .36 ± .06 from a sire model analysis using a subsample of the Nichols Farms Angus data (717 bulls born in 1975 through 1980); they likewise observed a decline in heritability to .29 when data were adjusted for yearling weight. In contrast, the current analysis yielded similar heritability estimates for age- and weight-adjusted scrotal circumference.

The heritability of calving rate as a 2-year-old was close to zero, indicating little genetic basis for fertility in heifers. However, the heritability of first calving date was .18 ± .08 which was similar to the value of .17 ± .04 reported by Meacham and Notter (1987) using Simmental field data, but higher than the values of .03 ± .02 reported for first calving date by Azzam and Nielsen (1987) from Garst Co. data, of .07 ± .09 reported by Bourdon and Brinks (1982) for Pioneer Hi-Bred data and .09 ± .13 reported by Smith et al. (1989b) for Colorado State University Hereford, Angus and Red Angus data. Lopez de Torre and Brinks (1990) reported a heritability of .16 ± .12 for calving date across all calvings in Spanish Retinta cattle and Meyer et al. (1990) reported heritabilities of days to calving across all parities of .05 to .09 in Australian data.

Heritability of second calving date declined to .11 ± .09. Meacham and Notter (1987) likewise reported a decline in heritability of second calving date to .07 ± .06 whereas Azzam and Nielsen (1987) reported that heritability of second calving date increased to .08 ± .04. By third calving, heritability of calving date continued to decline and was approaching zero.

Genetic correlations of age-adjusted scrotal circumference with first and second calving dates were estimated using multiple-trait REML (Meyer, 1991). Estimated genetic correlations were -.19 and -.27 for age-adjusted scrotal circumference with first and second calving dates, respectively. When scrotal circumference was adjusted for actual yearling weight, the genetic correlation with first calving date remained unchanged at -.19, but the magnitude of the correlation with second calving date increased by about one third to -.36. These negative correlations imply a favorable genetic relationship such that increasing scrotal circumference is associated with earlier calving dates. The relationship with scrotal circumference appears stronger at second calving. These genetic correlations are considerably smaller than the genetic correlations between yearling scrotal circumference and age at puberty in heifer of -.71 estimated by Brinks et al. (1978) and of essentially -1.0 estimated by King et al. (1983).

However, the heritability of age at puberty is generally higher than that of calving date and the correlation between age and puberty and date of first calving in females may also be considerably less than 1.0. Also, variation among breeds in age at puberty is large but, with a fixed breeding season beginning at about 15 months of age, generally does not translate into large differences in first calving date; a similar lack of correspondence between these traits within breeds would not be surprising. In line with the current study, Smith et al. (1989c) reported a favorable, but nonsignificant, phenotypic relationship between age at first calving and sire's scrotal circumference and Toelle and Robison (1985) reported a half-sib genetic correlation of -.14 between scrotal circumference and age at first calving.

In summary, these data produced heritabilities for scrotal circumference that were lower than expected. Potential reasons for this result include use of less-than complete pedigrees and possible culling of smaller males at weaning. These possibilities need to be investigated, but most other published work would be liable to the same criticisms.

Heritabilities for first and second calving dates were reasonably large, but those for third calving date and for calving rate at 2 years of age were essentially zero. Future work should involve incorporation of data on open cows and of service sire effects into the analysis. Other traits (e.g., first A.I. service conception rate) should be considered.

Genetic relationships between yearling scrotal circumference and calving dates were favorable but relatively small. Given these values, scrotal circumference could usefully supplement, but probably not replace, direct selection on female reproductive performance.

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BIF MID-YEAR BOARD MEETING MINUTES
YMCA of the Rockies
Estes Park, CO
October 23-24, 1992

The BIF Board of Directors held its mid-year board meeting at the YMCA of the Rockies in Estes Park, Colorado, on October 23-24, 1992.

Board members present for the meeting were Jim Leachman, President; Marvin Nichols, Vice President; Charles A. McPeake, Executive Director; Ron Bolze and Ronnie Silcox, Regional Secretaries; Paul Bennett, Glenn Brinkman, John Crouch, Bruce Cunningham, Jed Dillard, Jim Gibb, Burke Healey, Loren Jackson, Gary Johnson, Steve McGill, Roy McPhee, and W. Norman Vincel.

Board members not in attendance were Frank Baker, Don Boggs, Larry Cundiff, E. Paola de Rose, Doug Hixon, Craig Ludwig, Gary Weber and Darrell Wilkes.

Also in attendance were Roger McCraw and Beecher Allison from North Carolina State University.

The meeting was opened at 9:10 a.m. on October 23, 1992. President Leachman opened the meeting, visited with group and cleared the agenda.

President Leachman handed out a letter requesting financial support for western region breeding project meeting. He visited about Beef Improvement Association of Australia becoming a member of the U.S. Beef Improvement Federation. He added that the mission statement of BIF needs to be addressed. President added these three items to the agenda. President Leachman then requested the board to introduce themselves and discuss association with industry.

The minutes of the conference meeting were handed out with time allowed to read Bruce Cunningham and Burke Healey moved and seconded acceptance. Motion passed.

Jim Gibb moved Loren Jackson seconded that BIF go on record thanking Dr. William Zollinger for help in the BIF conference and proceedings. Motion carried.

Glenn Brinkman covered BIF's previous years of financial history with Quicken program and discussion followed. McPeake handed out up to date balance sheet and profit and loss statement. Burke Healey moved acceptance of financial statements. Jed Dillard seconded. Motion carried.

Membership reports were handed out and discussed in depth about future membership and contacts. Discussion involved Australia becoming a member and/or having a place on the board. John Crouch suggested the by-laws need to be examined by a committee. Roy McPhee moved to invite Australia to become a member and BIF became a member of the Australian association. Letter of invitation should be sent to Australia. Crouch seconded. Motion carried.

McPeake handed out financial report for BIF Convention in Portland prepared by Dr. Bill Zollinger. After discussion on printing, Bruce Cunningham moved and John Crouch seconded 1992 convention financial report be accepted. Motion passed.

Charles McPeake handed out budget for 1993. Norman Vincel moved and Loren Jackson seconded budget be tabled until after convention and book expenses are discussed. The motion carried.

Nominating committee was appointed by Leachman. John Crouch (chairman), Gary Weber, Loren Jackson and Burke Healey.

Awards committee - Doug Hixon, Paul Bennett, Glenn Brinkman and Gary Johnson. Doug Hixon requests the right to amend the present nomination form for seedstock and commercial awards. Discussion continued. Norman Vincel moved committee be given the right to change the forms for seedstock and commercial for 1993. John Crouch seconded. Motion passed. Paul Bennett moved present plaques to nominees. Loren Jackson seconded. Motion passed. John Crouch moved that nominees be outstanding seedstock and then winner be seedstock producer of the year. Norm Vincel seconded. Jim Gibb and Burke Healey amended to let Awards Committee handle. Both the amendment and motion carried.

Convention - Nichols and McCraw. Marvin brought the board up to date on prior planning for the convention with the following tentative schedule.

Wednesday - May 26th

- 4:00 - 7:00 PM - Board Meeting
- 7:00 PM - NAAB Seminar

Thursday - May 27th

- 8:30 - 9:00 AM - Keynote speaker - Dave Nichols
- 9:00 - 10:00 AM - Break
- 10:30 - 11:30 AM
- 11:30 AM - Caucus
- Lunch - 12:00 - 2:00 PM
- Introduce seedstock and commercial nominees
- North Carolina hosts introductions and welcome
- 2:00 - 5:00 PM - Committee work
    - Central Test and growth
    - Genetic Prediction
- 6:00 PM - Social
    - Clogging and Bluegrass music

Friday, May 28th

AM - Program

12:00 - Lunch - Announce all award winners

New Executive Director

2:00 - 5:00 PM - Committee work

Reproduction

Live Animal

Systems

Banquet - 25th Anniversary

Saturday, May 29th

AM - Board Meeting

Open

PM - Tours

Room rate is $85.00 - Grove Park Inn

Crouch suggested a central theme.
Discussion continued on topics for the program.
Lunch

After lunch Lee Leachman presented a program proposal for SPA seedstock producers. Lee presented an overview of SPA along with handouts of what SPA is and its purpose. A standard means of measuring performance financially and production. He continued with why we need software for present and future. Lee asked for financial support from BIF. A question-answer session followed with additional comments from the board. Burke Healey, Jim Gibb and Jed Dillard discussed a need for BIF's support of SPA. President Leachman brought the conversation to a head explaining the several proposals. John Crouch moved Jim Gibb seconded that BIF fund SPA to the tune of $4,000. Question was asked should we wait until all money requests are available. Burke moved to table motion. Loren Jackson seconded. Motion passed.

Leachman reopened to where the agenda was at lunch break concerning program ideas.

BIF will pay for programs, proceedings and postage for both.
Name tags - Roger McCraw
Ribbons - Charles McPeake
Nominees - for table awards committee - Roger will print

Plaques - Charles McPeake will handle
Lapel pin - Roger McCraw will handle
Speakers and flow of program - Ron Bolze and Ronnie Silcox

1. speaker contact for conference
2. speaker papers for proceedings

Block of rooms - 250

Registration fees - $100 including history book was moved by Paul Bennett. Jed Dillard seconded. Discussion followed. Motion passed.
Students $25 (proceedings and book)

Glenn Brinkman moved and Bruce Cunningham seconded that 2000 copies be printed and sell at $12.50. Motion passed.

Meeting adjourned at 5:15 PM until Saturday at 9:00 AM.

The Saturday segment was called to order at 9:00 AM on October 24, 1992. President Leachman brought everyone up to date on the agenda.

Budget

Book Expenses

| | |
|---|---|
| Edit | $ 500 |
| Printing | 10,888 |
| Travel | 1,041 |
| Miscellaneous | 1,000 |

Book Income (Projected)

| | | |
|---|---|---|
| Convention | $4,000 | Book $7,429 not covered |
| USDA (Weber) | 1,000 | |
| Sell | 1,000 | |

Healey moved approval of budget for book. Bruce Cunningham seconded. Motion carried.

Discussion on Western Regional Conference continued with the different levels of financial backing being sought by the committee.

Ultra sound certification school or workshop - $2,000 requested by John Crouch

| | |
|---|---|
| Moving | $ 300 |
| Plaques | $1,200 |
| Pens | $1,500 |

Glenn Brinkman moved acceptance of moving, plaques and pens. John Crouch seconded. Motion carried.

John Crouch moved to continue discussion on SPA a tabled motion. Jed Dillard seconded. Motion carried. Discussion followed if SPA fits the current mission statement of BIF and whether or not to fund SPA $4,000. Vote was unanimous in support of funding.

Glenn Brinkman brought up that E.T. was not calculated in SPA.

Glenn Brinkman moved, Loren Jackson seconded $2,000 be paid to Iowa State for ultra sound certification. Motion carried.

Roy McPhee moved and John Crouch seconded that the Western Region funding be denied. Motion carried.

Roy McPhee moved acceptance of budget as modified. Norman Vincel seconded. Motion carried.

Iowa plans look good for 1994 convention plans--everything is in order. Discussion continued on finances for convention.

After much discussion on convention budgets. Loren Jackson moved a budget policy be put in place that BIF expect a convention to break even or underwrite up to $5,000 convention loss. Both parties sign a letter of agreement on convention budget. BIF and convention would share equally any profits. Paul Bennett seconded.

Glenn Brinkman moved to amend, Burke Healey seconded, that if the $5,000 is not underwritten host state will receive all profits. Amendment carried. Motion as amended passed.

Jim Gibb moved and Loren Jackson seconded to send Don Boggs a letter of thanks for his assistance in coordinating the BIF factsheets revisions. Motion carried.

(a) Central Test and Growth
    Ronnie Silcox reported of plans for speakers at convention. Canada EPD's in test stations.

(b) Systems
    Jim Gibb reported SPA emphasis. Want to continue to work with SPA folks and work with simulation.

(c) Live animal evaluation -
    John Crouch discussed ultrasound, instrument grading
    Like to delay any guidelines update until after the Iowa meeting

(d) Reproduction - Cunningham
    Calving interval
    Calving ease
    Traits in keeping daughters as replacements
    Databases on why cows are culled.

(e) Genetic Prediction

John Crouch moved the following recommendations for inclusion in the sire evaluation reports be included in the guidelines: 1. Genetic trends by birth year for all animals be reported. 2. Average EPD's for all active sires (those with at least one calf included in the analysis in the last two years) be reported with the option to report the average EPD's of all sires in the analysis. 3. The average EPD's for all active dams (those having a calf in the analysis in the last two years) be reported. 4. A percentile breakdown (1,2,3,4,5% and every five % points thereafter) be reported for active sires, active dams, and non-parents from the most current birth year. Acceptance. Norman Vincel seconded. Motion carried.

John Crouch moved that two breed tables (1. a breed table for breeds in which adjustments for genetic trends could be made and 2. a breed table for all 26 breeds in the US MARC-GPE project that would include *all traits* available) be published by BIF yearly starting in 1993. Norman Vincel seconded. Motion passed.

Ronnie Silcox moved that tables be explained and clearly labeled and submitted to board by April 1 for board action. John Crouch seconded. Motion carried.

Edit committee - NCE edit -- Recommend edits, Keith Bertrand, Chairman, Paola de Rose, Richard Quaas, Bruce Golden.

Central Test

Ron Bolze moved central test committee formulate 1991 breed information and distribute to central test managers and recommend it be printed in the sale catalog. Motion carried.

Discussion followed on an on-farm testing combining with central test records and the handling of such records.

Performance in the showring. McPeake discussed. Leachman illustrated what Red Angus had done at Nile in handing out data to the judge and to the audience. Very positive move was his opinion. Hereford people have handed out performance information. Discussion continued. Crouch moved Roy McPhee seconded that Leachman appoint a committee to study the standardization process. Leachman appointed himself chairman along with Gibb, McGill, Hixon, Cunningham and Gary Johnson.

What the committee will present will be ready on April 1, 1993.

Will be in live animal evaluation committee

The material will be handed out to audience.

John Crouch recommended a committee to review the by-laws of BIF. Leachman appointed committee as follows: Burke Healey, Chairman and asked Burke to select the other members later. Roy McPhee moved Jed Dillard seconded. Motion passed.

Norman Vincel reviewed for the board directors and terms over the past several years with a chart of past directors. Norman asked that election information be included in the program. Jim Gibb moved Executive Director be responsible for the continuation of the chart. Norman Vincel seconded. Motion carried.

Norman Vincel moved and John Crouch seconded that election information be in convention packet. Motion passed.

Cunningham moved Crouch seconded that NAAB information be included in BIF program. Motion passed.

Gary Johnson discussed cow efficiency and the need for critical data that could lead to more competitiveness in beef production. Discussion continued from the board.

The board agreed the mission statement would be handled by review of by-laws. The committee suggested was Gibb and Crouch.

Crossbreed data base - Jim Gibb discussed the need of F1 information to provide a service for a breed. Jim Leachman is not the only person that is in the composite production. Can we provide better information if we have this data base. Much more discussion followed.

Norman Vincel moved and Jim Gibb seconded that this information be given to the genetic prediction committee to request them to gather and study this situation. Motion carried. Discussion was held on whether or not the mid-year board meeting to be held again at YMCA in Colorado. Discussion continued. Ronnie Silcox moved the mid-year board meeting be found at YMCA unless a better facility was held. Glenn Brinkman seconded and motion carried.

There being no further business the board meeting was adjourned at 1:39 PM.

Respectfully Submitted,

Charles A. McPeake

Charles A. McPeake
Executive Director

**BEEF IMPROVEMENT FEDERATION**
**STATEMENT OF REVENUES AND EXPENSES**
**CASH BASIS**
**JANUARY 1, 1992 - DECEMBER 31, 1992**

| | | | |
|---|---|---|---|
| REVENUES: | | | |
| | DUES | 9,955.00 | |
| | PROCEEDINGS & GUIDELINES | 1,703.50 | |
| | INTEREST | 2,796.76 | |
| | REIMBURSEMENT MID-YR BD MTG. | 2,082.30 | |
| | NATIONAL CONVENTION | 500.00 | |
| | TOTAL REVENUES | | 17,037.56 |
| EXPENSES: | | | |
| | SALARIES | 1,407.65 | |
| | PAYROLL TAXES | 155.79 | |
| | ACCOUNTING | 275.00 | |
| | OFFICE EXPENSE | 151.38 | |
| | PRINTING | 7,554.75 | |
| | DIRECTORS TRAVEL | 2,311.47 | |
| | TELEPHONE | 600.00 | |
| | GUIDELINE & PROCEEDING POSTAGE | 1,581.00 | |
| | POSTAGE - OTHER | 346.00 | |
| | HISTORY BOOK EXPENSE | 1,185.74 | |
| | LEGAL FEES | 85.00 | |
| | MID-YR BD MTG -92 | 4,461.41 | |
| | CONVENTION EXPENSES | 1,696.65 | |
| | MISCELLANEOUS | 438.39 | |
| | TOTAL EXPENSES | | 22,250.23 |
| EXCESS OF EXPENSE OVER REVENUE | | | -5,212.67 |

SEE ATTACHED ACCOUNTANT'S COMPILATION REPORT

# BEEF IMPROVEMENT FEDERATION
# STATEMENT OF ASSETS, LIABILITIES AND FUND BALANCE
# CASH BASIS
# DECEMBER 31, 1992

| | |
|---|---|
| ASSETS | |
| CURRENT ASSETS | |
| CASH IN BANK - CHECKING | 1,279.02 |
| SAVINGS CERTIFICATE | 54,435.39 |
| TOTAL CURRENT ASSETS | 55,714.41 |
| | |
| LIABILITIES | |
| CURRENT LIABILITIES | 82.83 |
| | |
| EQUITY ACCOUNTS | |
| FUND BALANCE - DECEMBER 31, 1991 | 60,844.25 |
| CURRENT YEAR EXCESS (expense over revenue) | -5,212.67 |
| TOTAL FUND BALANCE | 55,631.58 |
| | |
| TOTAL LIABILITIES & FUND BALANCE | 55,714.41 |

SEE ATTACHED ACCOUNTANT'S COMPILATION REPORT

Agenda
BIF Board of Directors Meeting
Grove Park Inn and Country Club
Asheville, North Carolina
Wednesday, May 26, 1993

1. Clear Agenda - Jim Leachman

2. Minutes - Charles McPeake

3. Treasurer's Report - Charles McPeake

4. Membership Report - Charles McPeake

5. Report on North Carolina Convention - Roger McCraw

6. Plans for 1994 Convention in Iowa - Marvin Nichols

7. Future Convention Invitations - Charles McPeake
   a. Wyoming
   b.
   c.

8. Standing Committee Reports - Plans for the Convention
   a. Live animal and carcass evaluation - John Crouch
   b. Central test station and growth - Ronnie Silcox
   c. Genetic prediction - Larry Cundiff
   d. Systems - Jim Gibb
   e. Reproduction - Bruce Cunningham

9. BIF By-Laws Committee Report - Burke Healey, Chairman

10. Election of Directors - Norman Vincel

11. Elect New Officers - Nominating Committee - John Crouch, Chairman

12. Awards - Award Committee - Doug Hixon, Chairman

13. Establishment of Frank Baker Scholarship Fund - Charles McPeake

14. New Business

## Minutes of Beef Improvement Federation
## Board of Directors Meeting
## Grove Park Inn
## Asheville, North Carolina
## May 26-29, 1993

The BIF Board of Directors held it's Convention at the Grove Park Inn in Asheville, North Carolina, on May 26, through May 29, 1993.

Board members present for the meeting were James Leachman, President; Charles McPeake, Executive Director; Paul Bennett, Don Boggs, John Crouch, Larry Cundiff, Bruce Cunningham, Paola de Rose, Jed Dillard, Jim Gibb,Burke Healey, Doug Hixon, Loren Jackson, Gary Johnson, Craig Ludwig, Steve McGill, Roy McPhee, Marvin Nichols, Ronnie Silcox, Norman Vincel, Gary Weber, and Darrell Wilkes.

Board members not in attendance were Glenn Brinkman and Jack Chase. Ron Bolze attended as the new Executive Director.

Also attending the meeting were Roger McCraw and Beecher Allison of North Carolina as BIF Conference hosts.

President Leachman called the meeting to order at approximately 4:15 p.m. on Wednesday, May 26, 1993, and the following items of business were transacted.

President Leachman cleared the agenda. Two additional items were added to the agenda. These included a proposal submitted by Hayes Walker to sell advertising to cover the cost of printing the 1993 proceedings and a committee report on performance information in the showring.

**Minutes of the Previous Meeting** - Copies of the minutes from the previous midyear board meeting held October 23 and 24, 1992 at YMCA of the Rockies in Estes Park, Colorado were distributed by Charles McPeake. Bruce Cunningham cited a typographical error. Roy McPhee moved that the minutes be accepted as amended to correct the typographical error. Jed Dillard seconded and the minutes were approved as amended.

**Treasurers Report** - Charles McPeake provided copies of the statement of assets, liabilities and fund balance (cash basis) for December 31, 1992, and May 12, 1993. He also provided copies of the statement of revenues and expenses (cash basis) for the periods of time including January 1, 1992 - December 31, 1992, and January 1, 1993 - May 12, 1993. Discussion followed concerning certificate of deposit maturity date, history book printing expense and BIF financial support of NCA seedstock SPA development. Norm Vincel moved and Bruce Cunningham seconded acceptance of the financial report. Motion carried.

**Membership Report** - Charles McPeake distributed copies of the membership report. The reported show that 30 state organizations, 27 breed associations and 18 other firms had paid membership dues as of May 25, 1993. John Crouch moved and Jed Dillard seconded acceptance of the membership report. Motion carried.

Hayes Walker was invited to present a proposal. The proposal involved selling advertisement space to breed associations and other organizations in the 1993 BIF proceedings to cover the cost of printing the proceedings. After much discussion involving printing costs, delegation of responsibiliity and proposal details, Jim Gibb questioned commercialization of the proceedings. Roy McPhee moved and Jed Dillard seconded to decline the proposal. Motion carried.

**Plans for 1993 Convention** - President Leachman welcomed our hosts to the board meeting and Roger McCraw brought the board up to date on Convention activities and numbers. Discussion involved luncheon and awards banquet, head table seating, emcees and activities. The board expressed thanks to Roger McCraw and Beecher Allison for a job well done.

**Plans for 1994 Convention** - Marvin Nichols brought the board up to date on current plans and contributions from organizations in Iowa. Marvin indicated that the 1994 Convention would be a cooperative effort between Daryl Strohbehn and Doyle Wilson from the ISU Animal Science Department and the Iowa Cattlemen's Association and the Iowa Beef Breeds Council. The 1994 Convention will be held at the Holiday Inn in Des Moines, Iowa, on June 1, 2, 3, and 4.

**Plans for the 1995 Convention** - Doug Hixon announced plans for the 1995 Convention in Wyoming with more details to be announced later.

**Standing Committee Reports** - Plans for the Convention

a. **Live Animal and Carcass Evaluation - John Crouch**
   John Crouch reported that Doug Parrett would not be reporting on mechanical grading with no report at the comittee meeting. John indicated that Doyle Wilson would be extending an invitation and providing details on the ultrasound training and certification seminar scheduled for June 2-5, 1993. President Leachman requested that the subcommittee charged with formulating recommendations for the use of performance data in the showring meet the following morning to formulate the committee report and for further discussion at the midyear meeting.

b. **Central Test and Growth - Ronnie Silcox**
   Ronnie Silcox reported that the three speakers (Kiser/Beal/Boggs) from the Thursday morning general session would participate in a panel discussion involving trait selection for birthweight/calving ease, milk production, growth and mature size as it relates to central bull test stations. An open discussion

forum would follow to provide direction for future central test and growth committee efforts.

**c. Genetic Prediction - Larry Cundiff**
Larry Cundiff reported that the Genetic Prediction Committee would follow the same program as printed in the brochure. Including Edits for Genetic Prediction Analysis (Keith Bertrand), Interim EPD's (Bruce Cunningham), Interbreed Comparisons (Larry Cundiff) and Accuracy of Interbreed Comparisons (L. S. Van Vleck). In addition, Bruce Golden would provide insight into Direct/Maternal Convariance Analysis for Weaning Weight.

**d. Systems - Jim Gibb**
Jim Gibb reported that Don Boggs would report on the new IRM/SPA Desk Top Record Book. Lee Leachman would update the committee on the current status of seedstock SPA. Economic value of traits would not be presented. Daryl Strohbehn would provided insight into monitoring end product targets.

**e. Reproduction - Bruce Cunningham**
Bruce Cunningham reported that the reproduction committee would follow the program as printed in the brochure including Genetic Evaluation of Reproductive Traits (Dave Notter), Adjustment Factors for Scrotal Circumference (Robert Schalles) and Revised Guidelines for Breeding Soundness Examination (Bruce Cunningham).

**Election of Directors - Norman Vincel**
Norman Vincel discussed nomination and election of directors. He handed out information to be distributed prior to the caucuses for election of directors. He indicated that caucuses would need to nominate and elect three new board members to replace Jim Gibb, James Leachman and Marvin Nichols as Breed Association, Western Region and At-Large Directors, respectively. Jim Gibb, Doug Hixon, Don Boggs and Ronnie Silcox would moderate the breed associations, Western, Central and Eastern areas, respectively.

**By-Law Changes - Burke Healey**
Burke Healey distributed copies of the current By-Laws (approved in November of 1987) and proposed changes from the By-Laws review committee consisting of Burke Healey, Chairman, Jim Gibb, John Crouch, Ronnie Silcox, Paul Bennett, Norman Vincel and Ron Bolze. Board members were encourage to study the proposed changes and be prepared for board action at the midyear meeting. Jim Gibb recognized the efforts involved with By-Law review and the Board thanked Healey for his efforts.

**Election of new officers - John Crouch**
John Crouch, Chairman of the nominating committee consisting of Gary Weber, Loren Jackson and Burke Healey, presented the following nominations: Marvin Nichols for President and Paul Bennett for Vice-President. There being no further nominations,

Bruce Cunningham moved the nominations cease and the two be elected by acclamation. Steve McGill seconded and the motion carried. Burke Healey moved that Marvin Nichols be appointed as an additional Executive Board member for one year term in accordance with the provisions as set out in the BIF By-Law 7, Sec. 2(e), and that said term shall commence immediately upon the election of a successor to his present position as member at-large. Jim Gibb seconded and the motion passed.

**Awards Committee - Doug Hixon**

Doug Hixon, Chairman of the Awards Committeee consisting of Paul Bennett, Glenn Brinkman and Gary Johnson, presented the following recipients of awards:

Pioneer Award:
Richard Willham, James Bennett, Dixon Hubbard, M. K. "Curly" Cook, O'Dell Daniels, Hayes Gregory and James W. "Pete" Patterson

Continuing Service Award:
Robert McQuire
Henry Webster
Charles McPeake

Ambassador Award:
J. T. "Johnny" Jenkins

Outstanding Seedstock Producer Award:
R. A. "Rob" Brown
David Nichols

Outstanding Commercial Producer Award:
Jon Ferguson

Doug Hixon reported that the committee had expressed concern that some nominations may not have been completed by the nominee themselves. He distributed nomination forms reflecting proposed changes which will be discussed at the midyear meeting.

**Frank Baker Scholarship Fund -**

Charles McPeake proposed that BIF explore the potential for a Frank Baker Scholarship Fund, the proceeds from which could financially support graduate students studying beef cattle animal breeding. Jim Gibb moved and Paul Bennett seconded committee appointment to explore such matters. Committee appointment was tabled until the Board reconvened Saturday morning.

John Crouch moved Board adjournment until Saturday morning. Bruce Cunningham seconded and the motion carried.

President Marvin Nichols reconvened the Board of Directors meeting at 8:45 a.m. Saturday, May 29, 1993. He welcomed three new Directors including Willie Altenburg, John Hough and Lee Leachman representing Western Region, Breed Association and at-large Directors, respectively.

**Frank Baker Scholarship Fund -**
Discussion was reinitiated relative to fund usage and method of establishment. Burke Healey asked if there had ever been a filing of BIF with the IRS as a non-profit organization. If not, he questioned the legal ability of BIF to accept charitable donations. John Crouch moved and Paul Bennett seconded for BIF to establish the Frank Baker Scholarship Fund. Motion passed. President Nichols appointed a committee consisting of Charles McPeake, Chairman, Ronnie Silcox, John Crouch and Gary Weber.

**History Book - Ideas Into Aciton**
President Nichols encouraged Board members to actively campaign and move the remaining approximately 1500 copies of the book. Don Boggs agreed to write a newsrelease for distribution to popular press. Gary Weber agreed to write a newsrelease for the American Society of Animal Science Newsletter and to explore the possibility of USDA purchase for distribution to agricultural libraries. Norman Vincel moved and Paul Bennett seconded the following individual or bulk rate sales levels:

| | |
|---|---|
| Single copy | $12.50 |
| 20 to 49 | 10.00 |
| 50 to 99 | 9.00 |
| > 100 | 8.00 |

Loren Jackson moved and Bruce Cunningham seconded that BIF go on record as recognizing the efforts of Frank Baker, Richard Willham and Roy Wallace as authors of "Ideas Into Action". Letters of thanks will follow. Motion carried.

Larry Cundiff reported that Richard Willham has bound copies of past proceedings, guidelines, workshop proceedings and the history. These, along with other materials used to write the history are to be placed in the archives at Iowa State University.

Burke Healey moved and Roy McPhee seconded that Richard Willham be appointed for one year term to the Board as an "Ex Officio" member. Motion carried.

James Leachman moved and Craig Ludwig seconded that Richard Willham become the official Historian for BIF. Motion carried.

Gary Weber suggested the Dixon Hubbard could make valuable contribution to the Board in Frank Bakers absence. John Crouch moved and Bruce Cunningham seconded the appointment of Dixon Hubbard to the Board in an "Ex Officio" capacity. Motion carried.

**Midyear Board Meeting** - Ron Bolze reported that tentative reservations had been made to hold the midyear Board meeting on October 21-23, 1993, at YMCA of the Rockies, Barclay Lodge in Estes Park, Colorado. After much discussion, Roy McPhee moved and Norman Vincel seconded to hold the midyear Board meeting in Estes Park (location only). Motion carried. Bruce Cunningham moved and John Crouch seconded to hold the meeting on October 28-30. Bruce Cunningham moved and Paul Bennett seconded to amend the original motion to different dates of September 30-October 2. The amendment passed and the amended motion passed. Willie Altenburg offered the use of American Breeders Service vans for transportation to and from the Barclay Lodge and Denver Airport. If reservations could not be made for the Estes Park Barclay Lodge for September 30 - October 2, the midyear Board meeting will be held in Kansas City.

**COMMITTEE REPORTS**

**Systems Committee - Jim Gibb**
Jim Gibb reported that the Systems Committee would present the results of the End Products Target Survey at the midyear meeting. No Board action was required. President Nichols appointed John Hough as the new chairman of the Systems Committee as Jim Gibb is leaving the Board.

**Genetic Prediction Committee - Larry Cundiff**
Larry Cundiff reported that many Genetic Prediction Committee members felt the need for a genetic prediction workshop in the near future. Tentative plans were being laid. No Board action was required.

**Central Test and Growth Committee - Ronnie Silcox**
Ronnie Silcox reported that average breed EPD tables for individuals born in 1992 were being prepared for inclusion in the proceedings. The Central Test and Growth Committee expressed the need for an "on-farm testing" fact sheet. No Board action was required.

**Live Animal and Carcass Evaluation - John Crouch**
John Crouch reported that Doyle Wilson would provide a complete report from the Ultrasound Training and Certification Seminar at Iowa State University at the mid year meeting. In addition, the subcommittee on use of performance data in the showring should report at the same time. No Board action required.

**Reproduction - Bruce Cunningham**
Bruce Cunningham reported that some breed association performance programs were adopting cow inventory based systems which may have some merit for collecting reproductive data for possible EPD analysis. Kansas State scrotal circumference age adjustment equations should be finalized for Board approval in Iowa. The Society of Theriogenology Revised Breeding Soundness Examination Guidelines will be printed in the proceedings. No Board action required.

**By-Laws Changes**
Norman Vincel questioned why three regional secretaries and the executive secretary are non-voting "Ex Officio" members only. Discussion generated no need to give these

positions voting power. John Crouch moved and Craig Ludwig seconded to insert Directors "transitionary" terms of office into the proposed By-Law changes. Motion carried.

Craig Ludwig moved and Noman Vincel seconded for BIF to pay for the hatband and shotgun presented to Charles McPeake as out-going Executive Director.

Jed Dillard thanked the board for the flower arrangement and words of encouragement during his recent hospital stay.

Ronnie Silcox suggested that BIF go on record as appreciating the efforts of Roger McCraw, Beecher Allison and other North Carolina personnel resulting in another successful Convention. Thank you letters followed.

President Nichols appointed a committee to prepare a document specifying the Convention responsibilities of BIF and the host state. Committee members included Paul Bennett, Chairman; Norman Vincel, John Hough and Roger McCraw.

There being no further business, President Nichols adjourned the meeting at 10:30, Saturday, May 29, 1993.

Respectfully Submitted,

Ron Bolze
Executive Director

BEEF IMPROVEMENT FEDERATION
STATEMENT OF REVENUES AND EXPENSES
CASH BASIS
JANUARY 1, 1993 - MAY 12, 1993

| | | |
|---|---|---|
| REVENUES: | | |
| DUES | 10,050.55 | |
| PROCEEDINGS & GUIDELINES | 330.00 | |
| INTEREST | 937.97 | |
| REIMBURSEMENT MID-YR BD MTG. | 770.00 | |
| TOTAL REVENUES | | 12,088.52 |
| EXPENSES: | | |
| SALARIES | 433.13 | |
| PAYROLL TAXES | 31.73 | |
| OFFICE EXPENSE | 231.50 | |
| DIRECTORS TRAVEL | 358.72 | |
| POSTAGE - OTHER | 450.00 | |
| HISTORY BOOK EXPENSE | 992.28 | |
| IOWA STATE (ULTRA SOUND) | 2,000.00 | |
| TOTAL EXPENSES | | 4,497.36 |
| EXCESS OF REVENUE OVER EXPENSE | | 7,591.16 |

SEE ATTACHED ACCOUNTANT'S COMPILATION REPORT

BEEF IMPROVEMENT FEDERATION
STATEMENT OF ASSETS, LIABILITIES AND FUND BALANCE
CASH BASIS
MAY 12, 1993

| | |
|---|---|
| ASSETS | |
| CURRENT ASSETS | |
| CASH IN BANK - CHECKING | 7,849.38 |
| SAVINGS CERTIFICATE | 55,373.36 |
| TOTAL CURRENT ASSETS | 63,222.74 |
| | |
| LIABILITIES | |
| CURRENT LIABILITIES | .00 |
| | |
| EQUITY ACCOUNTS | |
| FUND BALANCE - DECEMBER 31, 1992 | 55,631.58 |
| CURRENT YEAR EXCESS | 7,591.16 |
| TOTAL FUND BALANCE | 63,222.74 |
| | |
| TOTAL LIABILITIES & FUND BALANCE | 63,222.74 |

SEE ATTACHED ACCOUNTANT'S COMPILATION REPORT

## PAID - BIF MEMBER ORGANIZATIONS AND AMOUNT OF DUES FOR 1993
As of May 25, 1993

| STATE BCIA'S | DUES |
|---|---|
| Alabama | $100.00 |
| Buckeye Beef (Ohio) | $100.00 |
| California | $100.00 |
| Florida | $100.00 |
| Georgia | $100.00 |
| Hawaii | $100.00 |
| Indiana | $100.00 |
| Iowa | $100.00 |
| Kansas | $100.00 |
| Kentucky | $100.00 |
| Minnesota | $100.00 |
| Mississippi | $100.00 |
| Missouri | $100.00 |
| New Mexico | $100.00 |
| New York | $100.00 |
| North Carolina | $100.00 |
| North Dakota | $100.00 |
| Oklahoma | $100.00 |
| Oregon | $100.00 |
| Pennsylvania | $100.00 |
| South Carolina | $100.00 |
| South Dakota | $100.00 |
| Tennessee | $100.00 |
| Texas | $100.00 |
| Utah | $100.00 |
| Virginia | $100.00 |
| Washington | $100.00 |
| West Virginia | $100.00 |
| Wisconsin | $100.00 |
| Wyoming | $100.00 |

**Breed Associations**

| | |
|---|---|
| American Angus | $600.00 |
| American Beefalo | $50.00 |
| American Blonde d'Aquitaine | $100.00 |
| American Brahman | $200.00 |
| American Chianina | $200.00 |
| American Gelbvieh | $300.00 |
| American Hereford | $500.00 |
| American International Charolais | $300.00 |
| American Murray Grey | $100.00 |
| American Polled Hereford | $500.00 |
| American Red Poll | $100.00 |
| American Salers | $300.00 |
| American Shorthorn | $200.00 |
| American Simmental | $500.00 |
| American Tarentaise | $100.00 |
| Barzona Breeders | $100.00 |
| Belted Galloway Society | $100.00 |
| Beefmaster Breeders | $300.00 |
| Canadian Charolais | $200.00 |
| Canadian Hereford | $100.00 |
| Canadian Simmental | $100.00 |
| International Braford Assoc. | $200.00 |
| International Brangus Breeders | $300.00 |
| North American Limousin | $300.00 |
| Red Angus | $200.00 |
| Salers Assoc. of Canada | $100.00 |
| Santa Gertrudis Breeders | $200.00 |

**Others**

| | |
|---|---|
| Agriculture Canada - Red Meat Div. | $100.00 |
| American Breeders Service | $100.00 |
| Canadian Hays Converter Association | $100.00 |
| Connors State College | $100.00 |
| Great Western Beef Expo | $50.00 |
| King Ranch | $50.00 |
| Manitoba Agriculture | $100.00 |
| NOBA | $100.00 |
| National Assoc. of Animal Breeders | $100.00 |
| National Cattlemen Assoc. | $100.00 |
| Ontario Beef Cattle Performance | $100.00 |
| Rancho Arboleda | $50.00 |
| Ronald Schlegel | $50.00 |
| Select Sires, Inc. | $100.00 |
| Taylors Black Simmental | $50.00 |
| Tri-State Breeders Corp. | $100.00 |
| Turner Bros. Farms, Inc. | $50.00 |
| 21st Century Genetics | $100.00 |

## BIF MEMBERS WHO HAVE NOT PAID MEMBERSHIP DUES FOR 1993 (as of May 25, 1993)

| STATE BCIA'S | |
|---|---|
| Colorado | $100.00 |
| Idaho | $100.00 |
| Illinois | $100.00 |
| Montana | $100.00 |

**Others**

| | |
|---|---|
| North American South Devon | $100.00 |
| White Butte Ranch | $50.00 |

## THE SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

| | | |
|---|---|---|
| John Crowe | CA | 1972 |
| Dale H. Davis | MT | 1972 |
| Elliot Humphrey | AZ | 1972 |
| Jerry Moore | OH | 1972 |
| James D. Bennett | VA | 1972 |
| Harold A. Demorest | OH | 1972 |
| Marshall A. Mohler | IN | 1972 |
| Billy L. Easley | KY | 1972 |
| Messersmith Herefords | NE | 1973 |
| Robert Miller | MN | 1973 |
| James D. Hemmingsen | IA | 1973 |
| Clyde Barks | ND | 1973 |
| C. Scott Holden | MT | 1973 |
| William F. Borror | CA | 1973 |
| Raymond Meyer | SD | 1973 |
| Heathman Herefords | WA | 1973 |
| Albert West III | TX | 1973 |
| Mrs. R.W. Jones, Jr. | GA | 1973 |
| Carlton Corbin | OK | 1973 |
| Wilfred Dugan | MO | 1974 |
| Bert Sackman | ND | 1974 |
| Dover Sindelar | MT | 1974 |
| Jorgensen Brothers | SD | 1974 |
| J. David Nichols | IA | 1974 |
| Bobby Lawrence | GA | 1974 |
| Marvin Bohmont | NE | 1974 |
| Charles Descheemacker | MT | 1874 |
| Bert Crame | CA | 1974 |
| Burwell M. Bates | OK | 1974 |
| Maurice Mitchell | MN | 1974 |
| Robert Arbuthnot | KS | 1975 |
| Glenn Burrows | NM | 1975 |
| Louis Chesnut | WA | 1975 |
| George Chiga | OK | 1975 |
| Howard Collins | MO | 1975 |
| Jack Cooper | MT | 1975 |
| Joseph P. Dittmer | IA | 1975 |
| Dale Engler | KS | 1975 |
| Leslie J. Holden | MT | 1975 |
| Robert D. Keefer | MT | 1975 |
| Frank Kubik, Jr. | ND | 1975 |
| Licking Angus Ranch | NE | 1975 |
| Walter S. Markham | CA | 1975 |
| Gerhard Mittnes | KS | 1976 |

| | | |
|---|---|---|
| Ancel Armstrong | VA | 1976 |
| Jackie Davis | CA | 1976 |
| Sam Friend | MO | 1976 |
| Healey Brothers | OK | 1976 |
| Stan Lund | MT | 1976 |
| Jay Pearson | ID | 1976 |
| L. Dale Porter | IA | 1976 |
| Robert Sallstrom | MN | 1976 |
| M.D. Shepherd | ND | 1976 |
| Lowellyn Tewksbury | ND | 1976 |
| Harold Anderson | SD | 1977 |
| William Borror | CA | 1977 |
| Robert Brown, Simmental | TX | 1977 |
| Glen Burrows, PRI | NM | 1977 |
| Henry, Jeanette Chitty | FL | 1977 |
| Tom Dashiell, Hereford | WA | 1977 |
| Lloyd DeBruycker | MT | 1977 |
| Wayne Eshelman | WA | 1977 |
| Hubert R. Freise | ND | 1977 |
| Floyd Hawkins | MO | 1977 |
| Marshall A. Mohler | IN | 1977 |
| Clair Percel | KS | 1977 |
| Frank Ramackers, Jr. | NE | 1977 |
| Loren Schlipf | IL | 1977 |
| Tom & Mary Shaw | ID | 1977 |
| Bob Sitz | MT | 1977 |
| Bill Wolfe | OR | 1977 |
| James Volz | MN | 1977 |
| A.L. Frau | | 1978 |
| George Becker | ND | 1978 |
| Jack Delaney | MN | 1978 |
| L.C. Chestnut | WA | 1978 |
| James D. Benett | VA | 1978 |
| Healey Brothers | OK | 1978 |
| Frank Harpster | MO | 1978 |
| Bill Womack, Jr. | AL | 1978 |
| Larry Berg | IA | 1978 |
| Buddy Cobb | MT | 1978 |
| Bill Wolfe | OR | 1978 |
| Roy Hunt | PA | 1978 |
| Del Krumwied | ND | 1979 |
| Jim Wolf | NE | 1979 |
| Rex & Joann James | IA | 1979 |
| Leo Schuster Family | MN | 1979 |

| | | |
|---|---|---|
| Bill Wolfe | OR | 1979 |
| Jack Ragsdale | KY | 1979 |
| Floyd Mette | MO | 1979 |
| Glenn & David Gibb | IL | 1979 |
| Peg Allen | MT | 1979 |
| Frank & Jim Willson | SD | 1979 |
| Donald Barton | UT | 1980 |
| Frank Felton | MO | 1980 |
| Frank Hay | CAN | 1980 |
| Mark Keffeler | SD | 1980 |
| Bob Laflin | KS | 1980 |
| Paul Mydland | MT | 1980 |
| Richard Tokach | ND | 1980 |
| Roy & Don Udelhoven | WI | 1980 |
| Bill Wolfe | OR | 1980 |
| John Masters | KY | 1980 |
| Floyd Dominy | VA | 1980 |
| James Bryan | MN | 1980 |
| Charlie Richards | IA | 1980 |
| Blythe Gardner | UT | 1980 |
| Richard McLaughlin | IL | 1980 |
| Bob Dickinson | KS | 1981 |
| Clarence Burch | OK | 1981 |
| Lynn Frey | ND | 1981 |
| Harold Thompson | WA | 1981 |
| James Leachman | MT | 1981 |
| J. Morgan Donelson | MO | 1981 |
| Clayton Canning | CAN | 1981 |
| Russ Denowh | MT | 1981 |
| Dwight Houff | VA | 1981 |
| G.W.Cornwell | IA | 1981 |
| Bob & Gloria Thomas | OR | 1981 |
| Roy Beeby | OK | 1981 |
| Herman Schaefer | IL | 1981 |
| Myron Aultfathr | MN | 1981 |
| Jack Ragsdale | KY | 1981 |
| W.B. Williams | IL | 1982 |
| Garold Parks | IA | 1982 |
| David A. Breiner | KS | 1982 |
| Joseph S. Bray | KY | 1982 |
| Clare Geddes | CAN | 1982 |
| Howard Krog | MN | 1982 |
| Harlin Hecht | MN | 1982 |
| William Kottwitz | MO | 1982 |
| Larry Leonhardt | MT | 1982 |
| Frankie Flint | NM | 1982 |
| Gary & Gerald Carlson | ND | 1982 |
| Bob Thomas | OR | 1982 |
| Orville Stangl | SD | 1982 |
| C. Ancel Armstrong | KS | 1983 |
| Bill Borror | CA | 1983 |
| Charles E. Boyd | KY | 1983 |
| John Bruner | SD | 1983 |
| Leness Hall | WA | 1983 |
| Ric Hoyt | OR | 1983 |
| E. A. Keithley | MO | 1983 |
| J. Earl Kindig | MO | 1983 |
| Jake Larson | ND | 1983 |
| Harvey Lemmon | GA | 1983 |
| Frank Myatt | IA | 1983 |
| Stanley Nesemeier | IL | 1983 |
| Russ Pepper | MT | 1983 |
| Robert H. Schafer | MN | 1983 |
| Alex Stauffer | WI | 1983 |
| D.John & Lebert Shultz | MO | 1983 |
| Phillip A. Abrahamson | MN | 1984 |
| Rob Bieber | SD | 1984 |
| Jerry Chappel | VA | 1984 |
| Charles W. Druin | KY | 1984 |
| Jack Farmer | CA | 1984 |
| John B. Green | LA | 1984 |
| Ric Hoyt | OR | 1984 |
| Fred H. Johnson | OH | 1984 |
| Earl Kindig | VA | 1984 |
| Glen Klippenstein | MO | 1984 |
| A. Harvey Lemmon | GA | 1984 |
| Lawrence Meyer | IL | 1984 |
| Donn & Sylvia Mitchell | CAN | 1984 |
| Lee Nichols | IA | 1984 |
| Clair K. Parcel | KS | 1984 |
| Joe C. Powell | NC | 1984 |
| Floyd Richard | ND | 1984 |
| Robert L. Sitz | MT | 1984 |
| Ric Hoyt | OR | 1984 |
| J. Newbill Miller | VA | 1985 |
| George B. Halterman | WV | 1985 |
| David McGehee | KY | 1985 |
| Glenn L. Brinkman | TX | 1985 |
| Gordon Booth | WY | 1985 |
| Earl Schafer | MN | 1985 |
| Marvin Knowles | CA | 1985 |
| Fred Killam | IL | 1985 |
| Tom Perrier | KS | 1985 |
| Don W. Schoene | MO | 1985 |

| | | |
|---|---|---|
| Everett & Ron Batho & Families | CAN | 1985 |
| Bernard F. Pedretti | WI | 1985 |
| Arnold Wienk | SD | 1985 |
| R.C.Price | AL | 1985 |
| Clifford & Bruce Betzold | IL | 1986 |
| Gerald Hoffman | SD | 1986 |
| Delton W. Hubert | KS | 1986 |
| Dick & Ellie Larson | WI | 1986 |
| Leonard Lodden | ND | 1986 |
| Ralph McDanolds | VA | 1986 |
| Roy D. McPhee | CA | 1986 |
| W.D. Morris & James Pipkin | MO | 1986 |
| Clarence Van Dyke | MT | 1986 |
| John H. Wood | SC | 1986 |
| Evin & Verne Dunn | CAN | 1986 |
| Glenn L. Brinkman | KS | 1986 |
| Jack & Gini Chase | WY | 1986 |
| Henry & Jeanette Chitty | FL | 1986 |
| Lawrence H. Graham | KY | 1986 |
| A. Lloyd Grau | NM | 1986 |
| Mathew Warren Hall | AL | 1986 |
| Richard J. Putnam | NC | 1986 |
| Robert J. Steward & Patrick C. Morrissey | OR | 1986 |
| Leonard Wulf | MN | 1986 |
| Charles & Wynder Smith | GA | 1987 |
| Lyall Edgerton | CAN | 1987 |
| Tommy Branderberger | TX | 1987 |
| Henry Gardiner | KS | 1987 |
| Gary Klein | ND | 1987 |
| Ivan & Frank Rincker | IL | 1987 |
| Larry D. Leonhardt | WY | 1987 |
| Harold E. Pate | AL | 1987 |
| Forrest Byergo | MO | 1987 |
| Clayton Canning | CAN | 1987 |
| James Bush | SD | 1987 |
| Robert J. Steward & Patrick C. Morrissey | OR | 1987 |
| Eldon & Richard Wiese | MN | 1987 |
| Douglas D. Bennett | TX | 1988 |
| Don & Diane Guilford and David & Carol Guilford | CAN | 1988 |
| Kenneth Gillig | MO | 1988 |
| Bill Bennett | WA | 1988 |
| Hansell Pile | KY | 1988 |

| | | |
|---|---|---|
| Gino Pedretti | CA | 1988 |
| Leonard Lorenzen | OR | 1988 |
| George Schlickau | KS | 1988 |
| Hans Ulrich | CAN | 1988 |
| Donn & Sylvia Mitchell | CAN | 1988 |
| Darold Bauman | WY | 1988 |
| Glynn Debter | AL | 1988 |
| William Glanz | WY | 1988 |
| Jay P. Book | IL | 1988 |
| David Luhman | MN | 1988 |
| Scott Burtner | VA | 1988 |
| Robert E. Walton | WS | 1988 |
| Harry Airey | CAN | 1989 |
| Ed Albaugh | CA | 1989 |
| Jack & Nancy Baker | MO | 1989 |
| Ron Bowman | ND | 1989 |
| Jerry Allen Burner | VA | 1989 |
| Glynn Debter | AL | 1989 |
| Sherm & Charlie Ewing | CAN | 1989 |
| Donald Fawcett | SD | 1989 |
| Orrin Hart | CAN | 1989 |
| Leonard A. Lorenzen | OR | 1989 |
| Kenneth D. Lowe | KY | 1989 |
| Tom Mercer | WY | 1989 |
| Lynn Pelton | KS | 1989 |
| Lester H. Schafer | MN | 1989 |
| Bob R. Whitmire | GA | 1989 |
| Dr. Burleigh Anderson | PA | 1990 |
| Boyd Broyles | KY | 1990 |
| Larry Earhart | WY | 1990 |
| Steven Forrester | MI | 1990 |
| Doug Fraser | CAN | 1990 |
| Gerhard Gueggenberger | CA | 1990 |
| Douglas & Molly Hoff | SD | 1990 |
| Richard Janssen | KS | 1990 |
| Paul E. Keffaber | IN | 1990 |
| John & Chris Oltman | WI | 1990 |
| John Ragsdale | KY | 1990 |
| Otto & Otis Rincker | IL | 1990 |
| Charles & Ruby Simpson | CAN | 1990 |
| T. D. & Roger Steele | VA | 1990 |
| Bob Thomas Family | OR | 1990 |
| Ann Upchurch | AL | 1991 |
| Nicholas Wehrmann & Richard McClung | VA | 1991 |
| John Bruner | SD | 1991 |
| Ralph Bridges | GA | 1991 |

| | | |
|---|---|---|
| Dave & Carol Guilford | CAN | 1991 |
| Richard & Sharon Beitelspacher | SD | 1991 |
| Tom Sonderup | NE | 1991 |
| Steve & Bill Florschuetz | IL | 1991 |
| R.A. Brown | TX | 1991 |
| Jim Taylor | KS | 1991 |
| R.M. Felts & Son Farm | TN | 1991 |
| Jack Cowley | CA | 1991 |
| Rob & Gloria Thomas | OR | 1991 |
| James Burns & Sons | WI | 1991 |
| Jack & Gini Chase | WY | 1991 |
| Summitcrest Farms | OH | 1991 |
| Larry Wakefield | MN | 1991 |
| James R. O'Neill | IA | 1991 |
| Francis & Karol Bormann | IA | 1992 |
| Glenn Brinkman | KS | 1992 |
| Bob Buchanan Family | OR | 1992 |
| Tom & Ruth Clark | VA | 1992 |
| A.W. Compton, Jr. | AL | 1992 |
| Harold Dickson | MO | 1992 |
| Tom Drake | OK | 1992 |
| Robert Elliott & Sons | TN | 1992 |
| Dennis, David & Danny Geffert | WI | 1992 |
| Eugene B. Hook | MN | 1992 |
| Dick Montague | CA | 1992 |
| Bill Rea | PA | 1992 |
| Calvin & Gary Sandmeier | SD | 1992 |
| Leonard Wulf & Sons | MN | 1992 |
| R.A. Brown | TX | 1993 |
| Norman Bruce | IL | 1993 |
| Wes & Fran Cook | NC | 1993 |
| Clarence, Elaine and Adam Dean | SC | 1993 |
| Dan Eldridge & Yates Adcock | OK | 1993 |
| Joseph Freund | CO | 1993 |
| R.B. Jarrell | TN | 1993 |
| Rueben, Leroy and Bob Littau | SD | 1993 |
| J. Newbill Miller | VA | 1993 |
| J. David Nichols | IA | 1993 |
| Miles P. "Buck" Pangburn | IA | 1993 |
| Lynn Pelton | KS | 1993 |
| Ted Seely | WY | 1993 |
| Collin Sander | SK | 1993 |
| Harrell Watts | AL | 1993 |
| Bob Zarn | MB | 1993 |

## SEEDSTOCK BREEDER OF THE YEAR

| | | |
|---|---|---|
| John Crowe | CA | 1972 |
| Mrs. R.W. Jones | GA | 1973 |
| Carlton Corbin | OK | 1974 |
| Leslie J. Holden | MT | 1975 |
| Jack Cooper | MT | 1975 |
| Jorgensen Brothers | SD | 1976 |
| Glenn Burrows | NM | 1977 |
| James D. Bennett | VA | 1978 |
| Jim Wolfe | NE | 1979 |
| Bill Wolfe | OR | 1980 |
| Bob Dickinson | KS | 1981 |
| A.F. "Frankie" Flint | NM | 1982 |
| Bill Borror | CA | 1983 |
| Lee Nichols | IA | 1984 |
| Ric Hoyt | OR | 1985 |
| Leonard Lodoen | ND | 1986 |
| Harry Gardiner | KS | 1987 |
| W.T. "Bill" Bennett | WA | 1988 |
| Glynn Debter | AL | 1989 |
| Doug & Molly Hoff | SD | 1990 |
| Summitcrest Farms | OH | 1991 |
| Leonard Wulf & Sons | MN | 1992 |
| R.A. "Rob" Brown | TX | 1993 |
| J. David Nichols | IA | 1993 |

## THE COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

| | | |
|---|---|---|
| Chan Cooper | MT | 1972 |
| Alfred B. Cobb, Jr. | MT | 1972 |
| Lyle Eivens | IA | 1972 |
| Broadbent Brothers | KY | 1972 |
| Jess Kilgore | MT | 1972 |
| Clifford Ouse | MN | 1973 |
| Pat Wilson | FL | 1973 |
| John Glaus | SD | 1973 |
| Sig Peterson | ND | 1973 |
| Max Kiner | WA | 1973 |
| Donald Schott | MT | 1973 |
| Stephen Garst | IA | 1973 |
| J.K. Sexton | CA | 1973 |
| Elmer Maddox | OK | 1973 |
| Marshall McGregor | MO | 1974 |
| Lloyd Mygard | MD | 1974 |
| Dave Matti | MT | 1974 |
| Eldon Wiese | MN | 1974 |
| Lloyd DeBruycker | MT | 1974 |
| Gene Rambo | CA | 1974 |
| Jim Wolf | NE | 1974 |
| Henry Gardiner | KS | 1974 |
| Johnson Brothers | SD | 1974 |
| John Blankers | MN | 1975 |
| Paul Burdett | MT | 1975 |
| Oscar Burroughs | CA | 1975 |
| John R. Dahl | ND | 1975 |
| Eugene Duckworth | MO | 1975 |
| Gene Gates | KS | 1975 |
| V.A. Hills | KS | 1975 |
| Robert D. Keefer | MT | 1975 |
| Kenneth E. Leistritz | NE | 1975 |
| Ron Baker | OR | 1976 |
| Dick Boyle | ID | 1976 |
| James D. Hackworth | MO | 1976 |
| John Hilgendorf | MN | 1976 |
| Kahau Ranch | HI | 1976 |
| Milton Mallery | CA | 1976 |
| Robert Rawson | IA | 1976 |
| William A. Stegner | ND | 1976 |
| U.S.Range Exp. Sta | MT | 1976 |
| John Blankers | MN | 1977 |
| Maynard Crees | KS | 1977 |
| Ray Franz | MT | 1977 |
| Forrest H. Ireland | SD | 1977 |
| John A. Jameson | IL | 1977 |
| Leo Knoblauch | MN | 1977 |
| Jack Pierce | ID | 1977 |
| Mary & Stephen Garst | IA | 1977 |
| Odd Osteross | ND | 1978 |
| Charles M. Jarecki | MT | 1978 |
| Jimmy G. McDonnal | NC | 1978 |
| Victor Arnaud | MO | 1978 |
| Ron & Malcolm McGregor | IA | 1978 |
| Otto Uhrig | NE | 1978 |
| Arnold Wyffels | MN | 1978 |
| Bert Hawkins | OR | 1978 |
| Mose Tucker | AL | 1978 |
| Dean Haddock | KS | 1978 |
| Myron Hoeckle | ND | 1979 |
| Harold & Wesley Arnold | SD | 1979 |
| Ralph Neill | IA | 1979 |
| Morris Kuschel | MN | 1979 |
| Bert Hawkins | OR | 1979 |
| Dick Coon | WA | 1979 |
| Jerry Northcutt | MO | 1979 |
| Steve McDonnell | MT | 1979 |
| Doug Vandermyde | IL | 1979 |
| Norman, Denton & Calvin Thompson | SD | 1979 |
| Jess Kilgore | MT | 1980 |
| Robert & Lloyd Simon | IL | 1980 |
| Lee Eaton | MT | 1980 |
| Leo & Eddie Grubl | SD | 1980 |
| Roger Winn, Jr. | VA | 1980 |
| Gordon McLean | ND | 1980 |
| Ed Disterhaupt | MN | 1980 |
| Thad Snow | CAN | 1980 |
| Oren & Jerry Raburn | OR | 1980 |
| Bill Lee | KS | 1980 |
| Paul Moyer | MO | 1980 |
| G.W. Campbell | IL | 1981 |
| J.J. Feldmann | IA | 1981 |
| Henry Gardiner | KS | 1981 |
| Dan L. Weppler | MT | 1981 |
| Harvey P. Wehri | ND | 1981 |
| Dannie O'Connell | SD | 1981 |
| Wesley & Harold Arnold | SD | 1981 |
| Jim Russell & Rick Turner | MO | 1981 |
| Oren & Jerry Raburn | OR | 1981 |

| | | |
|---|---|---|
| Orin Lamport | SD | 1981 |
| Leonard Wulf | MN | 1981 |
| Wm. H. Romersberger | IL | 1982 |
| Milton Krueger | MO | 1982 |
| Carl Odegard | MT | 1982 |
| Marvin & Donald Stoker | IA | 1982 |
| Sam Hands | KS | 1982 |
| Larry Campbell | KY | 1982 |
| Lloyd Atchison | CAN | 1982 |
| Earl Schmidt | MN | 1982 |
| Raymond Josephson | ND | 1982 |
| Clarence Reutter | SD | 1982 |
| Leonard Bergen | CAN | 1982 |
| Kent Brunner | KS | 1983 |
| Tom Chrystal | IA | 1983 |
| John Freitag | WI | 1983 |
| Eddie Hamilton | KY | 1983 |
| Bill Jones | MT | 1983 |
| Harry & Rick Kline | IL | 1983 |
| Charlie Kopp | OR | 1983 |
| Duwayne Olson | SD | 1983 |
| Ralph Pederson | SD | 1983 |
| Ernest & Helen Schaller | MO | 1983 |
| Al Smith | VA | 1983 |
| John Spencer | CA | 1983 |
| Bud Wishard | MN | 1983 |
| Bob & Sharon Beck | OR | 1984 |
| Leonard Fawcett | SD | 1984 |
| Fred & Lee Kummerfeld | WY | 1984 |
| Norman Coyner & Sons | VA | 1984 |
| Franklyn Esser | MO | 1984 |
| Edgar Lewis | MT | 1984 |
| Boyd Mahrt | CA | 1984 |
| Don Moch | ND | 1984 |
| Neil Moffat | CAN | 1984 |
| William H. Moss, Jr. | GA | 1984 |
| Dennis P. Solvie | MN | 1984 |
| Robert P. Stewart | KS | 1984 |
| Charlie Stokes | NC | 1984 |
| Milton Wendland | AL | 1985 |
| Bob & Sheri Schmidt | MN | 1985 |
| Delmer & Joyce Nelson | IL | 1985 |
| Harley Brockel | SD | 1985 |
| Kent Brunner | KS | 1985 |
| Glenn Harvey | OR | 1985 |
| John Maino | CA | 1985 |
| Ernie Reeves | VA | 1985 |
| John E. Rouse | WY | 1985 |
| George & Thelma Boucher | CAN | 1985 |
| Kenneth Bentz | OR | 1986 |
| Gary Johnson | KS | 1986 |
| Ralph G. Lovelady | AL | 1986 |
| Ramon H. Oliver | KY | 1986 |
| Kay Richardson | FL | 1986 |
| Mr. & Mrs. Clyde Watts | NC | 1986 |
| David & Bev Lischka | CAN | 1986 |
| Dennis & Nancy Daly | WY | 1986 |
| Carl & Fran Dobitz | SD | 1986 |
| Charles Fariss | VA | 1986 |
| David J. Forster | CA | 1986 |
| Danny Geersen | SD | 1986 |
| Oscar Bradford | AL | 1987 |
| R.J. Mawer | CAN | 1987 |
| Rodney G. Oliphant | KS | 1987 |
| David A. Reed | OR | 1987 |
| Jerry Adamson | NE | 1987 |
| Gene Adams | GA | 1987 |
| Hugh & Pauline Maize | SD | 1987 |
| P.T. McIntire & Sons | VA | 1987 |
| Frank Disterhaupt | MN | 1987 |
| Mac, Don & Joe Griffith | GA | 1988 |
| Jerry Adamson | NE | 1988 |
| Ken, Wayne & Bruce Gardiner | CAN | 1988 |
| C.L. Cook | MO | 1988 |
| C.J. & D.A. McGee | IL | 1988 |
| William E. White | KY | 1988 |
| Frederick M. Mallory | CA | 1988 |
| Stevenson Family | OR | 1988 |
| Gary Johnson | KS | 1988 |
| John McDaniel | AL | 1988 |
| William A. Stegner | ND | 1988 |
| Lee Eaton | MT | 1988 |
| Larry D. Cundall | WY | 1988 |
| Dick & Phyllis Henze | MN | 1988 |
| Jerry Adamson | NE | 1989 |
| J.W.Aylor | VA | 1989 |
| Jerry Bailey | ND | 1989 |
| James G. Guyton | WY | 1989 |
| Kent Koostra | KY | 1989 |
| Ralph G. Lovelady | AL | 1989 |
| Thomas McAvoy, Jr. | GA | 1989 |
| Bill Salton | IA | 1989 |
| Lauren & Mel Shuman | CA | 1989 |
| Jim Tesher | ND | 1989 |

| | | | | | |
|---|---|---|---|---|---|
| Joe Thielen | KS | 1989 | Charles Daniel | MO | 1992 |
| Eugene & Ylene Williams | MO | 1989 | Jed Dillard | FL | 1992 |
| Phillip, Patty & Greg Bartz | MO | 1990 | John & Ingrid Fairhead | NE | 1992 |
| John J. Chrisman | WY | 1990 | Dale J. Fischer | IA | 1992 |
| Les Herbst | KY | 1990 | E. Allen Grimes Family | ND | 1992 |
| Jon C. Ferguson | KS | 1990 | Kopp Family | OR | 1992 |
| Mike & Diana Hooper | OR | 1990 | Harold, Barbara & Jeff Marshall | PA | 1992 |
| James & Joan McKinlay | CAN | 1990 | Clinton E. Martin & Sons | VA | 1992 |
| Gilbert Meyer | SD | 1990 | Lloyd & Pat Mitchell | CAN | 1992 |
| DuWayne Olson | SD | 1990 | William Van Tassel | CA | 1992 |
| Raymong R. Peugh | IL | 1990 | James A. Theeck | TX | 1992 |
| Lewis T. Pratt | VA | 1990 | Aquilla M. Ward | WV | 1992 |
| Ken & Wendy Sweetland | CAN | 1990 | Albert Wiggins | KS | 1992 |
| Swen R. Swenson Cattle Co. | TX | 1990 | Ron Wiltshire | CAN | 1992 |
| Rober A. Nixon & Son | VA | 1991 | Andy Bailey | WY | 1993 |
| Murray A. Greaves | CAN | 1991 | Leroy Beitelspacher | SD | 1993 |
| James Hauff | ND | 1991 | Glenn Calbaugh | WY | 1993 |
| Pat Hardy | GA | 1991 | Oscho Deal | NC | 1993 |
| J. R. Anderson | WI | 1991 | Jed Dillard | FL | 1993 |
| Ed & Rich Blair | SD | 1991 | Art Farley | IL | 1993 |
| Reuben & Connee Quinn | SD | 1991 | Jon Ferguson | KS | 1993 |
| Dave & Sandy Umbarger | OR | 1991 | Walter Hunsuker | CA | 1993 |
| James A. Theeck | TX | 1991 | Nola and Steve Kleiboeker | MO | 1993 |
| Ken Stielow | KS | 1991 | Jim Maier | SD | 1993 |
| John E. Hanson, Jr. | CA | 1991 | Bill and Jim Martin | WV | 1993 |
| Charles & Clyde Henderson | MO | 1991 | Ian & Alan McKillop | ON | 1993 |
| Russ Green | WY | 1991 | George & Robert Pingetzer | WY | 1993 |
| Bollman Farms | IL | 1991 | Timothy D. Sutphin | VA | 1993 |
| Craig Utesch | IA | 1991 | James A. Theeck | TX | 1993 |
| W.B. Allen | TN | 1992 | Gene Thiry | MB | 1993 |
| Mark Barenthsen | ND | 1992 | | | |
| Rary Boyd | AL | 1992 | | | |

## COMMERCIAL PRODUCER OF THE YEAR

| | | | | | |
|---|---|---|---|---|---|
| Chan Cooper | MT | 1972 | Al Smith | VA | 1983 |
| Pat Wilson | FL | 1973 | Bob & Sharon Beck | OR | 1984 |
| Lloyd Nygard | ND | 1974 | Glenn Harvey | OR | 1985 |
| Gene Gates | KS | 1975 | Charles Fariss | VA | 1986 |
| Ron Blake | OR | 1976 | Rodney G. Oliphant | KS | 1987 |
| Steve & Mary Garst | IA | 1977 | Gary Johnson | KS | 1988 |
| Mose Tucker | AL | 1978 | Jerry Adamson | NE | 1989 |
| Bert Hawkins | OR | 1979 | Mike & Diana Hooper | OR | 1990 |
| Jeff Kilgore | MT | 1980 | Dave & Sandy Umbarger | OR | 1991 |
| Henry Gardiner | KS | 1981 | Kopp Family | OR | 1992 |
| Sam Hands | KS | 1982 | Jon Ferguson | KS | 1993 |

## AMBASSADOR AWARD

| | | | |
|---|---|---|---|
| Warren Kester | Beef Magazine | MN | 1986 |
| Chester Peterson | Simmental Shield | KS | 1987 |
| Fred Knop | Drovers Journal | KS | 1988 |
| Forrest Bassford | Western Livestock Journal | CO | 1989 |
| Robert C. de Baca | The Ideal Beef Memo | IA | 1990 |
| Dick Crow | Western Livestock Journal | CO | 1992 |
| J. T. "Johnny" Jenkins | Livestock Breeder Journal | GA | 1993 |

## PIONEER AWARDS

| | | | |
|---|---|---|---|
| Jay L. Lush | Iowa State University | Research | 1973 |
| John H. Knox | New Mexico State University | Research | 1974 |
| Ray Woodward | American Breeders Service | Research | 1974 |
| Fred Willson | Montana State University | Research | 1974 |
| Charles E. Bell, Jr. | USDA-FES | Education | 1974 |
| Reuben Albaugh | University of California | Education | 1974 |
| Paul Pattengale | Colorado State University | Education | 1974 |
| Glenn Butts | Performance Registry Int'l | Service | 1975 |
| Keith Gregory | RLHUSMARC | Research | 1975 |
| Bradford Knapp, Jr. | USDA | Research | 1975 |
| Forrest Bassford | Western Livestock Journal | Journalism | 1976 |
| Doyle Chambers | Louisiana State University | Research | 1976 |
| Mrs. Waldo Emerson Forbes | Wyoming Breeder | Breeder | 1976 |
| C. Curtis Mast | Virginia BCIA | Education | 1976 |
| Dr. H. H. Stonaker | Colorado State University | Research | 1977 |
| Ralph Bogart | Oregon State University | Research | 1977 |
| Henry Holsman | South Dakota State University | Education | 1977 |
| Marvin Koger | University of Florida | Research | 1977 |
| John Lasley | University of Florida | Research | 1977 |
| W. L. McCormick | Tifton, Georgia Test Station | Research | 1977 |
| Paul Orcutt | Montana Beef Performance Assoc. | Education | 1977 |
| J. P.. Smith | Performance Registry Int'l | Education | 1977 |
| James B. Lingle | Wye Plantation | Breeder | 1978 |
| R. Henry Mathiessen | Virginia Breeder | Breeder | 1978 |
| Bob Priode | VPI & SU | Research | 1978 |
| Robert Koch | RLHUSMARC | Research | 1979 |
| Mr. & Mrs. Carl Roubicek | University of Arizona | Research | 1979 |
| Joseph J. Urick | US Range Livestock Experiment Station | Research | 1979 |
| Byron L. Southwell | Georgia | Research | 1980 |
| Richard T. "Scotty" Clark | USDA | Research | 1980 |
| F. R. "Ferry" Carpenter | Colorado | Breeder | 1981 |
| Clyde Reed | Oklahoma State University | | 1981 |
| Milton England | Panhandle A & M College | | 1981 |
| L. A. Moddox | Texas A & M College | | 1981 |
| Charles Pratt | Oklahoma | | 1981 |
| Otha Grimes | Oklahoma | | 1981 |
| Mr. & Mrs. Percy Powers | Texas | | 1982 |
| Gordon Dickerson | Nebraska | | 1982 |
| Jim Elings | California | | 1983 |
| Jim Sanders | Nevada | | 1983 |
| Ben Kettle | Colorado | | 1983 |
| Carroll O. Schoonover | University of Wyoming | | 1983 |
| W. Dean Frischknecht | Oregon State University | | 1983 |
| Bill Graham | Georgia | | 1984 |
| Max Hammond | Florida | | 1984 |

| | | |
|---|---|---|
| Thomas J. Marlowe | VPI & SU | 1984 |
| Mick Crandell | South Dakota State University | 1985 |
| Mel Kirkiede | North Dakota State University | 1985 |
| Charles R. Henderson | Cornell University (Retired) | 1986 |
| Everett J. Warwick | USDA-ARS (Retired) | 1986 |
| Glenn Burrows | New Mexico | 1987 |
| Carlton Corbin | Oklahoma | 1987 |
| Murray Corbin | Oklahoma | 1987 |
| Max Deets | Kansas | 1987 |
| George F. & Mattie Ellis | New Mexico | 1988 |
| A. F. "Frankie" Flint | New Mexico | 1988 |
| Christian A. Dinkel | South Dakota State University (Retired) | 1988 |
| Roy Beeby | Oklahoma | 1989 |
| Will Butts | Tennessee | 1989 |
| John W. Massey | Missouri | 1989 |
| Donn & Sylvia Mitchell | Manitoba, Canada | 1990 |
| Hoon Song | Agriculture Canada | 1990 |
| Jim Wilton | University of Guelph, Canada | 1990 |
| Bob Long | Texas Tech | 1991 |
| Bill Turner | Texas A & M | 1991 |
| Frank Baker | Arkansas | 1992 |
| Ron Baker | Oregon | 1992 |
| Bill Borror | California | 1992 |
| Walter Rowden | Arkansas | 1992 |
| James W. "Pete" Patterson | North Carolina State University (Retired) | 1993 |
| Hayes Gregory | North Carolina State University (Retired) | 1993 |
| James D. Bennett | Virginia | 1993 |
| O'Dell G. Daniel | University of Georgia (Retired) | 1993 |
| M. K. "Curly" Cook | University of Georgia (Retired) | 1993 |
| Dixon Hubbard | USDA-Extension | 1993 |
| Richard Willham | Iowa State University | 1993 |

## CONTINUING SERVICE AWARD

| | | | | | |
|---|---|---|---|---|---|
| Clarence Burch | OK | 1972 | Art Linton | MT | 1983 |
| F. R. Carpenter | CO | 1973 | James Bennett | VA | 1984 |
| E.J. Warwick | DC | 1973 | M. K. Cook | GA | 1984 |
| Robert De Baca | IA | 1973 | Craig Ludwig | MO | 1984 |
| Frank H. Baker | OK | 1974 | Jim Glenn | IBIA | 1985 |
| D. D. Bennett | OR | 1974 | Dick Spader | MO | 1985 |
| Richard Willham | IA | 1974 | Roy Wallace | OH | 1985 |
| Larry V. Cundiff | NE | 1975 | Larry Benyshek | GA | 1986 |
| Dixon D. Hubbard | DC | 1975 | Ken W. Ellis | CA | 1986 |
| J. David Nichols | IA | 1975 | Earl Peterson | MT | 1986 |
| A.L. Eller, Jr. | VA | 1976 | Bill Borror | CA | 1987 |
| Ray Meyer | SD | 1976 | Daryl Strohbehn | IA | 1987 |
| Don Vaniman | MT | 1977 | Jim Gibb | MO | 1987 |
| Lloyd Schmitt | MT | 1977 | Bruce Howard | CAN | 1988 |
| Martin Jorgensen | SD | 1978 | Roger McCraw | NC | 1989 |
| James S. Brinks | CO | 1978 | Robert Dickinson | KS | 1990 |
| Paul D. Miller | WI | 1978 | John Crouch | MO | 1991 |
| C. K. Allen | MO | 1979 | Jack Chase | WY | 1992 |
| William Durfey | NAAB | 1979 | Leonard Wulf | MN | 1992 |
| Glenn Butts | PRI | 1980 | Henry W. Webster | SC | 1993 |
| Jim Gosey | NE | 1980 | Robert McGuire | AL | 1993 |
| Mark Keffeler | SD | 1981 | Charles McPeake | GA | 1993 |
| J. D. Mankin | ID | 1982 | | | |

## ORGANIZATIONS OF THE YEAR

| | |
|---|---|
| Beef Improvement Committee, Oregon Cattlemen's Association | 1972 |
| South Dakota Livestock Production Records Association | 1973 |
| American Simmental Association, Inc. | 1974 |
| American Simmental Association, Inc. (Breed) | 1975 |
| Iowa Beef Improvement Association (BCIA) | 1975 |
| The American Angus Association (Breed) | 1976 |
| The North Dakota Beef Cattle Improvement (BCIA) | 1976 |
| The American Angus Association (Breed) | 1977 |
| The Iowa Beef Improvement Association (BCIA) | 1977 |
| The American Hereford Association (Breed) | 1978 |
| Beef Performance Committee of Cattlemen's Association | 1978 |
| The Iowa Beef Improvement Association (BCIA) | 1979 |

# NOMINEES FOR OUTSTANDING SEEDSTOCK PRODUCER AWARD

**R. A. Brown**
**R. A. Brown Ranch**
**Throckmorton, Texas**

The R. A. Brown ranch includes 112,000 acres and 1350 purebred cows of five breeds: Simmental, Simbrah, Angus, Red Angus, and Senepol. The ranch also manages 1508 head of commercial cows. In addition to producing purebred cattle, the ranch also produces composite replacement females.

Mr. Brown is on the Board of Directors of the American Simmental Association, American International Senepol Association, National Cattleman's Association, and the American Quarter Horse Association.

**Nominated by Texas Beef Cattle Improvement Association**

**Norman Bruce**
**Leveldale Farms**
**Mason City, Illinois**

Norman Bruce owns and operates the historic Leveldale Farms in partnership with Dr. Les Mathers III. Mr. Bruce was a vocational Agriculture teacher until 1975 when he assumed management of Leveldale. At that time he began a Limousin program to complement the Shorthorn herd that was in existence.

Mr. Bruce has served as President of the Illinois Limousin Association, is active in the Illinois Beef Association and is very involved in collecting carcass data from his purebred cow herd.

**Nominated by Illinois BCIA**

**Wes and Fran Cook**
**Mountain Creek Farm**
**Bahama, North Carolina**

Mountain Creek Farm was purchased by Wes and Fran Cook in 1978. The current farming operation consists of 120 acres of land with 40 registered Angus cows. The Cooks are on an intensive AI program. Bulls are fed a grain and forage ration to gain 2.75-3.0 pounds per day in an on-farm test.

The Cooks serve on the North Carolina BCIP Committee and on the North Carolina Angus Association Board of Directors.

**Nominated by North Carolina Beef Cattle Improvement Program**

**Clarence, Elaine and Adam Dean**
**Starr D Farm**
**Starr, South Carolina**

Starr D Farm maintains a 300-cow herd of purebred Charolais. Starr D Farm produces about 90-100 Charolais bulls annually. Over two-thirds of the bulls sell to repeat customers.

The Deans have held the offices of President of South Carolina Charolais Association, Director of South Carolina Cattleman's Association, and are members of the AICA Foreign Marketing Committee.

**Nominated by American International Charolais Association**

**Dan Eldridge/Yates Adcock**
**Middle Creek Ranch**
**Dustin, Oklahoma**

Dan Eldridge and Yates Adcock manage the 8,000 acre hay and cattle operation at Middle Creek Ranch. The cow herd consists of 490 Salers cows and 93 head of commercial cows.

The goal of Middle Creek Ranch is to produce moderate-frame, problem-free cattle. Bull weaning weights average 570 pounds and calving difficulty is less than 1%, including heifers.

Dan Eldridge has served as a Board Member and President of the Oklahoma Salers Association. Yates Adcock has served on several state and national Salers Association committees.

**Nominated by American Salers Association**

**Joseph D. Freund**
**Running Creek Ranch**
**Elizabeth, Colorado**

Running Creek Ranch has been in the cow-calf business for the past twenty-two years, the last thirteen as producers of Limousin seedstock. The cow herd consists of over 800 cows, making them the 19th largest seedstock producer in the United States. Over 150 bulls and a similar number of heifers are sold private treaty each year.

Running Creek has cooperated with Colorado State University and the North American Limousin Foundation on several research projects.

**Nominated by the North American Limousin Foundation**

**R. B. Jarrell**
**Eaglesville, Tennessee**

R. B. Jarrell got into the Polled Hereford business in 1932 at the age of five with two 4-H heifers. The current herd consists of 98 cows. Mr. Jarrell has been on the Tennessee BCIA program since 1959 and has been on the APHA program for 22 years. Eighty percent of the cows are bred to top performance AI bulls, and his bulls are sold to commercial producers across Middle Tennessee and North Alabama.

Mr. Jarrell has served as President and Director of the Tennessee BCIA and Vice-President of the Tennessee Polled Hereford Association.

**Nominated by Tennessee Beef Cattle Improvement Association**

**Reuben, LeRoy and Bob Littau**
**Littau Angus Ranch**
**Winner, South Dakota**

Littau Angus Ranch is a family operation raising registered Angus since the mid-1950's. The total operation consists of about 6,000 acres and 400 cows. Cattle have been evaluated through AHIR for the last 20 years. Complete carcass data are collected on steers which are used for progeny testing herd sires.

Reuben has served as President of the South Dakota Angus Association, Director of the South Dakota Stockgrowers, and is currently Chairman of the South Dakota Beef Industry Council.

**Nominated by South Dakota Beef Cattle Improvement Association**

**J. Newbill Miller**
**Ginger Hill Angus**
**Washington, Virginia**

Ginger Hill Angus is a family purebred Angus operation started in 1956. The Ginger Hill herd consists of 84 breeding females, and the operation is dedicated to producing cattle that are suitable for the commercial beef industry. Embryo transfer is currently being used with superior proven cows. Bulls are grain tested on the farm with some sent to central test stations.

Mr. Miller has served as Director and President of the Virginia Beef Cattle Improvement Association and the Virginia Angus Association.

**Nominated by Virginia Beef Cattle Improvement Association**

**J. David Nichols**
**Nichols Farm Ltd.**
**Bridgewater, Iowa**

Dave Nichols' herd began with the purchase of 40 registered Angus in 1952 when Dave was in 4-H. In 1968 Nichols Farm bought some of the first Simmental semen imported into the U.S. About nine years ago Nichols Farm added Salers to its program. The farm currently manages 797 cows, making it the largest seedstock operation in Iowa.

Dave Nichols serves on the NCA Board and the National Beef Board. Mr. Nichols has served as President of the American Simmental Association and as President of BIF.

**Nominated by Iowa Cattleman's Association**

**Miles P. "Buck" Pangburn**
**Pangburn Stock Farm**
**Northwood, Iowa**

Pangburn Stock Farm is a family operation which consists of 410 acres with 40 head of Simmental cows and 70 head of commercial cows. The farm has been in the family since 1860, and the Simmental herd began 20 years ago. Bulls are tested in Iowa and Minnesota test stations as well as in an on-farm program.

Mr. Pangburn has served on the Iowa Bull Test Committee and on the Board of Directors of the Iowa Cattleman's Association.

**Nominated by Iowa Beef Cattle Improvement Association**

**Lynn Pelton**
**Pelton Simmental/Red Angus**
**Burdett, Kansas**

Lynn Pelton started a farming corporation with his brother Gary in 1975. The corporation owns and leases 2,300 acres in cultivation and 1,800 acres of native range grassland. The cow herd consists of 225 head of Simmental and Angus. Mr. Pelton currently sells about 75 bulls each year and has begun selling F1 Simmental-Red Angus females.

Mr. Pelton has served as Director, Vice-President and President of the Kansas Simmental Association. He is a founding member of the Kansas Red Angus Association.

**Nominated by Kansas Livestock Association**

**Ted Seely**
**Popo Agie Angus**
**Lander, Wyoming**

Popo Agie Angus Ranch evolved over several years. Ted Seely grew up on his father's dairy farm where he artificially bred dairy cows. After the family sold the dairy, he started with a few commercial cows which lead to the registered Angus herd in 1975. Artificial insemination has remained a critical component of the operation. The cow herd consists of 135 head.

Mr. Seely was named 1992 WBCIA Seedstock Producer of the Year.

**Nominated by Wyoming Beef Cattle Improvement Association**

**Collin Sander**
**Windy Willow Farms**
**Hodgeville, Saskatchewan**

Collin Sander and his family maintain 100 head of Angus cows. The majority of their bulls are sold to commercial cattlemen through private treaty and through two Saskatchewan bull test stations. Mr. Sander has utilized Federal-Provincial Record of Performance for the past 16 years and has supported provincial bull testing for the past 17 years.

Mr. Sander was founding President of Saskatchewan Beef Cattle Performance Association. He is a current Director of Canadian Angus Association and Chairman of the Breed Development Committee.

**Nominated by Saskatchewan Agriculture and Food**

**Harrell Watts**
**Simmentals of Alabama**
**Sardis, Alabama**

Harrell Watts has been a breeder of Simmental cattle for 23 years. Mr. Watts maintains a herd of 50 registered Simmental cows and 180 commercial cows on his 5,000 acre farm. In addition, he stays busy with 1,120 acres of cotton, 100+ acres of small grain and 1,000 acres of timberland. Mr. Watts has been a member of the Alabama BCIA for 23 years and regularly participates in the BCIA bull test program.

Mr. Watts has served as President of the Alabama Purebred Beef Breeds Council and President of the Alabama Simmental Association and is a Director on the State BCIA Board

**Nominated by Alabama Beef Cattle Improvement Association**

**Bob Zarn**
**ZAR Ranches**
**Piney, Manitoba**

Bob Zarn has been in the cattle business for 28 years and in the seedstock business for 14 years. The cow herd consists of 120 Blonde d'Aquitaine cows and 25 head of commercial cows. ZAR Ranches has placed bulls in Manitoba test stations every year since 1979.

Mr. Zarn has served as Director and President of the Manitoba/Saskatchewan Blonde d'Aquitaine Association and Director of the Canadian Blonde d'Aquitaine Association. He is Chairman of the Manitoba/Saskatchewan Blonde Bull Test Station.

**Nominated by Manitoba Agriculture**

## Brown and Nichols are Co-winners of BIF Outstanding Seedstock Producer Award

**Asheville, NC** -- For the first time in the 25-year history of the Beef Improvement Federation (BIF), co-winners were named to receive BIF's Outstanding Seedstock Producer Award. Honored at the 25th Anniversary Convention held at the Grove Park Inn in Asheville, North Carolina were R.A. "Rob" Brown of Throckmorton, Texas and J. David Nichols of Bridgewater, Iowa.

Rob Brown is considered one of the most forward thinking, creative, yet pragmatic cattle breeders anywhere. Since he assumed the management reins in 1965, the R.A. Brown Ranch has expanded from 26,000 acres to more than 112,000 acres and five purebred cattle herds -Simmental, Simbrah, Red Angus, Senepol and Angus. The 1,350 purebred cows are managed exactly the same as the 1,508 commercial cows, except for pedigree information.

Rob has emphasized calving ease, balanced EPDs and bulls with moderate frame, capacity and fleshing ability. He uses trait leaders and owns 2J Polled Siegfried and RAB Polled Power, Trait Leaders in weaning and yearling weights that are leased to ABS. He has bred six other Simmental bulls that are Trait Leaders in ten traits. He has more Simbrah bulls in the sire summary than any other breeder.

Under extensive range conditions, the 95 percent average annual pregnancy rate, 70 percent of which is through artificial insemination, is further testimony of Brown's never ending demand for production efficiency.

Rob Brown gives freely of his time to industry service. He has served on the boards of ASA, NCA, TSCRA, AQHA, AISA and others. He served as president of ASA and AISA. He has been honored many times by various industry groups.

Rob Brown is a gentleman, a rancher, an innovator and a disciple of performance testing who personifies the goals and objectives of the Beef Improvement Federation.

Dave Nichols, managing partner of Nichols Farm Ltd, began in the cattle business with the purchase of 40 registered Angus in 1952, while in 4-H. In 1968, Nichols Farm bought some of the first Simmental semen imported into the U.S. Approximately nine years ago, they added Salers to the seedstock program. Currently the farm manages 797 cows.

Dave has always set goals and sought solutions to cattle producers problems since those early days in 4-H. He has combined research information with an acute sense for merchandising his product to be the largest beef cattle seedstock producer in Iowa. They have gone from selling five bulls annually in the early years, to nearly 500 annually.

Nichols Farms has been at the forefront of collecting genetic data on their seedstock. A recent project has provided them with a DNA library on every cow. They are currently involved in carcass characteristic research utilizing ultrasound and this DNA library. Seventy-five percent of all cows are bred AI to high accuracy EPD bulls. Recently, Nichols has moved the operation more extensively into embryo transfer, flushing 73 of their top Angus and Simmental cows.

In addition to managing Nichols Farms, Dave continues to work for the industry by serving as a director and officer of several breed associations, as an Iowa Cattlemen's Association district director and currently is Iowa's representative on the Beef Promotion and Research Board.

The Beef Improvement Federation believes it is most appropriate to honor two such outstanding and deserving seedstock producers on the occasion of their 25th anniversary.

**Nichols & Brown Named Co-winners of 1993 BIF Seedstock Breeder Award**
(Left to Right) Charles McPeake, Executive Director; David Nichols,
R. A. "Rob" Brown, Jim Leachman, President

# NOMINEES FOR COMMERCIAL PRODUCER OF THE YEAR

**Andy Bailey**
**Star Valley/Stewart Brothers Ranches**
**Thayne, Wyoming**

Andy Bailey is Ranch Manager and part owner of Star Valley/Stewart Brothers Ranches. The operation consists of 1100 Black Baldy and Limousin/Black Baldy cross cows run over 300,000 acres in Nevada, Wyoming and Idaho. Cows are wintered in Nevada and summered 600 miles away in Wyoming and Idaho.

Since 1980 percent calf crop has increased from about 70% to 94%, and average weaning weights have increased from 399 pounds to 554 pounds.

Mr. Bailey serves on the Board of Directors of the North American Limousin Foundation and on the NCA Public Lands Committee.

**Nominated by North American Limousin Foundation**

**Leroy Beitelspacher**
**Beitelspacher Farm**
**Bowdle, South Dakota**

Leroy Beitelspacher has been involved in the cattle business for the past 21 years. The Beitelspacher Farm consists of 1500 acres of cropland and 1600 acres of pasture. In addition to 200 cows, the Beitelspachers also purchase approximately 200 head of calves each year to background or finish.

Over the last six years the Beitelspacher Farm has developed an intensive grazing system. Over the past 11 years weaning weights have increased by 80 pounds.

Mr. Beitelspacher was named South Dakota Commercial Beef Producer of the Year in 1992.

**Nominated by South Dakota Beef Cattle Improvement Association**

**Glenn Calbaugh**
**Calbaugh Cattle Company**
**Gillette, Wyoming**

Calbaugh Cattle Company runs 400 head of commercial cows. At weaning calves are sent to a custom feedlot. Red Angus is used extensively in the crossbreeding program.

Heifers are bred A.I. at Calbaugh Cattle Company, and calve in a 30-day period. Cows are bred natural service and calve in a 45-day period. Over the past eight years weaning weights have increased from 418 pounds to 513 pounds.

Mr. Calbaugh has served as Director of the Wyoming Beef Cattle Improvement Association and is currently on the Executive Committee of the Wyoming Stock Growers Association.

**Nominated by Red Angus Association of America**

**Oscho Deal**
**Circle D Farms**
**China Grove, North Carolina**

The 500-acre Circle D Farm has been in the Deal family for seven generations. The cattle herd consists of 70 head of brood cows. Corn, soybeans and cattle are the major enterprises. By-products such as poultry litter, municipal sludge, and cotton waste are used to reduce feed and fertilizer costs.

All cows are bred A.I. Last year 93% of the calves were born in a 39-day period.

Mr. Deal is a charter member of the North Carolina Gelbvieh Association.

**Nominated by North Carolina Beef Cattle Improvement Association.**

**Jed Dillard**
**Basic Beefmasters, Inc.**
**Greenville, Florida**

In 1992 Jed Dillard and Allen Boyd purchased the cow-calf operation that Mr. Dillard had managed since 1978. The herd consists of 210 cows that are bred to Beefmaster bulls. Steers are sold at weaning and heifers are sold as yearling replacements.

Under Mr. Dillard's management since 1978, calves weaned per cow exposed increased 18 percentage points, and weaning weights have increased by 95 pounds.

Mr. Dillard chairs the Florida Cattlemen's Association IRM Committee and is past President of the Florida Beef Cattle Improvement Association.

**Nominated by Florida Beef Cattle Improvement Association.**

**Art Farley**
**C-More Beef Farm**
**Seymour, Illinois**

Art and Harold Farley own and operate a 1600 acre livestock and grain farm and maintain a 70-herd Simmental cow herd and a 150-head feedlot. They started their cow herd in 1979 primarily to utilize their pasture acreage and to provide calves for their feedlot.

They have increased their average weaning weights from 492 pounds in 1979 to 606 pounds in 1987. Since then they have maintained their weaning weights at 600 pounds since this is the optimum size for their cow maintenance and feedlot performance. Annually they have over a 95 percent calf crop.

Mr. Farley is currently Director and Secretary of the Ililinois Simmental Association and of the American Simmental Association.

**Nominated by Illinois Beef Cattle Improvement Association**

**Jon C. Ferguson**
**Ferguson Brothers Inc.**
**Kensington, Kansas**

Ferguson Brother's operation is located in the western part of North Central Kansas. There are 2,100 acres of cultivated land and 5,100 acres of rangeland. The beef operation is made up of 730 cows, predominantly Angus and Angus cross, and approximately 1000 head of stockers each year. Ownership is retained on most of these stockers through the finishing phase at custom feedlots.

Mr. Ferguson maintains a 60-day breeding season for mature cows with conception rates from 93-96%. Last year 460 pounds of calf were weaned per cow exposed. 1992 steers went on feed at 670 pounds, gained 3.6 pounds per day and were killed at 1,194 pounds at 15-1/2 months of age. Eighty-two percent graded choice with an average yield grade of 3.1.

Mr. Ferguson has served on several committees and on the Board of Directors of the Kansas Livestock Association. He has also served on NCA's Board of Directors and on NCA's Ag Policy Committee.

**Nominated by Kansas Livestock Association**

**Walter Hunsuker**
**Bar Mountain Ranch**
**Porterville, California**

Bar Mountain Ranch is a diversified cattle operation including 400 head of commercial cows and approximately 1000 head of stocker cattle each year. All of the commercial cows are bred A.I. for the first cycle to Angus bulls in an attempt to produce moderate frame size cattle.

Mr. Hunsuker joined the California BCIA program in 1967. Weaning weights have gone from 350 pounds at nine months of age to 620 pound steers and 580 pound heifers at seven months of age.

Mt. Hunsuker is President of the Tulane County Cattlemen's Association and has served on the Board of the Amerifax Cattle Association.

**Nominated by California Beef Cattle Improvement Association**

**Nola and Steve Kleiboecker**
**Kleiboeker Farm**
**Wentworth, Missouri**

Kleiboeker Farm is a diversified operation which includes 250 beef cows, 85 sows, row crops and alfalfa. The cow herd consists of Angus,Polled Hereford and Simmental crosses. Most of the calves are sold at weaning. Some steers are kept through a stockering program, and the Kleiboekers have sent some steers through feed-out programs.

Over the past ten years the Kleiboekers have seen a 70-pound increase in weaning weights.

Nolan and Steve Kleiboeker were named 1991 Missouri BCIA Commercial Cattlemen of the year.

**Nominated by Missouri Beef Cattle Improvement Association**

**Jim Maier**
**Maier Ranch**
**Morristown, South Dakota**

Jim Maier's family has been in the commercial cattle business for 15 years. The Maier Ranch consists of 2400 acres of crop, hay and pasture land. The beef herd consists of 76 head of Simmental-Hereford cross brood cows. Charolais are used as terminal sires.

Over the past six years adjusted 205-day weights have increased from 630 to 690 pounds. The Maier Ranch has consistently calved over 95% of the cow herd in 42 days.

Mr. Maier is the North Dakota BCIA Outstanding Producer of the Year.

**Nominated by North Dakota Beef Cattle Improvement Association**

**Bill and Jim Martin**
**Lover's Lane Farm**
**Moorefield, West Virginia**

Bill and Jim Martin, along with their father, Leonard, own and manage 175 cows. They background about 400 head of cattle each year. In addition to beef cattle, the Martins also finish 800 head of market hogs and grow 150,000 chickens each year.

Bill and Jim Martin were named West Virginia Cattleman's Association's 1992 Cattlemen of the Year. Bill Martin serves on the West Viriginia Bull Test Committee and is a National Pork Producers Director.

**Nominated by West Virginia Beef Cattle Improvement Association**

**Ian and Alan McKillop**
**Argyle Farms**
**Dutton, Ontario**

Ian and Alan McKillop have been in the cattle business for 15 years. Part of the farm has been in the family since 1851. The farming operation includes hay, corn, wheat, 6000 laying hens and 76 cows. The cow herd consists of Limousin-Charolais crosses, and calves are finished on the farm.

Since 1984 weaning weights have increased from 479 to 526 pounds.

The McKillops received the 1992 Mark of Excellence Award from the Ontario Beef Cattle Performance Association.

**Nominated by Ontario Beef Cattle Performance Association**

**George and Robert Pingetzer**
**Six Iron Ranch**
**Shoshoni, Wyoming**

Six Iron Ranch is a father-son operation which raises alfalfa, oats, malt barley and corn in addition to the 600 cow herd. Commercial cows are Red Angus-Saler crosses which are used to produce yearling feeders. Bulls are produced from a registered Red Angus herd (100 head) and a registered Saler herd (50 herd).

The Pingetzers received the WBCIA Outstanding Commercial Cattleman Award for 1992.

**Nominated by Wyoming Beef Cattle Improvement Association**

**Timothy D. Sutphin**
**Simmons Farm**
**Pulaski, Virginia**

Mr. Sutphin has served as Manager of Simmons Farm for the past 11 years. The operation covers 1300 acres in three counties. The cow herd consists of 240 head of Angus-Simmental crosses.

When Mr. Sutphin became Manager in 1982, the calving season lasted eight months, 7% of cows required assistance at birth, and weaning weights were 340 pounds. Calves weaned per cow exposed was 85%. In 1992, 95% of cows exposed raised a calf with an average weaning weight of 670 pounds. The calving season lasts 60 days and 1% of cows, including heifers, require assistance at birth.

Mr. Sutphin serves on the Virginia Cattleman's Association Board of Directors and has served as Vice-President of the VA-NC Wool Marketing Association.

**Nominated by Virginia Beef Cattle Improvement Association**

**James A. Theeck**
**Mayfair Ranch**
**Brenhan, Texas**

James Theeck has been General Manager of Mayfair Ranch for 26 years. Currently Brahman, Hereford, Santa Gertrudis, Gelbvieh and Beefmaster bulls are used in the 1526 cow herd. Each year about 400 head of commercial heifers are sold at a $200-400 premium over market. Steer calves are backgrounded. Ownership through the feedlot is sometimes retained depending on market conditions.

Since 1967 pregnancy rate on the ranch has improved from 67% to 95-98%. Weaning weights have increased over 100 pounds.

Mr. Theeck has served on the SGBI Board, the Limousin Type Task Force, and as President of the Mid-Coast Santa Gertrudis Association. He has received numerous awards including the Man of the Year in Texas Agriculture from the Texas County Agents' Association.

**Nominated by Texas Beef Cattle Improvement Association**

**Gene Thiry**
**Oak Lake, Manitoba**

Gene Thiry calves 130 cows annually. Calves are Angus, Simmental, and Charolais crosses. For the past fifteen years calves have been fed to slaughter.

Since Mr. Thiry enrolled in the Manitoba ROP program in 1981, calf weaning weights have increased by 80 pounds.

Mr. Thiry has served as Livestock Director on the local M.P.E. Board and as Director for Sifton municipality with Keystone Agricultural Producers.

**Nominated by Manitoba Agriculture**

## Jon Ferguson Named BIF Outstanding Commercial Producer

**Asheville, NC** -- Jon C. Ferguson, managing partner of Ferguson Brothers,Inc., Kensington, Kansas, has been selected as the Beef Improvement Federation's 1993 Outstanding Commercial Producer at their 25th Anniversary Convention held at the Grove Park Inn in Asheville, North Carolina.

Jon returned to the family operation in 1973 after receiving a degree in nuclear engineering from Massachusetts Institute of Technology. The Ferguson Brothers' operation is located in western, north central Kansas. It consists of 2,100 acres under cultivation and 5,100 acres of rangeland. The beef operation consists of 730 head of predominately Angus and Angus cross females and approximately 1,000 head of stocker cattle annually. Ownership of a majority of the stockers is retained with the cattle finished in a custom feedlot.

Although some may think Ferguson chose the wrong college curriculum to be a cattleman, the thought couldn't be more wrong. Jon says the essence of an engineering degree is problem solving. Coupled with a knowledge of Animal Science, the problem solving process can advance a beef production system. Jon holds the belief that being a successful cattleman is accomplishing the most with the least in terms of both labor and capital investment. Although Ferguson strives for efficient costs within his commercial operation, he does not restrain from making progressive changes to improve quality. His business sense and dedication to excellence has made his operation very successful.

Since 1989, Ferguson has incorporated artificial insemination into his program, using it on approximately 480 heifers and cows. His replacement heifers are mostly exclusively from the AI matings, from Angus sires with appropriate maternal and growth EPDs at a reasonable cost. In the last two years, Jon has cooperated with the American Angus Association in the collection of carcass data on the steers from these AI matings.

Jon Ferguson is a businessman. He has the unique ability to discover ways to produce a quality product while keeping control of costs. BIF is pleased to recognize this excellent production system with their 1993 Outstanding Commercial Producer Award.

**Jon Ferguson Family Receives 1993 BIF Commercial Producer Recognition**
(Left to Right) Charles McPeake, Executive Director; Emily Ferguson, Linda Ferguson, Jon Ferguson, Olivia Ferguson, Jim Leachman, President

**Pioneers All**
(Front Row) Dr. Charles McPeake, Mr. Hayes Gregory, Dr. J. W. (Pete) Patterson, Mr. Jim Leachman. (Back Row) Dr. Dixon Hubbard, Dr. Richard Willham, Mr. James Bennett, Dr. Dan Daniels, Dr. M.K. "Curly" Cook

## Patterson and Gregory Receive a 1993 BIF Pioneer Award

**Asheville, NC** -- The Beef Improvement Federation (BIF) has recognized the long-time, effective efforts of two North Carolinians at their 25th Anniversary Convention. Dr. James W. (Pete) Patterson and Mr. Hayes Gregory were named recipients of BIF's Pioneer Awards at the annual meeting held at the Grove Park Inn in Asheville, North Carolina on May 26-30.

Pete and Hayes grew up in Macon County, North Carolina. Both attended North Carolina State University, received B.S. degrees in Animal Science and then served two years with the U.S. Army. Following their army duty, they entered M.S. programs at North Carolina State University in 1953.

Both men worked with Dr. H.A. Stewart, a true pioneer in beef cattle breeding, on their research projects. They worked together from 1955 to 1959 with 3,000 calves in several herds across the state. The calves were weighed every 28 days until weaning age to determine repeatability of measurements and to assess the most appropriate number of weighings and ages for estimating weaning weights. During this time, Gregory was conducting a study as part of his graduate research to determine the relationships between a bull's performance on test and the weaning performance of his progeny. Patterson, for his graduate research project, was using the data to develop age-of-dam adjustments for weaning data. Incorporated into these studies were trials on effectiveness of alternative systems for identification.

Patterson joined NCSU as an extension livestock specialist in 1954. As a result of the work he and Gregory did, he was instrumental in getting a special bill approved by the state legislature in 1958 to fund the establishment of the North Carolina Beef Cattle Improvement Program. Later, he was instrumental in getting support to establish central bull testing stations in North Carolina. He obtained a Ph.D. in animal breeding and genetics from VPI in 1967. He retired as Specialist-in-Charge of Extension Animal Husbandry at North Carolina State University in 1984.

Gregory joined the teaching and research faculty in the Department of Animal Science at NCSU in 1954. In 1965, he left the university to develop a farm and beef herd for Texas Gulf, Inc. on a 60,000-acre tract of land in Aurora, North Carolina. He developed a commercial herd of 1,150 beef cows. All sires used were performance tested. Almost all were purchased from the USMARC at Clay Center with a few coming from the NCSU herd. The herd was enrolled in NC BCIP and records were used in culling and selection decisions. During this time, Gregory served one term as president of the North Carolina Cattlemen's Association, a position he used effectively to work with the state legislature in support of the university and the Department of Animal Science, and two terms as chairman of the NC BCIP Committee. In 1977, Gregory re-joined the university as an extension livestock specialist, a position he held until his retirement in 1991. BIF is pleased to recognize the accomplishments of Patterson and Gregory, true pioneers of performance testing in the Southeast.

## James Bennett is Recipient of a BIF Pioneer Award

**Asheville, NC** -- The Beef Improvement Federation (BIF) recognized the many contributions of James D. Bennett to genetic improvement by presenting him with a Pioneer Award at their 25th Annual Convention at the Grove Park Inn in Asheville, North Carolina.

James was born in Campbell County, Virginia in 1933 and grew up on his family's tobacco and cattle farm. He still lives and operates with his family as Knoll Crest Farm. His father, the late Paul Bennett, started a registered Polled Hereford herd in the 1940's, and Knoll Crest Farm developed one of the finest performance-tested, Polled Hereford seedstock sources in the country. Today, Knoll Crest Farm operates on a large scale with three sons involved in the family corporation and all income derived from the sale of cattle. The seedstock operation currently includes Polled Hereford, Gelbvieh and Angus cattle.

James Bennett was a prime mover in performance selection of beef cattle and has served as an educator for the movement in the Southeast and throughout the country since getting involved in the early 1960's.

Developing into an outstanding leader and spokesman for the beef cattle industry, James has served as president of both BIF and the American Polled Hereford Association. He currently serves on the National Cattlemen's Association Beef Board. In his home state, he served as president of the Virginia Beef Cattle Improvement Association and the Virginia Polled Hereford Association. He has served as a director of the Virginia Cattlemen's Association and the Virginia Beef Exposition. BIF previously honored James as their Outstanding Seedstock Producer in 1968, after having received a similar award from the state association the same year. He has been honored as the Virginia Cattleman of the Year and currently chairs the Virginia Extension Service Advisory Committee.

James has operated a central bull test station in cooperation with the Virginia Beef Cattle Improvement Association in Virginia and surrounding states.

James Bennett has been unselfish with his time and talents in assisting efforts to improve the profitability of commercial beef production. BIF is proud to recognize this state and national leader in genetic improvement by making him a Pioneer Award recipient.

## Dr. O.G. Daniel Receives a BIF Pioneer Award

**Asheville, NC** -- The Beef Improvement Federation (BIF) honored a true pioneer in the genetic improvement of beef cattle when they presented a Pioneer Award to Dr. O'Dell G. Daniel at their 25th Anniversary Convention held at the Grove Park Inn in Asheville, NC.

Dr. Daniel received a B.S. degree in Animal Science from Oklahoma State University in 1951 and a Ph.D. degree in Animal Science from Oklahoma State University in 1957.

He served on the staff at Panhandle A&M College, Goodwell, Oklahoma from 1951-1956 as assistant and associate professor and was made Dean of Agriculture in 1957. Dr. Daniel joined the University of Georgia faculty in 1958 as Professor of Animal Science and Head of the Extension Animal Science Department. He was appointed chairman of the Division of Animal and Dairy Science in November, 1979.

In his position as Head of the Extension Animal Science Department, Dr. Daniel was responsible for starting the first extension newsletter, helped organize the Beef Cattle Improvement Association and the Georgia Cattlemen's Association and provided the leadership for one of the strongest junior livestock programs in the nation.

Dr. Daniel has been an educational advisor to the Georgia Cattlemen's Association, the Georgia Beef Cattle Improvement Association, the Bull and Boar Test Committees and the Georgia Stocker-Finisher Council, as well as several purebred breed associations.

Dr. Daniel served as an advisor on performance testing to national purebred cattle associations and has judged cattle in 22 states.

After retiring from the University of Georgia, Dr. Daniel has remained active in the beef industry. As an Angus and Gelbvieh breeder, he is very active in state breed associations. He has also served on the American Gelbvieh Association's Board of Directors.

BIF is pleased to recognize the many contributions of Dr. Daniel by presenting him with this Pioneer Award.

## BIF Pioneer Award Presented to Dr. M.K. "Curly" Cook

**Asheville, NC** -- The Beef Improvement Federation (BIF) honored a long-time contributor to the genetic improvement of beef cattle when they presented a Pioneer Award to Dr. M.K. "Curly" Cook at their 25th Anniversary Convention held at the Grove Park Inn in Asheville, North Carolina.

Curly Cook was born in Logan, Oklahoma on September 26, 1934. He received a B.S. degree in Animal Husbandry from Panhandle A & M College in 1956 and a M.S. degree in Animal Nutrition at the University of Georgia in 1961. After working as a ranch manager, a county agent, and an area livestock specialist, Curly worked at the University of Georgia from 1962 to 1989 where he received his Ph.D. in Ruminant Physiology in 1975. He served as department head from 1980 -1989. Dr. Cook served as Associate Director of the Georgia Cooperative Extension Service from 1989 to 1992.

As an extension livestock specialist in Georgia, Dr. Cook supervised the Georgia BCIA program and served as advisor to the Georgia Central Bull Test Program. He has served as educational advisor to the Georgia Cattlemen's Association, as well as several purebred breed associations. Dr. Cook currently serves on the Executive Board of the Georgia Cattlemen's Association.

Dr. Cook has been a long-time supporter of the Beef Improvement Federation. He has served on numerous BIF Committees since the 1960's including chairing the 1984 Convention Committee. As Associate Director of the Georgia Cooperative Extension Service, Dr. Cook continued to support BIF. His support was instrumental in the printing of current BIF fact sheets. Dr. Cook received the BIF Continuing Service Award in 1984.

BIF believes it very appropriate to recognize Dr. Cook's distinguished career by presenting him with a Pioneer Award.

## Dr. Dixon Hubbard Receives a 1993 Pioneer Award

**Asheville, NC** --The Beef Improvement Federation (BIF) recognized a long-time contributor by presenting Dr. Dixon Hubbard with the coveted Pioneer Award at the organization's 25th Anniversary Convention at the Grove Park Inn in Asheville, North Carolina.

Dixon Hubbard was born and raised on a wheat and cattle ranch in western Oklahoma. He received B.S., M.S. and Ph.D. degrees from Oklahoma State University. His career started with a teaching assignment at Panhandle State University in Goodwell, Oklahoma. After owning and operating a feed company, doing consulting work, and restructuring a family farming and ranching operation from 1961 to 1963, he served as area feedlot and livestock specialist for the Texas Agricultural Extension service from 1963 to 1967. He served as National Animal Science Program Leader for ES-USDA in Washington from 1967 to 1977. It was during this period of time that Dr. Hubbard took over the work started by Frank Baker, and actually worked closely with Dr. Baker, many extension animal scientists, the leadership of the National Cattlemen's Association and beef breed associations to cause the Beef Improvement Federation to develop into the organization it has become.

During those early years of BIF, Dixon Hubbard helped shoulder the leadership development load, the committee structure and work load and augmented communications both throughout the industry and within the organization. As Federal Extension Animal Scientist, a great portion of his effort was turned toward the development of beef cattle improvement through performance testing. BIF, as well as many state performance programs, grew and developed with his untiring assistance. It took a Dixon Hubbard to follow a Frank Baker, working at the national level, to cause BIF to flourish.

After 1977, Dr. Hubbard continued to stay involved with the development of BIF. His USDA positions have changed with his becoming staff leader in Livestock and Veterinary Sciences and currently serves as coordinator of the Extension National Initiative in International Marketing and Sustainable Agriculture for USDA.

Dixon Hubbard was a workhorse for BIF in it's early formation and development years. He provided insight, encouragement and service. BIF is pleased to be able to recognize these essential contributions on the occasion of its 25th Anniversary by presenting Dr. Dixon Hubbard with a Pioneer Award.

## Dr. Richard Willham Receives BIF Pioneer Award

**Asheville, NC** -- Dr. Richard Willham, Professor of Animal Science at Iowa State University, was a recipient of the Beef Improvement Federation's (BIF) Pioneer Award at BIF's 25th Anniversary Convention at the Grove Park Inn in Asheville, North Carolina. Dr. Willham has been active in BIF since its formative years. At that time, he was the primary advocate of Estimated Breeding Values (EBVs). Drawing on principles set forth in scientific literature, he personally developed guidelines and computer programs for both breeders and breed associations, assisting them in generating EBVs.

As Secretary of the Genetic Prediction Committee within BIF, he has personally written or edited all BIF Guidelines editions outlining genetic procedures for national sire evaluation and genetic prediction.

Dr. Willham's career has been marked by excellence as an educator and significant research contributions. He has written textbooks and trained numerous graduate students who have distinguished themselves as leaders in the livestock industry.

Widely known and respected for his books and lectures on the history of livestock breeding and production, Dr. Willham's most recent contribution was written with Roy Wallace and the late Frank Baker, and chronicles the 25 year development of BIF.

BIF is pleased to be able to recognize Dr. Richard Willham for his many contributions to genetic improvement in the beef cattle industry by presenting him with a 1993 Pioneer Award.

## Dr. Henry W. Webster Receives a 1993 BIF Continuing Service Award

**Asheville, NC --** The Beef Improvement Federation (BIF) honored Dr. Henry W. Webster with a Continuing Service Award at their 25th Anniversary Convention held at the Grove Park Inn in Asheville, North Carolina.

Henry was raised on a crop and livestock farm in Robeson County, North Carolina. He earned his B.S. and M.S. degrees from North Carolina State University. He earned his Ph.D. from Clemson University. Henry has worked for the Cooperative Extension Service for 29 years, starting as an assistant county agent and is now extension coordinator in North and South Carolina. He was also an area sales representative for American Breeders Service in North Carolina and Tennessee for two years.

Henry believes performance testing of bulls is a valuable educational tool. He has provided leadership effort in cooperation with the beef industry to strengthen the entrance and sales criteria (including height and weight) and performance standards (gain on test) for all bulls tested in South Carolina since 1979.

Henry is a strong advocate of a records program for beef cattle producers. He encourages the commercial cattlemen to use the South Carolina Beef Cattle Records Program while encouraging the purebred breeders to use their breed association's programs. In addition to production, he has stressed the importance of marketing the product. He has worked to develop and implement a number of quality, strategically-located, graded feeder calf sales.

To complement the marketing program, in 1983, Henry established an allbreed, commercial, replacement heifer sale which was a first of its' kind. The sale requires performance records and provides animals which are ready to breed. The sale has been an especially useful source of genetics for new cattlemen as well as an additional source of replacements for established operations. Subsequently, other states have established replacement heifer sales due to the success in South Carolina.

Henry has been active in the ASAS Southern Section of the American Society of Animal Science serving on the Reproductive Marketing, Performance Testing and Extension Awards Committees.

Henry and his wife Johnelle have one son, Patrick. He is very active in church and has served as an Elder for the Fort Hill Presbyterian Church in Clemson, South Carolina.

## McGuire is Honored by BIF

**Asheville, NC --** Dr. Bob McGuire of Auburn University was honored by the Beef Improvement Federation (BIF) when he received a Continuing Service Award at their 25th Anniversary Convention held at the Grove Park Inn in Asheville, North Carolina.

A most deserving recipient of this award, Dr. McGuire's longtime career has been one of dedicated service coupled with a strong desire to help cattlemen improve their business through performance testing. Dr. McGuire, while serving as county extension agent in North Carolina, was heavily involved in collecting data to establish the now standard 205-day weight. He is a distinguished Extension Animal Scientist and professor at Auburn University. Dr. McGuire is highly respected for his work with the oldest continous bull testing program in the nation. His work in establishing the performance testing of bulls on grass has been very useful to the Southeastern cattlemen.

Dr. McGuire's work has spanned a period of 35 years. He worked with the BCIA programs in both North Carolina and Georgia, and for the past 19 years he has worked with the Alabama program.

Bob McGuire's work is vital to the Alabama cattle industry. His knowledge and service to cattle producers is sought throughout the nation. Nominated by the Alabama Beef Cattle Improvement Association, BIF is pleased to honor Dr. Bob McGuire with a Continuing Service Award.

**Recipients of BIF Continuing Service Awards**
(Left to Right)
Dr. Henry Webster,
Dr. Charles McPeake
Dr. Robert McGuire and
Jim Leachman, President

## Charles A. McPeake Receives 1993 BIF Continuing Service Award

**Asheville, NC --** The Beef Improvement Federation (BIF) honored Dr. Charles McPeake, immediate past Executive Director of BIF, with a Continuing Service Award at their 25th Anniversary Convention held at the Grove Park Inn in Asheville, North Carolina.

A native of Lexington, Tennessee, Dr. McPeake received a B.S. degree at the University of Tennessee at Martin in 1968. After working four years with the University of Tennessee Cooperative Extension Service as a county extension agent in Giles County, Tennessee, he returned to school. He completed a M.S. degree in animal science at University of Tennessee in 1974, and moved to Michigan State University where he received a Ph.D. in animal breeding. He has served as a Beef Extension Specialist in South Dakota and Oklahoma.

At South Dakota State University , his position was charged with performance testing where over 50,000 weaning weights and 20,000 yearling weights were processed annually. In 1980, he moved to Oklahoma State University and managed Oklahoma Beef, Inc. Much of the test station's data has been used in research studies at OSU and nationally to justify change in performance testing procedures.

In 1990, McPeake moved to the University of Georgia as professor and head, Extension Animal Science Department. In 1992, he became extension leader and assumed responsibilities for Dairy Science and Veterinary Medicine in addition to Extension Animal Science.

Dr. McPeake has served the Beef Improvement Federation in several capacities: from 1978-1984 as a member of the Seedstock Committee; 1981-1982 co-chairman with Dr. Frank Baker of the BIF meeting in Stillwater, Oklahoma; 1985-1988 as secretary and chairman of the Central Test Committee and more recently, 1989-1993 as Executive Director.

He is a member of the American Society of Animal Science; Gamma Sigma Delta; American Registry of Professional Animal Scientists; Alpha Gamma Rho Fraternity; cattlemen's organizations on the local, state and national level and American Quarter Horse Association. In addition, he is active on numerous committees within many of these organizations.

Dr. McPeake and his wife, Sandra, are the parents of two children--Andrea and Andrew. Andrea will attend the University of Georgia starting this summer. Andrew, a junior in high school, is active with livestock projects.

Dr. McPeake is stepping down as Executive Director after capably serving in that capacity for the past four years.

## BIF Honors J.T. "Johnny" Jenkins

**Asheville, NC** -- The Beef Improvement Federation (BIF) has recognized the long and productive career of J.T. "Johnny" Jenkins by presenting him with the 1993 BIF Ambassador Award at their 25th Anniversary Convention held at the Grove Park Inn in Asheville, North Carolina. The Ambassador Award is given to a member of the livestock press who has enhanced the principles and programs of BIF through his publication.

J.T. "Johnny" Jenkins was born in Asheville, Alabama in 1920. A University of Florida journalism graduate, he served as a camp newspaper editor for four years during World War II. In 1947, he joined the staff of The Florida Cattleman. A year later, he and his wife, Liddy, purchased the Southern Livestock Journal and moved to Macon, Georgia where they still live.

In 1958, Mr. Jenkins merged the Southern Livestock Journal with the Breeder Stockman to create the Livestock Breeder Journal. In 1983, he was founder of Beefweek magazine.

Johnny Jenkins has worked as journalist, publisher and printer for fifty years. He has been a strong supporter of state and national breed associations, youth programs and performance testing efforts. His involvement has been much greater than just writing about agriculture. He was an early leader and founder of state cattlemen's associations across the South, and he founded or influenced the founding of many of the state cattlemen's magazines we know today.

Johnny Jenkins has received numerous awards including the Livestock Publication Council Hall of Fame, the Polled Hereford Hall of Merit for Communications and the Georgia Cattlemen's Hall of Fame.

BIF is pleased and honored to be able to recognize the many contributions of "Johnny" Jenkins with their 1993 Ambassador Award.

**1993 BIF Ambassador**
J. T. "Johnny" Jenkins
flanked by Charles McPeake,
Executive Director (Left)
and Jim Leachman,
President (Right)

**Charles McPeake,
BIF
Executive Director
presents
"Ideas Into Action"
commemorative plaque
to Mrs Melonee Baker
in Memory of
Frank H. Baker,
Founder of the
Beef Improvement
Federation**


New BIF President,
Marvin Nichols, expressing
appreciation to former
President, Jim Leachman,
for contributions to BIF over the
last two years.

New BIF Vice -president,
Paul Bennett,
addressing BIF Convention
attendees.

**Ron Bolze,
Beef Extension Specialist,
Kansas State University,
assumes role as new
Executive Director of
Beef Improvement
Federation.**

**1993 BEEF IMPROVEMENT FEDERATION
BOARD OF DIRECTORS**

Front Row: Ron Bolze, Charles McPeake, Jim Leachman, Marvin Nichols. Second Row: Roy McPhee, Paul Bennett, Paola de Rose, Jed Dillard, Lee Leachman, John Hough, Willie Altenburg. Third Row: Gary Johnson, Doug Hixon, John Crouch, Loren Jackson, Don Boggs, Bruce Cunningham. Back Row: Norm Vincel, Burke Healey, Larry Cundiff, Ronnie Silcox, Gary Weber, Craig Ludwig. Those not pictured: Glenn Brinkman, Dixon Hubbard, Steve McGill, Darrell Wilkes, Richard Willham.

# 1993 BIF Attendees

Harry Airey
Canadian Charolais Association
2320 - 41 Avenue, NE
Calgary, Alberta, Canada T2E 6W8
403/250-9242

Beecher Allison
N. C. State University
516 Test Farm Road
Waynesville, NC 28781
704/456-7520

William & Patricia Altenburg
ABS & Amer. Simm. Assoc.
1604 E. County Road #76
Wellington, CO 80549
303/568-7808

John and Jackie Anderson
3428 Valley Woods
Verona, WI 53593
608/262-2503

Kent Anderson
North American Limousin Foundation
7383 S. Alton Way
Englewood, CO 80112
303/220-1693

C. Ancel Armstrong
New Breeds Industries
3220 Excel Road
Manhattan, KS 66502
913/537-8691

Roy Ax
University of Arizona
4612 Avenue del Cazador
Tucson, AZ 85718
602/621-1322

Mary Bellin-Ax
University of Arizona
4612 Avenue del Cazador
Tucson, AZ 85718
602/621-1322

Ken Aylesworth
Canadian Charolais Association
2320 - 41 Avenue, NE
Calgary, Alberta, Canada T2E 6W8
403/250-9242

William Backus
The University of Tennessee
Post Office Box 1071
Knoxville, TN 37901-1071
615-974-7291

Dr. David Bailey
Agriculture Canada
Post Office Box 3000, Main
Lethbridge, Alberta, Canada T1J 4B1
403/327-4561

Mrs. Mel Baker
Winrock International
1806 Berry Place
Conway, AR 72032

Edward Ballard
University of Illinois Coop. Ext. Service
1209 Wenthe Drive
Effingham, IL 62401-1697
217/347-5126

Mark and Kathy Barenthsen
HC 1, Box 182
Powers Lake, ND 58773
701/464-5741

Jeff Baxter
733 Red Mile Road
Lexington, KY 40504
606/233-3722

Bill Beal
VPI & SU
3400 Litton Reaves Hall
Blacksburg, VA 24061-0306
703/231-6936

Barry Bennett
Canadian Simmental Association
#13, 4101-19th Street, NE
Calgary, Alberta, Canada T2E 7C4
403/250-5121

James and Barbara Bennett
Knoll Crest Farm, Inc.
HCR Box 39
Red House, VA 23963
804/376-3567

Paul and Tracy Bennett
Knoll Crest Farm
HCR 1
Red House, VA 23963
804/376-5675

Larry Benyshek
University of Georgia
L-P Bldg., Animal & Dairy Sci.
Athens, GA 30602
706/542-6259

Philip Berg
North Dakota State University
Box 1377
Hettinger, ND 58639
701/567-4326

Keith Bertrand
University of Georgia
206 Livestock-Poultry Building
Athens, GA 30602
706/542-1852

Ralph Blalock, Jr.
Cooperative Extension Service
Post Office Box 129
Tarboro, NC 27886
919/641-7815

Scott Blanton
Double A Ranch
Post Office Box 421
Hoschton, GA 30548
706/654-3024

John Boehms
Amer.-Int'l. Charolais Association
Post Office Box 20247
Kansas City, MO 64195
816/464-5977

Don Boggs
South Dakota State University
Box 2170
Brookings, SD 57007
605/688-5448

Ron and Becky Bolze
Kansas State University
Route 2, Box 830
Colby, KS 67701
913/462-7575

Michael Borger
Ohio State University, Ag. Tech. Inst.
1328 Dover Road
Wooster, OH 44691
216/264-3911

Jerry & Margaret Bornemann
5415 S. State Road
Durand, MI 48429
517/743-4509

Andy Boston
Purdue Cooperative Extension Service
205 East Main Street
Paoli, IN 47454
812/723-7107

Rick Bourdon
Colorado State University
Dept. of Animal Science
Ft. Collins, CO 80523
303/491-6150

Garth Boyd
Colorado State University
Dept. of Animal Sciences
Ft. Collins, CO 80549
303/491-6233

Thomas H. Bradbury
Bradbury Land & Cattle Company
Post Office Box 256
Byers, CO 80103
303/822-5678

Darwin & Sharon Braund
NCSU, Dept. of Animal Science
Box 7621
Raleigh, NC 27695-7621
919/515-4474

Ralph Bridges
Georgia Cattlemen's Association
Route 1, Box 1778
Lexington, GA 30648

Glenn L. & Carolyn Brinkman
Brinks Brangus
Post Office Box 350
Eureka, KS 67045
316/583-7407

James Brinks
Colorado State University
Dept. of Animal Science
Fort Collins, CO 80523
303/491-6928

William R. Brockett
Virginia Beef Corporation
1215 James Madison Hwy.
Haymarket, VA 22069
703/754-8873

Dan T. Brown
University of Georgia
2564 Georgia Mtn. Expt. Station
Blairsville, GA 30512
706/745-6197

Donnell Brown
R. A. Brown Ranch
Post Office Box 789
Throckmorton, TX 76483
817-849-0611

R. A. Brown, Jr.
R. A. Brown Ranch
Post Office Box 789
Throckmorton, TX 76483
817-849-0611

Dean Bryant
Wye Angus
Post Office Box 169
Queenstown, MD 21658
410/827-6016

Gaylin Bryson
Bent Tree Farms
Route 4, Box 314A
Fort Payne, AL 35967
205/845-3009

Leonard S. & Dee Bull
NCSU, Dept. of Animal Science
Box 7621
Raleigh, NC 27695-7621
919/515-7892

Darrh Bullock
University of Kentucky
804 W P Garrigus
Lexington, KY 40546
606/257-7514

Jack Byrd
Knibbs Creek Farm
Post Office Box 313
Amelia, VA 23002
804/561-2421

Candace Cameron
South Carolina Cattlemen's Association
854 Issaqueena Trail #603
Central, SC 29630
803/654-8951

Jack and Gini Chase
Buffalo Creek Red Angus
Post Office Box 186
Leitor, WY 82837
307/736-2422

Jacques P. Chesnais
Agriculture Canada
20B Gervin
Nepean, Canada K2G0J8
819/994-0246

Chris Christensen
Christensen Bros. Simmentals
Route 2, Box 580
Wessington Springs, SD 57382
605/539-9522

Tom Chrystal
1887 H Avenue
Scranton, IA 51462
712/652-3759

Matt Claeys
N. C. State University
Box 7621
Raleigh, NC 27695-7621
919/515-7805

Porter Claxton
Claxton Farm
240 Upper Flat Creek
Weaverville, NC 28787

Stan Clements, Jr.
Clemson University
Route 4, Box 133
Abbeville, SC 29620
803/446-3391

M. K. and Sandra Cook
Cloud Creek Cattle Company
Route 1, Box 365
Crawford, GA 30630-9739
706/549-7382

Dr. Gene and Lynn Cornett
Reedy Fork Farms
110 Griffin Mill Road
Piedmont, SC 29673
803/277-4482

Clyde Cranwell
Tri-State Breeders
E10890 Penny Lane
Baraboo, WI 53913
608/356-8357

John and Judy Crouch
American Angus Association
3201 Frederick Boulevard
St. Joseph, MO 64506
816/233-3101

Larry V. Cundiff
USDA-ARS-USMARC
Post Office Box 166
Clay Center, NE 68933

Bruce Cunningham
American Simmental Association
1 Simmental Way
Bozeman, MT 59715
406/587-4531

Michael Currin
Franklin Hill Farm
310 Kettlebridge Drive
Cary, NC 27511
919/552-7742

David and Emma Danciger
Tybar Angus Ranch
1644 Prince Creek Road
Carbondale, CO 81623
303/963-1391

Dan and Nemah Daniel
Partisover Ranch
Route 1, Box 110-D
Colbert, GA 30628
706/788-2274

Randy Daniel
Partisover Ranch
Route 1, Box 110-B
Colbert, GA 30628
706/788-2537

Russ Danielson
North Dakota State University-ARS Dept.
Hultz Hall
Fargo, ND 58107
701/237-7648

Gerard Davis
Colorado State University
Dept. of Animal Science
Fort Collins, CO 80523
303/491-6902

Mike Davis
The Ohio State University
2029 Fyffe Road
Columbus, OH 43210
614/292-4984

Robert DeBaca

R.R. 1, Box 400
Huxley, IA 50124

Glynn and Bobbie Debter
Debter Hereford Farm
Route 1, Box 171
Horton, AL 35980
205/429-3553

E. Paola de Rose
Agriculture Canada
930 Carling Avenue
Ottawa, Canada K1A0C5
819/994-0246

H. H. Dickenson
American Hereford Association
Post Office Box 4059
Kansas City, MO 64101
816/842-3757

Bob and Jan Dickinson
2831 Severin Road
Gorham, KS 67640
913/998-4357

Jed Dillard
Basic Beefmasters, Inc.
Route 2, Box 92
Greenville, FL 32331
904/997-6223

Mary Howe diZerega
Oakdale Farm
Post Office Box 660
Upperville, VA 22176
703/592-3323

Peter Doris
Ontario Cattlemen's Association
50 Dovercliffe Road, #6
Guelph, Ontario, Canada N1G 3A6
519/824-0334

Jim Doubet
American Salers Association
5600 S. Quebec, Suite 220A
Englewood, CO 80111
303/770-9292

Elwain Dreyer
American Murray Grey Association
3177 Westfield TWP Rd. 152
Cardington, OH 43315
419/864-3360

J. Lloyd Ebersole
Sire Power
R. D. #2, Box 10
Tunkhannock, PA 18657
717/836-3168

Nita Effertz
Beef Today Magazine
South 2517 Greenferry Road
Coeur D'Alene, ID 83814
208/664-9324

Roger Effertz
Effertz Key Ranch
Route 2, Box 16
Velva, ND 58790
701/624-5104

Arthur L. & Carolyn Eller
Virginia Tech
Dept. of Animal Science
Blacksburg, VA 24061
703/231-9151

Wayne Eppler
American Brahman Breeders Association
1313 La Concha Lane
Houston, TX 77054
713/795-4444

S. R. and June Evans, Jr.
Evans Angus Farm
1604 Leflore Avenue
Greenwood, MS 38930
601/453-5317

Rick Faber
Virginia Polytechnic Institute
Animal Science
Blacksburg, VA 24061-0306
703/231-4752

Byron Fagg
Purdue University
Courthouse Annex
Salem, IN 47167
812/883-4601

Robert Felsman
University of Arkansas
Post Office Box 4007
Pine Bluff, AR 71603
501/543-8533

Frank and Lynn Felton
912 South Walnut
Maryville, MO 64468
816/582-2991

Jon and Linda Ferguson
Ferguson Brothers, Inc.
RR 1, Box 156
Kensington, KS 66951
913/476-2697

Lori Fink
Fink Beef Genetic Systems
7101 Anderson
Manhattan, KS 66502
913/776-9385

Claudio Fioretti
Kansas State University
Animal Science & Industry
Manhattan, KS 66506-1600
913/532-5654

Spike Forbes
Beckton Stock Farm
37 Beckton Drive
Sheridan, WY 82801
307/674-6095

Richard Forgason
Post Office Box 386
Hungerford, TX 77448
409/532-1352

Judy A. Frank
Noller and Frank Farms, Inc.
Route 1, Box 197
Sigourney, IA 52591
515/622-2388

James Frederick
Route 1, Box 395-8
Smithfield, NC 27577
919/934-0603

Joe and Colleen Freund
Running Creek Ranch
45400 County Road, #21
Elizabeth, CO 80107
303/623-8500

Stan Fry
Great Western Beef Expo
Post Office Box 127
Sterling, CO 80751
303/522-3206

Jerry Gann
Gann Enterprises
12710 Haskell Lane
Bowie, MD 20716
301/464-3534

Garth Gardiner
Gardiner Angus Ranch
Route 1, Box 290
Ashland, KS 67831
316/635-2932

Henry and Nan Gardiner
Gardiner Angus Ranch
Route 1, Box 290
Ashland, KS 67831
316/635-2932

Joe & Carolynne Garrett
Amer.-Int'l. Charolais Association
Post Office Box 20247
Kansas City, MO 64195
816/464-5977

Charles Gaskins
Washington State University
135 Clark Hall
Pullman, WA 99164-6310
509/335-6416

David Gazda
American Angus Association
111 Greenbrier Way
Athens, GA 30605
706/353-3446

Teddy Gentry
Bent Tree Farms
Route 4, Box 314A
Fort Payne, AL 35967
205/845-3009

Jim and Helen Gibb
American Gelbvieh Association
10900 Dover Street
Westminster, CO 80021
303/465-2333

Dr. Richard Gilbert
Red Angus Association of America
4201 I-35 North
Denton, TX 76207
817/387-3502

Ken Gill
Ultra Sight, Inc.
1907 Keokuk
Ackworth, IA 50001
515/942-6693

Diego Gimenez
Auburn University
Dept. of Animal & Dairy Science
Auburn University, AL 36849-5625
205/844-1520

Julie Gochenour
The Virginia Farmer
Route 1, Box 432
Maurertown, VA 22644

Mark and Melissa Goforth
603 Prince Avenue
Goldsboro, NC 27530
919/735-0970

Bruce Golden
Colorado State University
Animal Science Dept.
Ft. Collins, CO 80523
303/491-7128

Gerald Good
Sanofi Animal Health
313 E. Rockingham Street
Elkton, VA 22827
703/298-0467

Gary Gregory
N. C. State University
Route 1, Box 198-B
Bahama, NC 27503
919/477-8169

Hayes and Joyce Gregory
Wilkesboro, NC
919/667-5769

Junius Grimes
45 Joe Jenkins Road
Fairview, NC 28730
704/628-3113

Randall & Henrietta Grooms
Texas A&M University
14859 CR 192
Tyler, TX 75703
903/834-6191

Randy Guthrie
N. C. State University
Route 1, Box 198-B
Bahama, NC 27503
919/471-6872

Mike and Wendy Hall
Cal Poly State University
Animal Science Department
San Luis Obispo, CA 93407
805/756-2685

Stephen P. Hammack
Texas A&M University
Route 2, Box 1
Stephenville, TX 76401
817/968-4144

Joe Hampton
Upper Mountain Research Station
Route 2, Box 33
Laurel Springs, NC 28644
919/982-2501

Ken Hartzell
21st Century Genetics
Post Office Box 469
Shawano, WI 54166
715/526-2141

Dr. R. W. Harvey
NCSU, Animal Science Department
Box 7621
Raleigh, NC 27695-7621
919/515-4006

Burke Healey
Southern Cross Ranch
Post Office Box 444
Davis, OK 73030
405/369-2711

William and Kim Herring
Univ. of Georgia, Animal-Science Dept.
302 Livestock-Poultry Building
Athens, GA 30602-2771
706/542-0989

Dr. Joe High
University of Tennessee
Post Office Box 160
Spring Hill, TN 37174
615/486-2129

Ken Hill
VA-NC Select Sires
Post Office Box 370
Rocky Mount, VA 24151
703/483-5123

Doug Hixon
University of Wyoming
Post Office Box 3684
Laramie, WY 82071
307/766-3100

Gordon A. Hodges
Pineview Farms
Route 1, Box 400
Hamptonville, NC 27020
919/468-6363

Chad Hoffman
21st Century Genetics
Post Office Box 469
Shawano, WI 54166
715/526-2141

Jimmy Holliman
Auburn University
60 County Road 944
Marion Junction, AL 36759
205/872-7878

Fred Hopkins
University of Tennessee
809 Dogwood Trail
Seymour, TN 37865

Mike Hoppe
Great Western Beef Expo
Post Office Box 127
Sterling, CO 80751
303/522-3206

John Hough
American Polled Hereford Association
11020 NW Ambassador
Kansas City, MO 64153
816/891-8400

W. C. & Barbara Hounshell
Hounshell Farms
Route 4, Box 363
Wytheville, VA 24382
703/686-4055

Brian and Patty House
Select Sires
11740 U. S. 42 N.
Plain City, OH 43064
614/873-4683

Dixon Hubbard
USDA-Extension Service
3340 South Ag. Building
Washington, D.C. 20250-0900
202/720-4341

retired to
Box 232
Cordell, OK 73632
405/832-5061

Harlan Hughes
North Dakota State University
Room 301, Marrill Hall
Fargo, ND 58105
701/237-7380

Lance Hughes
West Virginia University
Post Office Box 6108
Morgantown, WV 26506-6108
304/293-2631

Harold Hupp
Clemson University - Coop. Extension
140 P & AS Building
Clemson, SC 29634-0361
803/656-5161

Don Hutzel
NOBA
Box 607
Tiffin, OH 44883
419/447-6262

John Irwin
Clemson University
219 Laurens Street
Laurens, SC 29360
803/984-2514

Loren Jackson
Int'l. Brangus Breeders Association
Post Office Box 696020
San Antonio, TX 78269-6020
210/696-8231

Jay Jenkins
University of Wyoming Coop. Extension
Post Office Box 3099
Cody, WY 82414
307/587-2204

Johnny and Liddy Jenkins
Macon, GA

Gary and Jody Johnson
RR #1, Box 117
Dwight, KS 66849
913/482-3362

Jim Johnson
Virginia Cattlemen's Association
Post Office Box 176
Daleville, VA 24083
703/992-1009

Mark Johnson
Oklahoma State University
109 Animal Science
Stillwater, OK 74078
405/744-6065

Sandy Johnson
West Virginia University
Post Office Box 6108
Morgantown, WV 26505
304/293-2406

David Johnston
University of New England
Animal Genetics & Breeding Unit
Armidale, N.S.W., Australia 2351
067/732658

Pat and Terri Kelley
Running Creek Ranch
45400 County Road, #21
Elizabeth, CO 80107
303/623-8500

Linda Kelly
University of Arizona
Post Office Box 182
Ft. Thomas, AZ 85536
602/475-2359

Warren and Lucile Kester
Beef Magazine
6 Wembly Circle
Bella Vista, AR 72714
501/855-2459

F. David Kirkpatrick
University of Tennessee
Post Office Box 1071
Knoxville, TN 37901
615/974-7294

Terry Kiser
The University of Georgia
Animal Science Department
Athens, GA 30602
706/542-1852

Brian Kitchen
American Simmental Association
1 Simmental Way
Bozeman, MT 59715
406/587-4531

Lambertlis Klei
Cornell University
B-022 Morrison Hall
Ithaca, NY 14853
607/255-4416

Richard Knipe
University of Illinois
44 White Pine Road
Geneseo, IL 61254
309/792-2500

Fred Knop
Drovers Journal
8009 Juniper
Prairie Village, KS 66208
913/649-3782

Lisa Kriese
Auburn University
Animal Science Building
Auburn University, AL 36849-5415

Peter Kuehni
Beef Improvement Ontario, Inc.
Box 1030
Guelph, Ontario, Canada N1H 6N1
519/836-3560

Rick Lacey
Lacey Ranches
62 Grassland Drive
Drummond, MT 59832
406/288-3359

Margaret Lamb
FDA/CVM/HFV-124
7500 Standish Place
Rockville, MD 20855
301/295-8605

Chuck and Teres Lambert
National Cattlemen's Association
Post Office Box 3469
Englewood, CO 80155
303/694-0305

John & Jeanne Lambert
Keith-Arthur Extension Service
Box 450
Ogallala, NE 69153
308/284-6051

J. F. Lancaster
Ann Angus Farms
Route 4, Box 16
Rocky Mount, NC 27801
919/977-3617

Jerry Langbehn
University Extension Service
328 Arapahoe
Thermopolis, WY 82443
307/864-3421

John Michael Langdon
7728 Raleigh Road
Benson, NC 27504
919/894-8525

James, Corinne, Lee Leachman
Leachman Cattle Company
Post Office Box 2505
Billings, MT 59102
406/656-9325

Les Ledene
Canadian Charolais Association
2320-41 Avenue NE
Calgary, Alberta, Canada T2E6W8
403/250-9242

John Letterle
Blue Ridge Beefalo, Inc.
175K Weaverville Hwy.
Asheville, NC 28804
704/645-9575

David Linker
Hickory Hill Farm
2246 Lusters Gate Road
Blacksburg, VA 24060
703/961-3766

Jerry Lipsey
University of Missouri
S-103 Animal Science Center
Columbia, MO 65211
314/882-2618

Reuben and Betty Littau
Littau Angus Ranch
HC 59 Box 12
Winner, SD 57580
605/879-2223

Del Little
University of Georgia
Livestock-Poultry Building
Athens, GA 30602
706/542-0948

Juan Ramiro Llamas
Tri-State Breeders
E10890 Penny Lane
Baraboo, WI 53913
608/356-8357

Keith Long
Buffalo Creek Red Angus
Box 184
Leiter, WY 82837
307/736-2421

Kenneth & Theresa Lowe
Oak Hollow
Post Office Box 205
Smiths Grove, KY 42171
502/563-4987

Robert Lowrey
University of Georgia
175 Williamsburg Lane
Athens, GA 30605
706/542-0950

Craig Ludwig
American Hereford Association
Box 014059
Kansas City, MO 64101
816/842-3757

David Lunt
Texas A&M University
Route 1, Box 148-F
McGregor, TX 76657
817/840-3032

Mark Lust
Tri-State Breeders
E10890 Penny Lane
Baraboo, WI 53913
608/356-8357

Michael MacNeil
USDA-ARS
Route 1, Box 2021
Miles City, MT 59301
406/232-8213

Jim and Nancy Maier
ND Beef Cattle Improvement Assn.
HCR 81, Box 52
Morristown, SD 57645
701/522-3218

Dave Maples
Alabama BCIA
Post Office Box 2499
Montgomery, AL 36102
205/265-1867

Linda C. Martin
Kansas State University
Dept. Animal Science & Industry
Manhattan, KS 66506
913/532-6533

Ken and Virginia Maxwell
Post Office Box 87
Pink Hill, NC 28572
919/568-3602

Mark A. McCann
Univ. of Georgia Coop. Ext. Service
College of Agriculture
Athens, GA 30602
706/542-2875

Richard & Susan McClung
Wehrmann Angus
Route 1, Box 390
New Market, VA 22844
703/896-5232

Roger & Phyllis McCraw
N. C. State University
Box 7621
Raleigh, NC 27695-7621
919/515-7722

John McDaniel
Alabama BCIA
Route 4, Box 38
Ashford, AL 36312
205/899-3420

Mike McDonnell
McDonnell Consulting
3810 14th Street
Columbus, NE 68601
402/563-2168

Mike and Wanda McDowell
Locust Level Farms
Route 1, Box 367
Vernon Hill, VA 24597
804/349-3779

Steve McGill
American Shorthorn Association
1001 Phillips Road
Anderson, SC 29625
803/260-0053

Robert and Ann McGuire
Auburn University
211 ADS Building
Auburn, AL 36849
205/844-1557

Ian McKillop
Beef Improvement Ontario, Inc.
R. R. 3
Dutton, Ontario, Canada N0L 1J0
519/762-2017

Charles & Sandra McPeake
BIF Exec. Dir., University of Georgia
Coliseum, Ext. Anim. Science
Athens, GA 30602
706/542-2584

Roy and Nellie McPhee
McPhee Red Angus
14298 N. Atkins Road
Lodi, CA 95240
209/727-3335

Steven Meadows
Clemson University
428 Stonehenge
Edgefield, SC 29824
803/637-0302

Charles and Ellen Miller
N. C. Dept. of Agriculture
2 West Edenton Street
Raleigh, NC 27611
919/733-7912

Dale and Deborah Miller
N. C. State University
Box 7621
Raleigh, NC 27695-7621
919/515-7772

Randy Mills
OSU Extension Service-Umatilla County
721 SE Third
Pendleton, OR 97801
503/276-7111

John Mizelle
Linden Farm
20237 Sacra Lane
Rapidan, VA 22733
703/672-5436

Daniel Moser
Univ. of Georgia, Anim.-Sci. Dept.
Livestock-Poultry Building
Athens, GA 30602-2771
706/542-0989

Jennifer Murray
Clemson University
Clemson, SC 29634

Fred Myers
Southern States Cooperative, Inc.
Post Office Box 26234
Richmond, VA 23260
804/281-1283

Buford Neas
Pres., Tenn. Simmental Assoc.
Route 4, Box 593
Greeneville, TN 37743
615/638-8900

Andra Nelson
University of Georgia
Livestock-Poultry Building
Athens, GA 30602
706/542-1852

Larry A. and Mary Nelson
Purdue University
1151 Lily Hall
W. Lafayette, IN 47907-1151
317/494-4831

J. David & Phyllis Nichols
Nichols Farms
RR 1, Box 98
Bridgewater, IA 50837

Marv Nichols
Nichols Cryo-Genetics
Route 1
Ankeny, IA 50021
515/964-3497

Mark Nieslanik
Tybar Angus Ranch
1644 Prince Creek Road
Carbondale, CO 81623
303/963-1391

David E. Noller
Noller and Frank Farms, Inc.
Route 1, Box 197
Sigourney, IA 52591
515/622-2388

Sally Northcutt
Oklahoma State University
201 Animal Science Building
Stillwater, OK 74078

David Notter
Virginia Tech
Dept. of Animal Science
Blacksburg, VA 24061-0306
703/231-5135

Bob Nusbaum
University of Wisconsin-Platteville
1 University Plaza
Platteville, WI 53818-3099
608/342-1452

Ken Odde
Colorado State University
Department of Animal Science
Ft. Collins, CO 80523
303/491-6923

Larry Olson
Clemson University
Post Office Box 247
Blackville, SC 29817
803/284-3344

Dennis Onks
University of Tennessee
3181 Experiment Station Road
Springfield, TN 37172
615/384-4927

Joe C. Paschal
Texas Agric. Extension Service
Route 2, Box 589
Corpus Christi, TX 78406
512/265-9203

Clifton and Rose Paulson
Route 1, Box 99
Colome, SD 57528
605/842-3287

Lynn Pelton
Pelton Simmentals/Red Angus
HC 2 Box 41
Burdett, KS 67523

Ted Perry
Cornell University
130 Morrison Hall
Ithaca, NY 14853
607/255-5923

Daniel Peschel
University of Wisconsin
9129 University Farm Road
Lancaster, WI 53813
608/723-2580

Charles W. Peters
Kansas State University
212 Weber
Manhattan, KS 66506
913/532-6533

John Pollak
Cornell University
B-22 Morrison Hall
Ithaca, NY 14853
607/255-4416

Richard Quaas
Cornell University
114 Morrison
Ithaca, NY 14853-4801
607/255-2853

Lauren Reavis
North American Limousin Foundation
7383 S. Alton Way
Englewood, CO 80115
303/220-1693

Clint Reese
N. C. Cattlemen's Association
Post Office Box 25756
Raleigh, NC 27695
919-832-0235

Reggie Reynolds
Virginia Cattlemen's Association
Post Office Box 176
Daleville, VA 24083
703/992-1009

Joe Reznicek
Cow Creek Ranch
Route 6, Box 95
Mocksville, NC 27028
919/998-9333

G. Reese Richman
American Simmental Association
1 Simmental Way
Bozeman, MT 59715
406/587-4531

Harlan Ritchie
Michigan State University
Dept. of Animal Science
East Lansing, MI 48824
517/355-8409

Bruce Robbins
Beefmaster Breeders Universal
6800 Park Ten #290 W
San Antonio, TX 78213
210/732-3132

Kelly Robbins
The University of Tennessee
Post Office Box 1071
Knoxville, TN 37901-1071
615/974-3130

Paul Robbins
North American Limousin Foundation
7383 S. Alton Way
Englewood, CO 80115
303/220-1693

Rodney Roberson
International Braford Association
422 East Main, Suite 218
Nacogdoches, TX 75961
409/569-8200

Johnny Rogers
N. C. State University
Box 7621
Raleigh, NC 27695-7621
919/515-4004

Oby Rogers
Rogers Bar HR
Post Office Box 700
Collins, MS 39428
601/765-1000

Larry and Kim Rowden
American Breeders Service
408 N. 5th Avenue
Broken Bow, NE 68822
308/872-2598

R. Scott & Mary Rushing
American Brahman Breeders Association
Post Office Box 507
Lampasas, TX 76550
512/556-5732

Robert Sand
University of Florida
Post Office Box 110910
Gainesville, FL 32611
904/392-1916

Yoshiyuki & Reiko Sasaki
Department of Animal Science
College of Agriculture
Kyoto Univ., Kyoto 606-01 JAPAN

Charles Sattler
National Association of Animal Breeders
Post Office Box 1033
Columbia, MO 65205
314/445-4406

Jim and Amy Saunders
Tye Brook Angus
Route 1, Box 29B
Piney River, VA 22964
804/277-9133

Thomas B. Saxe
Univ. of Georgia Coop. Ext. Serv.
901 West Washington
Benton, IL 62812
618/439-7263

Lawrason & Jane Sayre
Waffle Hill Farm
3332 Cool Branch Road
Chruchville, MD 21028
410/734-7136

Nancy Ann Sayre
Leighton Partners
2211 Pennington Road
Bel Air, MD 21015
410/836-0830

Robert and Linda Scarth
Post Office Box 3345
Iowa City, IA 52244
319/339-7829

David Schafer
Colorado State University
18683 Hwy. 140
Hesperus, CO 81326
303/385-4574

Bob Schalles
Kansas State University
Dept. Animal Science
Manhattan, KS 66506
913/532-5654

Neal Schrick
West Virginia University
Post Office Box 6108
Morgantown, WV 26505
304/293-2631

Dennis Schroeder
Ontario Ministry of Agriculture
R. R. 2
Dashwood, Ontario, Canada N0M 1N0
519/237-3708

Todd and Leslie See
N. C. State University
VGJ Center, Route 2, Box 141
Plymouth, NC 27962
919/793-4428

David Seibert
University of Illinois
727 Sabrina Drive
E. Peoria, IL 61611
309/694-7501

Amy Sell
Black Oak Simmental Farm
161 Sand Valley Road
Jonesborough, TN 37659
615/753-7756

David Sell
Black Oak Simmental Farm
161 Sand Valley Road
Jonesborough, TN 37659
615/753-7756

Martin Sieber
National Association of Animal Breeders
Post Office Box 1033
Columbia, MO 65203
314/445-4406

John Sieberns
Purdue Cooperative Extension Service
Box 139
English, IN 47118

Dr. Mike Siemens
University of Wisconsin
1675 Observatory Drive
Madison, WI 53706
608/263-4304

Ronnie Silcox
The University of Georgia
Coliseum
Athens, GA 30602
706/542-1852

Danny Simms
Kansas State University
Wober Hall
Manhattan, KS 66502
913/532-6131

Ross Siragusa
Straight Creek Farm/NALF
Route 8, Box 153
Fort Payne, AL 35967
205/845-0429

John D. Smalling
University of Tennessee
207 Brehm
Knoxville, TN 37996-4500
615/974-7196

Cindy Smith
Positive Results
Raleigh, NC

James I. & Nancy Smith
3064 Old Route 75
Stem, NC 27581
919/528-2403

Tim Smith
N. C. State University
Box 7621
Raleigh, NC 27695-7621
919-788-4503

Richard L. Spader
American Angus Association
3201 Frederick
St. Joseph, MO 64506
816/233-3101

James Spawn
Amer. Blonde d'Aquitaine Assoc.
Post Office Box 12341
Kansas City, MO 64116
816/421-1305

John Spitzer
Clemson University
Animal, Dairy & Vet. Sciences
Clemson, SC 29634
803/656-5164

Bill Spragins
Spragins Farm
51 Hwy. 213
Marshall, NC 28753
704/649-2505

Diana and David Springer
The Point Farm
Route 4, Box 579
Mocksville, NC 27028
919/998-8235

Randy Stanko
North Carolina State University
Box 7621
Raleigh, NC 27695-7621
919/515-2504

Robert Stewart
University of Georgia
Post Office Box 1209
Tifton, GA 31793
912/386-3407

Chad Stine
Mississippi State University
Pines Trailer Park, Lot #26
Starkville, MS 39759
601/324-7925

Julie Stitt
Canadian Hereford Association
5160 Skyline Way, NE
Calgary, Alberta, Canada T2E 6V1
403/275-2662

Randy Stoecker
Murphy Farms, Inc.
Post Office Box 759
Rose Hill, NC 28458
919/289-2111

Daryl Strohbehn
Iowa State University
109 Kildee Hall
Ames, IA 50011
515/294-2240

Zan Stuart
Stuart Land and Cattle Company
Box 146
Rosedale, VA 24280
703/880-1264

Harris Swain
Delaware State College
138 Beech Drive
Dover, DE 19901
302/739-5151

Steve Swigert
Noble Foundation
Post Office Box 2180
Ardmore, OK 73402
405/223-5810

William & Irene Switzer
RR1, Box 173
Cambridge, IA 50046
515/597-2440

Harvey Tedford
Canadian Limousin Association
5663 Burleigh Crescent
Calgary, Alberta, Canada
403/253-7309

Mark Thallman
Texas A&M University
Department of Animal Science
College Station, TX 77843
409/845-7694

Dr. Carl E. Thompson
Clemson University
Room 156, P & A Building
Clemson, SC 29634-0361
803/656-5165

Sam and Georgia Thurmond
Georgia Ranch
Route 1, Box 1168
Maysville, GA 30558
706/335-2668

Bruce Tier
University of New England
Animal Genetics & Breeding Unit
Armidale, N.S.W., Australia 2351
067/733335

Michael Todd
Senepol Cattle Breeders Association
354 Monticello Street
Somerset, KY 42501-2367
606/678-8227

David Trotter
Purdue Coop. Extension Service
9608 Hwy. 62, Suite #1
Charlestown, IN 47111
812/256-4591

Thomas B. Turner
The Ohio State University
2029 Fyffe Road
Columbus, OH 43210
614/292-4528

Henry M. Van der Byl
Beef Improvement Ontario
R. R. 1
Alexandria, Ontario, Canada K0G 1A0
613/525-4913

Norwood and Judy Van Dyke
Auburn University
Auburn, AL 36849
205/844-1564

David Van Heuvelen
Wolf Creek Software
8831 E. St. Charles Road
Columbia, MO 65202
314/474-9701

Bruce Van Meter
The University of Georgia
120 Viking Court, Apt. 5
Athens, GA 30605
706/546-4873

Dale Van Vleck
University of Nebraska, ARS
A218 Animal Sciences
Lincoln, NE 68583-0908
402/472-6010

Keith Vander Velde
American Breeders Service
6908 River Road
Deforest, WI 53532
608/846-3721

Jim Venner
Iowa State University
245 Kildee
Ames, IA 50011
515/294-2569

Norman Vincel
VA-NC Select Sires
Post Office Box 370
Rocky Mount, VA 24151
703/483-5123

Meredith Volk
Route 1, Box 235
Battle Creek, NE 68715

Joe Waggoner
Waggoner Farms
771 Belhaven Street
Jackson, MS 39202
601/355-9526

Wayne Wagner
West Virginia University
Post Office Box 6108
Morgantown, WV 26506
304/293-3392

Hayes Walker
The American Beef Cattleman
Box C
Ottawa, KS 66067
913/242-9419

Roy Wallace
Select Sires, Inc.
11740 Route 42
Plain City, OH 43064
614/873-4683

John C. Waller
The University of Tennessee
Animal Science Department
Knoxville, TN 37901-1071
615/974-7283

Henry R. Walls
Riegele Farms
Post Office Box 55
Hartly, DE 19953-0055
302/492-8338

Cunshan Wang
University of Wisconsin
1675 Observatory Drive, #470
Madison, WI 53706
608/263-4322

Jerry Ward
N. C. State University
Box 7621
Raleigh, NC 27695-7621
919/515-4049

Leon and Cathy Warner III
Ellerslie Farm
Route 3, Box 6000
Berryville, VA 22611
703/955-2265

Mark Warren
Beef Improvement Ontario
R. R. 1
Plainfield, Ontario, Canada K0K 2V0
613/477-2573

Steven Washburn
N. C. State University
Box 7621
Raleigh, NC 27695-7621
919/515-7726

Harrell and Cheryl Watts
Simmentals of Alabama
Post Office Box 26
Sardis, AL 36775
205/874-4813

Stanley Watts
Tennessee Cattlemen's Association
610 West College Street, #135
Murfreesboro, TN 37130
615/896-2333

Gary Weber
USDA-Extension Service
Washington, D.C. 20250-0900
202/720-2677

Dr. Henry Webster
Clemson University
Room 145, P & A Building
Clemson, SC 29634
803/656-3424

Marilou Wegner
Amer.-Int'l. Charolais Association
Post Office Box 20247
Kansas City, MO 64195
816/464-5977

Jack Whittier
University of Missouri
S-132 Animal Science Center
Columbia, MO 65211
314/882-7635

William H. Whittle, Jr.
Virginia Cooperative Extension
101 South Court Street
Luray, VA 22835-1248
703/743-5794

Darrell Wilkes
National Cattlemen's Association
Post Office Box 3469
Englewood, CO 80155
303/694-0305

Richard & Esther Willham
Iowa State University
239 Kildee Hall
Ames, IA 50011
515/294-3533

Robert Williams
Univ. of Georgia, Anim.-Sci. Dept.
302 Livestock-Poultry Building
Athens, GA 30602-2771
706/542-0989

Doyle E. Wilson
Iowa State University
109 Kildee Hall
Ames, IA 50011
515/294-2240

Frank & Jeanette Wilson
Claxton Farm
240 Upper Flat Creek
Weaverville, NC 28787
704/645-5019

Lemmy Wilson
Wilson Livestock Network
Post Office Box 627
Newport, TN 37821
615/623-7483

Paul and Rose Wischkaemper
Paris Mountain Farm
Route 2, Box 300
Rochelle, GA 31079-9730
912/624-2345

Tracey and Bill Wise
NCSU, Dept. of Animal Science
Box 7621
Raleigh, NC 27695-7621
919/515-4014

Phil Wood
Tar River Cattle Farm
305 Foster Drive
Rocky Mount, NC 27801
919/446-3489

Brent Woodward
Univ. of Minnesota, Dept. of Anim. Sci.
101 Haecker Hall
St. Paul, MN 55108
612/624-4995

Leonard and Vi Wulf
Wulf Limousin Farms
Route 3, Box 235
Morris, MN 56267
612/392-5802

Kevin and Lydia Yon
Congaree Farms
10240 Garners Ferry Road
Eastover, SC 29044
803/776-2333

Howard S. & Inez Young
Arkansas Cattlemen's Association
867 Heather Circle
Conway, AR 72032
501/329-0662

Doug Zalesky
South Dakota State University
801 San Francisco Street
Rapid City, SD 57701
605/394-2236

Keith Zoellner
Kansas State University
3104 Payne Drive
Manhattan, KS 66502
913/539-2560

Fritz Zook
Beartooth Meats
Broadus Stage
Miles City, MT 59301
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R. A. Zorn, Jr.
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Editor: Ron Bolze
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Ron Bolze, Executive Director
Beef Improvement Federation
Department of Animal Science, Kansas State University
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