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PROCEEDINGS

BEEF IMPROVEMENT FEDERATION

RESEARCH SYMPOSIUM & ANNUAL MEETING

MAY 1 - 3, 1985
THE CONCOURSE HOTEL
MADISON, WISCONSIN

BEEF IMPROVEMENT FEDERATION
ANNUAL CONVENTION

May 1 - 3, 1985
The Concourse Hotel
Madison, Wisconsin

WEDNESDAY - MAY 1

4:00 p.m. - BIF Board of Directors Meeting
-Executive Room

5:30 p.m. - Board Dinner
-Director Room 1

4:00 -
7:00 p.m. - **REGISTRATION** - Upper Level

7:00 p.m. - SYMPOSIUM - CALVING EASE
Blair Room - Dr. Larry Cundiff & Roy Wallace, Chairmen

"SELECTION FOR CALVING EASE IN DAIRY CATTLE - LESSONS TO BE LEARNED" - A. E. Freeman, Iowa State University

"SIRE EVALUATION AND ITS USE IN SELECTION FOR DIRECT AND MATERNAL COMPONENTS OF CALVING EASE" - John Pollak & Richard Quaas, Cornell Univ.

"FACTORS AFFECTING CALVING DIFFICULTY & IMPLICATIONS TO BREEDING & MANAGEMENT PROGRAMS" - Peter Burfening, Montana State University

THURSDAY - MAY 2

7:00-
9:00 a.m. - **REGISTRATION** - Upper Lobby (Open All Day)

8:15-
11:45 a.m. - SYMPOSIUM - BREEDING MANAGEMENT FOR MAXIMUM PROFIT - Ballroom A - Henry Gardiner, Chman., Ashland, Kansas

"MAXIMUM, MINIMUM AND OPTIMUM FOR THE SEEDSTOCK INDUSTRY" - H. H. Dickenson, Exec. V.P. Am. Hereford Assn.

"GENETIC IMPROVEMENT NEW ZEALAND STYLE" -James Innes, Livestock Breeder, New Zealand

10:00 a.m. - COFFEE BREAK - Compliments of AI Organizations

"THE BEEF COW - WHAT PURPOSE" -P. D. (Doc) Hatfield, Hatfield's High Desert Ranch, Brothers, Oregon

"CRITICAL POINTS IN USING CROSSBREEDING TO INCREASE PROFIT" - David Notter, Animal Scientist, VPI

"WHAT IS BEEF IMPROVEMENT?" - Jim Gosey, Animal Scientist, University of Nebraska

12:30 p.m. - **LUNCHEON** - Ballroom B & Empire Room
Gene Schroeder, President, Presiding.
Welcome to Wisconsin - Ellie Thomas-Larson, Pres. Wisconsin Beef Improvement Assn.
SEEDSTOCK AND COMMERCIAL NOMINEE INTRODUCTIONS
-Al Smith & Steve Wolfe
Charge to Committees - Henry Gardiner & Dixon Hubbard

2:00-
5:00 p.m. - **COMMITTEE MEETINGS** - Attend the meeting of your choice.

-**SIRE EVALUATION** - Larry Cundiff, Chman.
-Gorham-Hamilton Room

-**LIVE ANIMAL EVALUATION** - John Crouch, Chman.
-Fairchild Room

-**CENTRAL TEST** - Roger McCraw, Chman. - Executive Rm.

-**SYSTEMS** - Jim Gibb, Chman. - Blair Room

3:00 p.m. - COFFEE BREAK - Compliments of AI Organizations

5:00 p.m. - **CAUCUS FOR ELECTION OF DIRECTORS** - Gorham-Hamilton Room. Gene Schroeder in charge.

6:00 p.m. - **HOSPITALITY HOUR** - Ballroom

7:00 p.m. - **AWARDS BANQUET** - Ballroom
M.C.: Steve Radakovich, Earlham, Iowa
Awards: Dr. Frank Baker
Address: Baxter Black, DVM,
Compliments - Wellcome Animal Health

FRIDAY - MAY 3

6:00 a.m. - **BIF BOARD MEETING** - Executive Room

7:00 a.m. - **BREAKFAST** - Ballroom A & B
M.C.: Keith VanderVelde, Director
Address: "MERCHANDIZING BEEF IMPROVEMENT" - James Leachman, Leachman Cattle Co., Billings, Montana

9:00-
11:30 a.m. - **COMMITTEE MEETINGS**- Attend the meeting of your choice.
-REPRODUCTION - Roy Wallace, Chman. - Blair Rm.
-GROWTH - Harvey Lemmon, Chman. - Empire Rm.
-UTILIZATION - Steve Wolfe, Chman.
-Gorham-Hamilton Room
-EMBRYO TRANSFER & RELATED TECHNOLOGY -
Craig Ludwig, Chairman - Fairchild Room

10:30 a.m. - COFFEE BREAK - Compliments of AI Organizations

11:45 a.m. - **LUNCHEON** - Henry Gardiner-Vice President, In Charge
"WHAT I HEARD ON MY TRIP TO THE TOWER OF BABEL"
-Hank Fitzhugh, Winrock International
"THE YEAR AHEAD" - New BIF President

12:45 p.m. - **WISCONSIN CATTLE TOUR** - Load Buses at Concourse.
. Stop 1 - U.S. Dairy Forage Research Center at Baraboo. 300 cow dairy herd with emphasis on new technology in dairy production utilizing forages.
. Stop 2 - University of Wisconsin Cattle Physiology and Breeding Center at Arlington. Beef breeding research unit directed by Dr. Ed Hauser. Primary emphasis is on genetic x environmental interaction and cow efficiency.
. Stop 3 - International Headquarters of American Breeders Service, The worlds largest AI organization. Tour beef and dairy barns and facilities.

6:00 p.m. - **BEEF BARBEQUE** - Compliments of Animal Breeders Service

7:00 p.m. - Buses return to The Concourse in Madison

PROCEEDINGS OF BEEF IMPROVEMENT FEDERATION
1985 ANNUAL CONVENTION

Table of Contents

SELECTION FOR CALVING EASE IN DAIRY CATTLE - LESSONS TO BE LEARNED
(Secondary Traits: Sire Evaluation and the Reproductive Complex)

A. E. Freeman, Iowa State University - Ames

ABSTRACT

Genetic aspects of dystocia, reproduction and its association with production, and calf livability are reviewed. Measures of each are presented. Genetic and maternal effects, sire evaluation by births from heifers and older cows, and correlations with production and type are discussed for dystocia. Heritabilities for measures of reproduction were low. Fertility and production were antagonistic in cows but complementary between heifer breedings and production in first lactation. There were differences among sires for calf mortality up to 48 h after birth, but heritabilities were low. Livability and dystocia are closely correlated genetically. Methods for multiple traits ideally should be used for sire evaluation.

INTRODUCTION

Selection for milk production in the United States has been effective with consistent genetic gain in the last few years (47). Major research efforts have developed the methods of sire selection and evaluation currently practiced for production. In contrast, there has been comparatively little genetic research in the United States on the reproductive complex until fairly recently. Sires have been evaluated and selected for reproductive traits in addition to production and other traits of economic importance in the northern European countries and Israel. In the United States, selection has been poorly organized for daughter reproduction, although sires have been culled for low fertility.

Reproductive problems account for 16% of all disposals of Holsteins in the United States (35, 58), account for 27% in Israeli Holsteins (19), and rank second to production as a reason for disposal. Pelissier (38) discussed costs of low fertility and estimated the total costs of low fertility from milk losses, calf losses, replacement costs, veterinary services and medication, and additional breeding costs were $116.25 per cow in 1981. This accumulates to 1.266 billion dollars for the US dairy industry per year.

The reproductive complex considered here includes the events leading to conception, through to birth, and immediate postnatal survival; dystocia is a part of this complex. The extent of dystocia in Holsteins can be estimated from data collected through the National Association of Animal Breeders (NAAB) sire evaluation program. From 177,452 birth reports scores and percentage of observations in each class were: 1, no problem, 78%; 2, slight problem, 8%; 3, needed assistance, 8%; 4, considerable force, 3%; and 5, extreme difficulty, 3%. For first calvers, 15% were scored 3, 7% scored 4, and 6% scored 5. McDaniel (34) estimated the minimum costs per birth assisted in heifers was $50 to $60.

Calf mortality from the NAAB sire evaluation data (31) was 6.65% for all Holstein calves up to 48 h after birth. Mortality of male calves was 7.63% and for females 5.65% for all parities of dam. Calf mortality in births from first-parity dams was 10.5%, for second parities was 5.5%, and for third and greater parities was 5.7%.

Genetic aspects of the reproductive complex will be considered for dystocia, measures of fertility and their association with production, and calf mortality. Associations among these and other traits will be considered.

DYSTOCIA

Dystocia will be considered a direct genetic effect, as opposed to a maternal effect, unless otherwise noted.

Early studies of dystocia in the United States were with beef cattle and often involved crossbreeding (6, 9, 10, 27, 49). The first large study with dairy cattle in the United States was started in 1972 jointly with Midwest

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Breeders Coop., and later Select Sires, Inc. contributed data. This work was published by Pollak and Freeman (46). This preliminary work was expanded to data collection by member orgnizations of NAAB and accepted as a national NAAB-sponsored program in 1976. Holstein sires in artificial insemination (AI) service have been evaluated for dystocia since 1977 as described by Berger and Freeman (7). In the United States work on sire evaluation for dystocia has been by Cady (11), Teixeira (54), Mee (32), and Quass and Van Vleck (48). Philipsson (39, 40, 41, 42, 43, 44) worked extensively with calving difficulty in Sweden. A comprehensive summary of work relating to calving problems and early calf viability (23) was published that includes much European research.

Factors Affecting Calving Difficulty

Herds, years, and season of birth affect birth difficulty in dairy cattle and should be considered in sire evaluation. Subjective evaluations of birth difficulty will vary among herd owners in the scores assigned to differing degrees of birth difficulty. Absorbing herd-year-season subclasses adjusts for average differences and interactions among these effects but does not take out inconsistencies of scoring within these subclasses. Births from all ages of dam have higher scores in winter than do births in the summer (46). Heifer births also are scored higher in winter in Israel (5) and in Sweden (40). It is not known if this is a true seasonal effect but could be influenced by increased exercise in the summer or closer observation by owners in the winter.

Sex of calf has a large effect on difficulty scores, amounting to about a .32 unit difference when birth difficulty is scored 1 to 5. Male calves are born with the most difficulty.

Age of the dam giving birth has a major effect on birth difficulty. In the recent NAAB data, differences between first and third and greater parities are about .7 with scoring 1 to 5. Pollak and Freeman (46) showed a significant but small interaction of age of dam by sex of calf for calving difficulty. Males always had a higher incidence of dystocia across ages of dam but less in older cows.

Size of calf also had a major effect on dystocia (46) whether size of calf was scored subjectively into five classes or whether actual weights were taken. Sex of calf remained a significant effect with calf size in the model (46), which indicates differences due to sex other than size. Size of calf also could be used as a measure of calving difficulty for sire evaluation. Seventy-six sires with an average of 130 progeny ranked different (r = .74) when evaluated for dystocia and calf size (45) where both traits were scored subjectively 1 to 5. Perhaps direct evaluations for calving difficulty are more accurate than indirect evaluations by calf size.

Direct-Maternal Effects

Heritabilities for calving difficulty are low whether measured as a trait of the calf (direct effect) or as a trait of the dam (maternal effect). Almost all estimates of heritabilities of calving difficulty as a maternal trait are lower than estimates for the direct effect. Heritabilities also are higher for direct effects measured on heifers than an older cows. Most estimates for direct effect are less than .10 in heifers and smaller in cows. Cady's estimates (11) were higher.

Thompson et al. (56) estimated heritabilities of direct effects for dystocia .08 for heifers and .04 for cows. Earlier results (46) gave larger estimates but were from a small subset of the same data (56).

To estimate direct-maternal relations in first parities, 19,237 birth reports were available from 5409 herd-year-seasons, and for later parities 69,458 birth reports in 11,280 herd-year-seasons were available from 323 sires (56). The mixed-model, multiple-trait procedure to estimate the relationship between direct and maternal effects used the same set of sires with each bull represented as both a sire and a maternal grandsire. Heritabilities as a maternal effect were .03 for heifers and .01 for cows. Genetic correlations between direct and maternal effects were −.38 for heifers and −.25 for cows. These were slightly larger than the −.19 estimated by Philipsson (41) from heifer data.

These results (41, 44) indicate genetic antagonism between direct and maternal effects, implying a relatively small fetus − maternal incompatibility. If selection was applied and effective in improving dystocia as a direct effect, such selection conceivably could become counterproductive or at least not effective in total because of the antagonistic direct-maternal relation. Freeman et al. (15) examined the expected response from selection for both direct and maternal effects, the effect of restricting maternal change to zero, and the effect of selecting for only direct effects. The conclusions were: 1) direct effects are more important than maternal effects for dystocia in Holsteins; 2) selection for only reduced dystocia by using progeny from all parities with equal economic weights for direct and maternal effects would be expected to result in about 80% of the gain from selection from change of the direct component; and 3) current selection in the US artificial insemination industry, which applies minimal selection for dystocia, is not likely to produce significant change in birth difficulty as a maternal trait.

Calving difficulties of heifers and older cows have been considered separate traits for sire evaluation and selection in Europe and Israel. Thompson et al. (56) estimated a genetic correlation of .84 between dystocia measured separately for heifers and cows. They used a mixed-model multiple-trait procedure with birth reports from 29,099 heifers, 114,386 cows from 650 sires in 14,170 herd-year-seasons. Selection of sires based on combined first-parity and later-parity births was always more efficient than selection on births from either first or later parities. This result (56) allows for a normal ratio of first to later parities, differences in direct and maternal heritabilities, and genetic correlation of .84.

Relationship of Dystocia Transmitting Ability with Type and Production Transmitting Ability

Sires were evaluated for dystocia in the NAAB program (7). Transmitting abilities for production were Predicted Differences (PD) milk, fat, fat percentage, and dollars from the USDA sire evaluation July 1, 1978. Transmitting abilities for type were PD type (PDT) and Total Performance Index (TPI) from January 1, 1979 Holstein-Friesian sire evaluation. Best Linear Unbiased Predictors (BLUP) (20) were computed for each trait in the Mating Appraisal for Profit (MAP) data of Midwest Breeders Coop. Thompson et al. described these data and (55) correlated predictions of transmitting ability among these traits. Genetic correlations between dystocia and each measure of PD for production ranged from −.04 to .03 for 423 active AI sires or for a larger sample of 1315 sires; rank correlations ranged from −.04 to .06. There is little relation between transmitting abilities for production and dystocia.

Transmitting abilities of dystocia were negatively correlated with PDT and TPI (55). Genetic correlations ranged from −.23 to −.29 and rank correlations from −.14 to −.08. Scale had the largest negative genetic correlation −.30 and rank correlation −.20 with dystocia in the MAP data. Selection for PDT would be expected to have a slight correlated response increasing dystocia, probably by increasing scale.

Sire Evaluation for Dystocia

Best Linear Unbiased Predictions (BLUP) for all Holstein sires in AI have been obtained by NAAB for dystocia since 1977 as in (7). Evaluations were within studs through 1979 because there were not sufficient ties across studs. Examination of the data in 1979 showed that all sires within each stud were tied to each other and that all studs had ties among their sires. Ties were progeny within herd-year-seasons. Ties through the relationship matrix from sire and maternal grandsire pedigree information supplement these data ties.

Categorical data present problems in analyses, and dystocia has been scored in categories, although the underlying scale of liability to dystocia is probably continuous. Sires are evaluated by a mixed model (7) that provides BLUP of a sire's transmitting ability for ease of calving. Primary variables that affect ease of birth of a sire's progeny are adjusted in the analysis to avoid these variables causing biases of estimates of sire's transmitting ability. Variables accounted for are herd-year-season of birth, sex of calf, and age of dam. Also, there is more variation in birth difficulty of first-calf heifers than older cows, which is accounted for in the analysis. Three items of information from the analysis (7) are presented on each sire. They are: 1) effective number of progeny, which is the diagonal of the sire equations in the BLUP analysis after herd-year-seasons are absorbed and before the ratio of the error to sire variance is added to the diagonal; 2) probability that a sire's transmitting ability is above the population mean of the sires evaluated, which assumes normality of sire transmitting abilities, and; 3) expected percentage of birth difficulties of first calf heifers. The latter is computed as the expected regression of percentage 4 and 5 dystocia scores of first-calf heifers on each sire's transmitting ability. The regression coefficient is computed from previous years' data.

It conceptually could be more desirable if the expected difficult births in first calf heifers could be obtained directly from the sire evaluation procedure. The procedure of Quaas and Van Vleck (48) obtains BLUP of the category frequencies for future progeny. If economic values can be assigned to each category, their procedure predicts future value of progeny. This can be a large number of economic values (11) that are not known in practical sire evaluation. Mee (32) developed an analysis that considers ordered categorical responses as for dystocia scores. This procedure uses more information because it uses the ordered categories. It (32) is computationally more tedious than that of (7). Mee (32), however, found little difference in the rank of sires by his procedure from the other two (7, 48). Gianola (16) considered alternatives for analyzing threshold data. His paper reviewed past methods and characterized options for animal breeding applications. None of these procedures accounts for potential bias from selection. The latter may not be large for dystocia in dairy cattle because little selection is applied to AI sires for dystocia.

REPRODUCTION

Much literature exists on fertility and its relation to production in dairy cattle. Only some of the literature that seems useful to potential sire evaluation will be discussed. Many managemental and some genetic aspects of reproduction, and its relation to production, are covered in Proceedings of the National Invitational Dairy Cattle Reproduction Workshop, April 13 to 15, 1982 by the Extension Committee on Policy, SEA-USDA. Much of the genetic literature was reviewed by Hansen (17). Two major questions are at issue. One is selection for productive performance with consideration of appropriate measures of reproduction; the other is the yield-fertility relationship for currently established measures of yield.

Measures of Fertility

Maijala (30) reviewed a large number of studies up to 1957. Weighted averages were .077 for repeatability and .032 for heritability of number of services and .123 for repeatability and .033 for heritability of calving interval. Everett et al. (14) found heritability of about .05 for many measures of fertility. Miller et al. (36) reported heritabilities of .04 for calving interval and herdlife. Schaeffer and Henderson (52) estimated heritabilities for days open in first, second, and third lactations of .02, .04, .00, respectively. Kragelund et al. (25) found a heritability of .06 for days open in Israeli Friesians. Although heritability was small, he (25) suggested that it still might be possible at least to prevent deterioration of fertility. Bar-Anan et al. (2) estimated heritability of nonreturn rate .01 and conception rate .035.

Recent work in this area (8, 17) used data from different regions of the United States to look at fertility, yield, and their relationship in Holsteins. Berger et al. (8), using a large data set from California, found heritabilities of .04 for days to first breeding, .04 for days to last breeding, .02 for days open, and .01 for number of services per conception in first lactations. Hansen (17) estimated heritabilities of many measures of fertility in a large sample of New York data. His estimates were all ≤ .04. He considered days open restricted to 150 days and without restriction. Heritabilities were higher when the variable was restricted, which presumably eliminates the effect of preferential treatment given to particular cows allowing them more opportunity to conceive. Restricting number of breedings to three and service period to 91 days produced similar results. Repeatabilities were all < .158 and generally < .10. Days open and service period had the largest repeatabilities, and days open and days to first breeding had the highest heritabilities, approximately .03. Measures associated with fertility that had the highest heritabilities were age at first breeding, .06, and age at successful breeding, .16, for breedings of virgin heifers. These may be measures more of maturity than true reproductive measures.

Heritabilities of reproductive traits are low, generally ≤ .05 as estimated from paternal half sisters. This implies that gains from mass selection would be minimal; however, selection of sires for daughter fertility could be effective. Reasonably large daughter groups would be needed, but use of a relationship matrix adds accuracy to selection when sires have small daughter groups and when a large data base is available. Selecting sires of sons in addition to selecting individual sires could make gains in fertility, although a reduction in yield could be expected, as will be discussed later.

Relationship of Yield and Fertility

Genetic evidence on the yield and fertility relation comes from two sources, data from producers and designed experiments.

Laben et al. (26) found that California herds (130,022 records from Holsteins in 201 herds) with higher Dairy Herd Improvement yields had distinctly shorter intervals to first postpartum breeding and fewer days open. Evidence was of an overall small but significant, antagonistic association between yield and fertility after adjustment for herd-year-seasons and parities. The increase of days to first breeding, days to last breeding, days open, and number of breedings associated with a 100-kg increase in 180-day fat-corrected milk (FCM) averaged .27, .80, .61, and .014, respectively. This work (26) indicates that high yield and associated stress have a small but real depressing effect on fertility; however, records of high producing herds show this antagonism can be overcome by good management.

Berger et al. (8) used the same data (26) to investigate genetic aspects of yield and fertility. As Laben et al. (26) did, FCM was used to indicate stress of production better than either milk or milk fat alone. With 72,187 records in 201 herds, genetic correlations between measures of reproductive performance and 60-, 180-, and 305-day FCM were positive, indicating that genetically higher-producing cows bred later, took longer to conceive, and required more services per conception. Genetic correlations in first lactation were highest between measures of reproductive performance and 305-day FCM (.48 to .62) and decreased for 180- and 60-day (.36 to .47) yields, the latter being unaffected by pregnancy.

Because of the potential significance of the yield-fertility relationship, Hansen (17) used independent data (provided by R. Everett, Cornell University, and J. Keown, Eastern Artificial Insemination Coop., Inc.) from New York to determine if results of (8) could be corroborated. Genetic correlations were positive, or antagonistic, between measures of yield and fertility in cows. The antagonism was greater in first, less in second parity, and less yet in third parity. Correlations in third parity of most measures of fertility and yield were smaller or not significantly different from zero by approximate standard errors. Others using large data (14, 25, 36) found genetic antagonism between yield and fertility, but this was not so in all studies.

Data were available for fertility of virgin heifers (17). Genetic correlations among measures of fertility from virgin heifers and measures of their production in first lactation were negative, indicating a complementary relationship. Although these correlations were consistent in sign, most were not larger than their approximate standard errors. These results agree with those in the summary of Maijala (30) and with Metz and Politiek (33) but not with those of Janson (24).

Experimental evidence on genetic association of yield and fertility is available from four designed experiments in the North Central Regional Dairy Cattle Breeding Project, NC-2. Herds at Iowa State University (53), University of Minnesota (18), and the University of Wisconsin (29) were selected for milk production using sires rated high for PDM. Comparison groups at different amounts of production were contemporary. One USDA herd at Beltsville, MD had one comparison group selected for milk and one selected on additional traits intended to reflect net merit (50). Correlated responses of fertility were not significantly different between groups within any of the four herds. Designed experiments can be more carefully controlled to study the stated objectives but cannot generate the volume of data available from producers' herds. It is possible that better reproductive management, including veterinary care, was maintained in these herds than in producer herds, so reproductive differences as correlated responses may not have been observed for this reason. Also, not over about 16% of the genetic variance of fertility is associated with yield, so lack of detection of significant differences between groups in fertility is not surprising.

Hansen (17) used index theory to quantitate expected response to selection for yield only, fertility only, restricting change in fertility to zero and with a range of economic weights on yield and fertility. If selection produced a 60-kg response in yield (305-day FCM) per year, the expected results of alternative selection can be summarized as: 1) Selection for only yield would be expected to reduce heifer service period 1 day and increase days open in first parity 1.5 days; 2) selection for only days open in first parity gave an expected response per year of −11 kg yield, .3 days in heifer service period, and −.6 days open in first parity; 3) restricting change in days open to zero in first parity resulted in an expected reduction of 22 kg for yield and a loss of .6 days for heifers' service period compared to selection for only yield; 4) relatively large economic weights on fertility were needed to get much response of first parity fertility; and 5) gains of cow fertility tended to be offset by losses of heifer fertility. Estimates for heifer service period (first breeding to conception) were when service period was restricted to 91 days and days open limited to 150.

Production is affected by pregnancy status. Days open is used commonly as a measure of pregnancy status. Many authors have studied effects of days open on milk and milk fat production. Oltenacu et al. (37) investigated the influence of days open in cows divided into high and low production classes based on early lactation production. The association between days open and cumulative yield was less for cows within a production class than across cows, with early lactation ignored. They (37) concluded that correction of 305-day yield should be to a standard number of days open and should be additive. Bar-Anan and Soller (4) recommended that early production be considered in adjusting for days open.

Thompson et al. (57) developed factors to adjust milk and milk fat records for days open and gave literature citations on the subject. They (57) showed that mature equivalent yields for the first three parities were lower for fewer days open and higher in later lactation than yields adjusted for days open. Effects of days open on production were reduced by including summit production (average of two highest of first three test days) in models; however, adjustments of records by factors from models including summit production were not satisfactory for records ⩾ 180 days open. Yields adjusted for days open were most predictive among three measures (305-day mature equivalent (ME) adjusted for days open, annualized yield, and 305-day ME-FCM records) of total cumulative yields at 26, 39, and 52 mo. Rank correlations among sire transmitting abilities were > .86. Records should be adjusted for days open for sire and cow evaluation. Even though the gains may not be large, small increases of accuracy can be justified for genetic evaluations.

Male fertility is also a part of the reproductive complex. This is a problem that includes differences of abilities of bulls to produce offspring and relationships of sires' fertility to their sons and daughters.

Saacke (51) gave a general description of measures of semen viability, conditions that affect semen viability, and types of abnormal sperm with discussion of how these relate to fertility. Laboratory (51) evaluation of semen is useful for predicting sire fertility. The goal is to predict fertility before semen is shipped from the laboratory, but the goal has not been reached. He (51) suggests that if emphasis is to be placed on reproductive efficiency, progress will be most efficient by culling bulls, not ejaculates within bulls.

Coulter and Foote (13) reviewed information on testicular measurements as indicators of reproductive performance and their relationship to productive traits. Heritabilities were .67 for scrotal circumference and .34 for testicular consistency. Correlations with several measures of seminal characteristics, other than those related to volume and sperm numbers, were high. Further, the correlation between tonometer readings and fertility, as measured by 60- to 90-day nonreturns to service, were .67.

Although substantial information is available on semen characteristics and their relationship to sire fertility, there seems little work on the relationship of sire's fertility to fertility of his sons or daughters. This type of information is needed to understand adequately the reproductive complex.

LIVABILITY

Little attention has been given to genetic differences of calf livability in the United States. This discussion will relate to perinatal mortality of Holsteins.

Most of the effects associated with variation of dystocia also affect calf livability. Livability, as discussed here, concerns those factors closely associated with birth. Prominent among these are herd-year-season, six of calf, age of dam, size of calf, gestation length, and multiple births (1, 5, 12, 28, 39, 40, 41, 54).

Heritability of stillbirth rate generally has been ⩽ .05 as a trait of the sire. Heritabilities of stillbirth as a maternal trait have been mostly lower than as trait of the sire (direct effect). Lindstrom and Vilva (28), studying Ayrshire data, reported a tendency for heritability of stillbirths to be higher for cows as dams (.082 and .049) than for heifers as dams (.027 and .029), bulls regarded as sires, and maternal grandsires, respectively.

Martinez (31) used data from the NAAB dystocia project. A total of 136,775 records were available with complete information on herd code, date of birth, gestation length, calf livability score, dystocia score, sex of calf, calf size, age of dam, and sire of calf. Calf livability was scored as dead at birth and died by 48 h. Using calves dead at birth and all deaths by 48 h and normalizing these same classifications of mortality, he (31) found heritabilities generally ⩽ .015. When these heritabilities were adjusted for discontinuity, they were ⩽ .061. Even though heritabilities were low, sires with over 400 offspring varied from 3.1 to 12.1% mortality of their offspring; one sire with 98 offspring had 1% mortality, and another sire with 81 progeny had 16% mortality of his progeny.

Martinez (31) found a quadratic relationship between livability and gestation length. This relationship differed for heifers and cows. For heifers, the optimum survival was for gestation lengths 3 to 4 days below the mean gestation length of 278.8 days for heifers; mortality increased rapidly for gestation lengths greater than the mean for heifers. For cows, the optimum survival was for gestation lengths 1 to 4 days above the mean of 279.7 days for cows; mortality was much greater for births less than the mean gestation lengths for cows.

With use of multiple-trait, mixed-model methods, genetic correlation between livability of progeny of heifers and of cows was estimated as .32 (31), not a strong genetic relation between expressions of the same trait in cows and heifers. Relations between direct and maternal effects on calf livability were analyzed separately for first and later parities. Genetic correlations were −.52 for both heifers and cows, showing a distinct antagonism. The genetic correlation between calf livability and calving difficulty, with use of all parities, was .66. Heritabilities from multiple-trait methods were .01 for calf livability and .041 for calving difficulty. Martinez (31) considered the expected correlated response of calf livability to direct selection for dystocia. With equal selection intensities for the two traits, genetic correlation = .66, dam heritability for dystocia = .04, and heritability of livability = .01, the expected correlated response was 41% greater than direct selection for livability in Holsteins. Such results, however, need to be viewed with caution, because small changes in parameter estimates cause substantial differences of expected correlated responses, and accurate prediction of correlation responses has been difficult in laboratory experiments.

DISCUSSION

Dystocia, the yield-fertility relationship, livability, and some related aspects have been considered. Perhaps measures of more specific physiological functions could be useful for reducing fertility problems by selection. Examples could be accurate recording of cystic ovaries and monitoring of progesterone in milk as possible measures of reproductive performance to be used alone or with other measures of fertility.

The cause of the antagonistic genetic correlation between yield and fertility can be discussed in several contexts. Normally, genetic correlations are considered to be caused by pleiotropy or linkage. The linkage groups would be expected to be broken up by crossing over after time unless strong selection kept them intact. Pleiotropy does cause genetic correlations. Bar-Anan (3) has proposed an intuitive argument, which he termed "endo-environmental effect", that he considers to be a cause of genetic correlations, but not necessarily the sole cause. For the antagonistic yield-fertility relationship, he suggests that the estimated negative association is a direct function of the endo-environmental effect. He suggests that adjusting feeding to the requirements of higher producers may provide equal opportunity for reproduction and avoid the antagonistic relationship.

The work of Hansen (17) suggests a favorable relation between genetic potential and fertility of heifers that becomes antagonistic when these heifers calve and are subjected to the stress of production. This could strengthen the hypothesis of Bar-Anan, but Laben (26) showed that the underlying antagonism exists at herd yields of more than 9,000 kg milk. Such relationships as found by Hansen (17) also could be explained by true pleiotropy but with different genes producing the pleiotropy at different times in the animal's life. This reversal of the genetic correlation could be termed interaction of genotype × environment. Little seems to be gained until such hypotheses can be tested. Perhaps additional knowledge will allow development of managemental techniques to overcome this problem.

A practical consideration for potential genetic improvement of fertility is accurate and uniform recording of fertility data. Whether for sire fertility or daughter fertility, more accurate and uniform data are needed on a national basis. Organizations for AI vary in the information available and collected. Some measures such as calving interval (except for the last), perhaps days open, and number of services are available through DHI programs. These may vary among processing centers as to the specific data used and kept; however, DHI programs certainly have the potential for recording such data.

The objective of a generally healthy cow, which maximizes production and minimizes costs, seems intuitively appealing. Although information is not available to select for minimizing health costs, there is a reasonable body of information related to fertility. At least three broad questions should be considered before selection. First, is the biology of the complex of traits reasonably well understood? This also includes ability to measure the traits, their genetic and environmental variances and covariances, potential interactions, and any attributes that allow managemental adjustments that might make selection unnecessary. Second, what are the economic values of the traits considered jointly? Are the economic values of near universal application, or do they differ markedly among producers? For example, getting cows to conceive is more of a problem experienced in common by dairy producers than is dystocia. Some breeds and herds within breeds experience little dystocia. If economic values differ substantially, this implies different selection goals. The latter is easier to accommodate on a herd than on a national basis, but different selection goals can be incorporated in sire selection. The more difficult problem is likely to be clearly defining goals. Indeed, determining selection goals is one of the most difficult, if not the most difficult, task of animal breeders. This is accentuated because of the lag between when selection is applied and when animals with the desired characteristics are produced for breeding. Third, is the analysis used to identify superior parents for breeding?

Sires could be evaluated for traits measuring reproductive fitness. It is doubtful that any single trait can measure all aspects of fertility. Stayability or some measure of how long cows remain in herds is an overall index of cow usefulness, but this has many components such as production, fertility, dystocia, diseases, etc., including the dairy producers personal preferences. In the absence of a single measure of fertility, economic values of components of the reproductive complex are needed.

Given that the biology of the traits is reasonably well understood and economic weights of the traits are known, a multiple-trait mixed-model analysis seems appropriate. A multiple-trait, mixed-model analysis for individual animals was described by Henderson and Quaas (22). Henderson (21) described a general analysis for sire evaluation using multiple traits including a relationship matrix. Both genetic and environmental correlations should be included, and were in his general description, but environmental correlations between traits were not used in his example. Multiple-trait analysis could be computationally expensive but could add precision to selection.

Martinez (31) solved for BLUP of sires separately with a mixed-model for livability, separately for dystocia, and then used a mixed-model multiple-trait procedure for the two traits. Rank and product-moment correlations were higher between solutions for sire transmitting abilities when the multiple-trait analysis was used. Multiple trait techniques incorporate both direct and indirect prediction using correlations between traits. This illustrates differences in sire evaluation techniques. If selection is for many traits, including production, type, reproduction, etc., all traits under selection ideally should be included in a multiple-trait, mixed-model analysis such as described by Henderson (21). Our current state of knowledge has not progressed far enough to allow this.

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Sire Evaluation and its Use in Selection for Direct and Maternal Components of Calving Ease

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Ease of calving is obviously an important trait for the beef cattle producer. Though it is lowly heritable, there are differences among sires in the incidence of difficult births of their progeny. Likewise, there are differences among bulls in the ease with which their daughters calve. Thus there is the potential to reduce calving problems genetically by identifying sires whose progeny are born more easily and/or whose daughters calve more easily, ie., a sire evaluation for direct and maternal components of calving ease. We have recently commenced a study of data on calving ease (CE) collected by the American Simmental Association (ASA) with this objective in mind. It is our purpose here to share what we have found.

It is not our charge to detail all the factors which influence CE scores but we would like to present some simple statistics from these data to show some of the challenges that must be faced. In Table 1, we have presented information from two sources: U. S. Meat Animal Research Center (MARC) and the ASA data. The MARC data comes from Cycle I, Phase I of the Germ Plasm Evaluation Program. The data are the average percentages of "No Calving Difficulty" of Angus and Hereford 2-yr olds. The average was 55.6% for calves sired by Angus or Hereford bulls. It was 49% when averaged over all breeds used in Cycle I. These data are presented for two purposes. The first is to point out that CE is a problem in first calf heifers (even 17% of the Jersey sired calves required assistance). The second point is to use these numbers as baseline for comparison for the uncontrolled field data we used. The ASA data are presented in Table 1B broken down by age of dam, % Simmental of dam and sex of calf. The average for all 2 yr-old dams was 64% unassisted births. This is higher than the MARC figures but probably no further than might be expected given that an unobserved birth is likely to be coded unassisted. At MARC we would expect few cows to be unobserved and some that were given assistance might have eventually calved. The main point is that the numbers are comparable. Furthermore, the relationships among frequencies follow similar patterns to the more detailed analyses of the MARC workers. For example, the difference between bull and heifer calves out of two year-old dams was 21% in the ASA data (23% in MARC data) but declines to 4% in 4 year old and older dams (7% in MARC mature dams). Our conclusion is that results from similar data in most beef breeds would look much the same; without such data, however, we will never know.

The broad pattern is clear. Any sire evaluation has to take into account age of dam and sex of calf. What's worth noting is that the differences in % unassisted births between bull and heifer calves depends upon the age of the dam and vice versa. In statistical jargon, there is an interaction. While obvious for major effects like age of dam and sex of calf, this interaction is not so obvious for smaller effects such as sires but by the nature of the data must exist. A "perfect" bull would be one whose calves are all born unassisted. Such a bull would be only about 5% better than the "average" bull if we look at mature dams but almost 40% better when bred to heifers. The conclusion is that sire differences aren't of the same magnitude. Another inference we might make is that data from cows (as opposed to heifers) are much more likely to indicate which bulls significantly increase calving difficulty but not bulls that decrease calving difficulty (at least not without very large numbers of progeny). In short, a heifer record provides much more information than does a cow record. A legitimate question is whether the cow records are even worth analyzing. The answer is probably yes for two reasons. The first is that there are many more records on cows than heifers. The second is that the potential exists for non-random mating, eg., young bulls might be "tried out" on cows. For the second reason, in particular, we should try to use all available information.

Table 1A. % of births with No Difficulty in 2 year-old Angus and Hereford cows[a].

Breeds of Sire	**% No Difficulty**
Angus, Hereford	55.6
Angus, Hereford, Jersey South Devon, Limousin Simmental, Charolais	49.0

a Germ Plasm Evaluation Program Progress Report No. 1. 1974. ARS - NC -13.

Table 1B. % Unassisted births and birth weights (in parentheses) in ASA data by age of dam, % Simmental of dam and sex of calf[b].

Age of Dam	**% Simmental of Dam**	**Sex of Calf**	
		Bulls	**Heifers**
2	0	**45** (83)	**71** (75)
	50	**55** (85)	**73** (78)
	≥ 75	**60** (86)	**78** (80)
3	0	**80** (86)	**90** (79)
	50	**88** (88)	**94** (82)
	≥ 75	**89** (90)	**95** (84)
≥4	0	**93** (88)	**96** (80)
	50	**95** (91)	**98** (84)
	≥ 75	**94** (93)	**98** (86)

b 493,335 calvings in the years 1969 through early 1984.

It seems there are two questions that can be asked about CE evaluations. The first question: will I have to pull a higher or lower fraction of this bull's calves? This is the direct effect. The effect of genes transmitted from sire to progeny that partly determine characteristics of the calf which in turn affect the ease of the calf's birth. The second question: will the daughters of this bull need relatively more or less assistance when they calve? This effect we will call the maternal grandsire (MGS) of the calf effect (usually "the MGS effect"). This MGS effect has two components: (i) the effect of the MGS as an ancestor of the calf (direct component), and (ii) the effect of the MGS as the sire of his daughters (maternal component). The direct component arises from the fourth, on average, of the genes the calf inherits from its MGS. Some of these genes influence those characteristics of the calf related to its ease of birth. The maternal influence the MGS has comes from the genes (half) a daughter inherits from her sire (the calf's MGS). Some of these genes influence characteristics of the daughter related to how easily she can deliver a calf. It is the combination of these two components, represented by the MGS effect, that determines the answer to the second question.

For purposes of explanation, however, it is useful to separate the MGS effect into its component parts. This can be done as:

Bull's Maternal Eval. = Bull's MGS Eval. - 1/2 Bull's Direct Eval.

The 1/2 comes from the fact that we expect a bull to transmit half as many genes to his daughter's progeny as to his own progeny. How does this help explain things? Probably a major component of CE relates to size. The direct effect refers to size of calf at birth; the maternal effect to size of daughters at calving. The MGS effect has to do in some way with the difference between the two. This simple scenario points out the complexity of the MGS effect. Size of dam and size of calf are positively related; bigger cows tend to have bigger calves. Size of calf and cow affect CE in opposite directions suggesting that direct and maternal genetic effects are likely to be negatively correlated. This points out the difficulty of using weight or growth trait evaluations as indicators of CE, particularly for the MGS effect. We also have to be cognizant of the correlated responses of our selection. Eg., are short term gains arising from selection for direct effects likely to be offset by unfavorable changes in other traits such as maternal effects for CE or growth potential?

In Table 2, we have presented the difference in average birth weights of calves born unassisted and those requiring assistance for the same categories as in Table 1. Not surprisingly, difficult births are associated with heavier birth weights. The differences are greater in bull calves than heifer calves and tend to increase with age of dam. The latter presumably reflects the increase in dam size; the former perhaps results from greater variation of birth weights in bull calves relative to heifer calves. These results suggest that birth weights of a sire's progeny are possible indicators of the calving ease. We might also expect yearling weights of progeny to provide an indicator of the maternal component of CE. To examine these possibilities, we compared first calf calving ease sire evaluations (direct and maternal) to evaluations for birth weight and yearling weight. The evaluations used are preliminary results from the study of the ASA data done at Cornell. We selected 1800 bulls with at least 20 progeny. These bulls were ordered on their birth weight (or yearling weight) evaluations and divided into 10 groups. The first group consists of the 180 bulls expected to sire the lightest birth weight progeny; the tenth group, the heaviest birth weights. Within each group, averages were calculated of the CE and weight evaluations. The CE averages were then plotted against the weight averages to show the relationships, Figures 1-4. The patterns are quite clear. Sires with lighter birth weight progeny tend to be evaluated as easier calvers (Figure 1). Similarly, the maternal component of CE is related to increased yearling weights (Figure 2). However the differences in Maternal CE between the top and bottom yearling weight bulls is not as great as the differences in Direct CE associated with the extremes in birth

Table 2. Difference in birth weights between calves requiring assistance and those born unassisted.

Age of Dam	% Simmental of Dam	Sex of Calf: Bulls	Sex of Calf: Heifers
2	0	10	6
	50	6	6
	≥ 75	7	6
3	0	10	6
	50	11	8
	≥ 75	10	8
≥4	0	10	7
	50	13	10
	≥ 75	12	9

Table 3. Estimates of heritabilities (underlined) and genetic correlations for components of calving ease in two year-old dams and older dams.

	1 - D	2 - D	1 - M	2 - M
1 - D	<u>.066</u>			
2 - D	.72	<u>.014</u>		
1 - M	-.62	-.43	<u>.099</u>	
2 - M	-.50	-.45	.75	<u>.025</u>

1 = 2 year-old dam D = direct component
2 = older dam M = maternal component

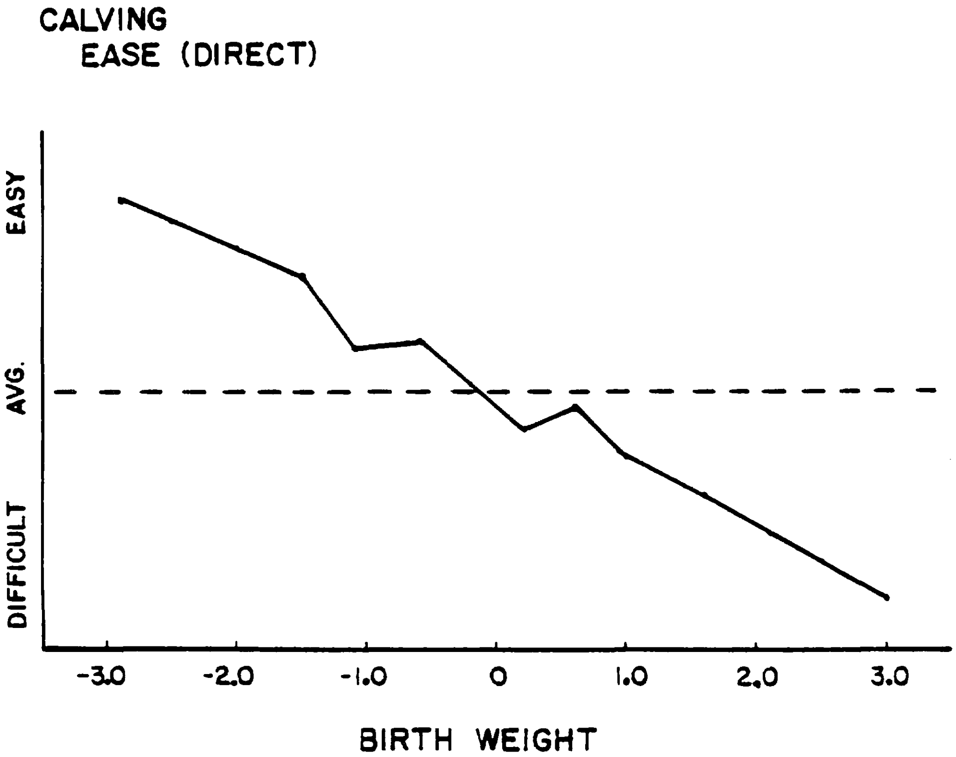

Figure 1. Direct calving ease evaluation vs. birth weight evaluation (bulls grouped by deciles).

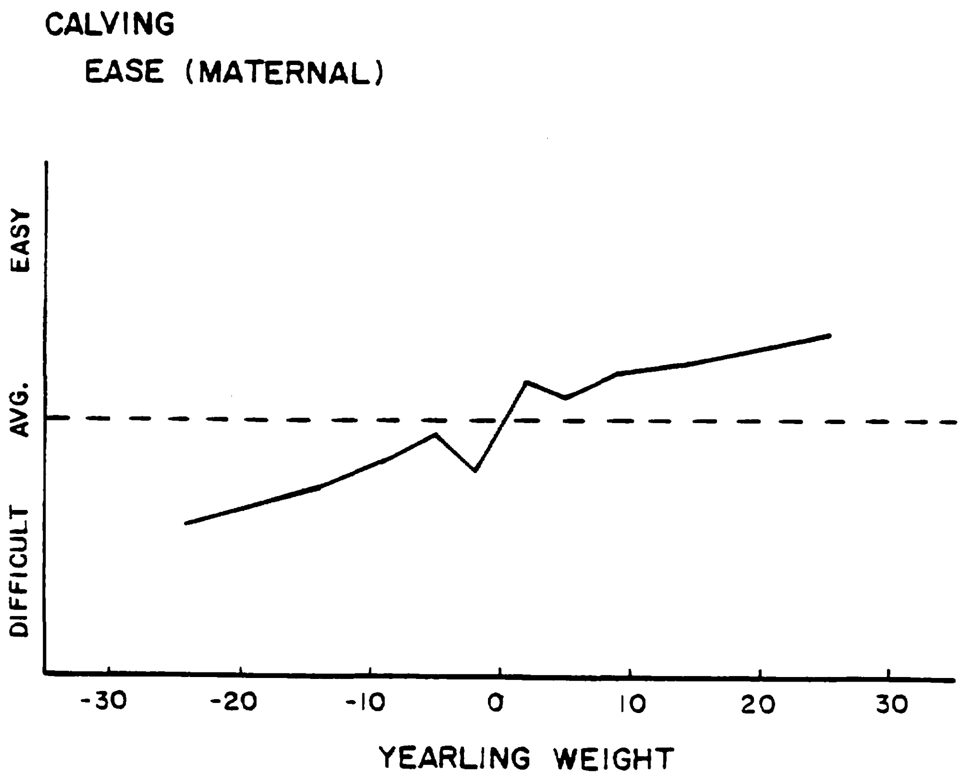

Figure 2. Maternal calving ease evaluation vs. yearling weight evaluation (bulls grouped by deciles).

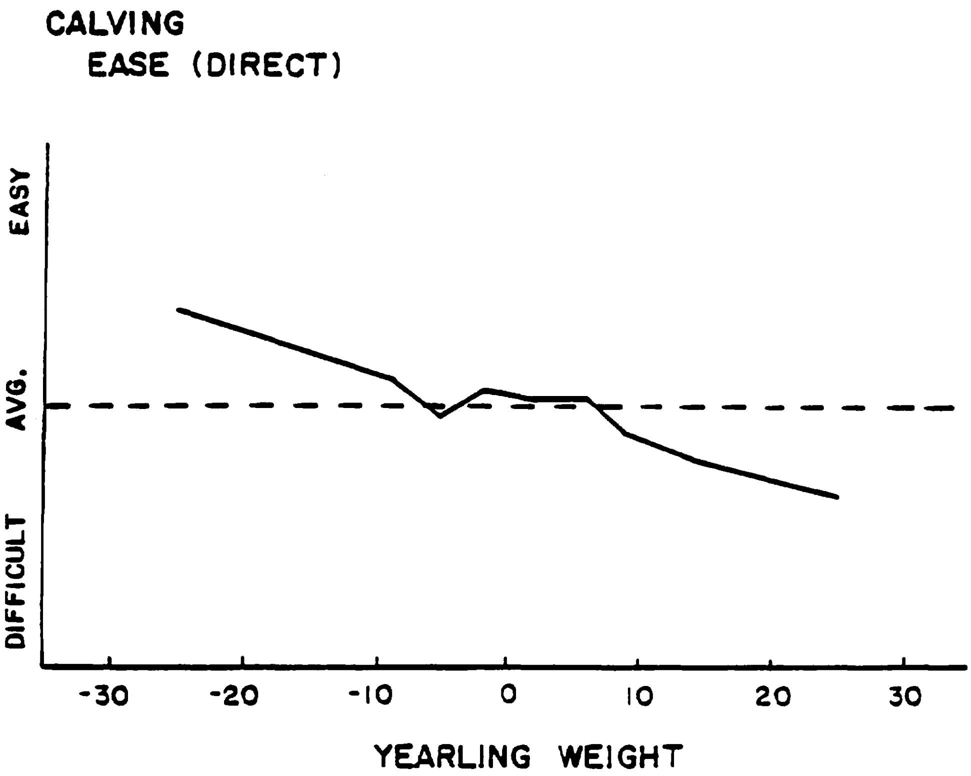

Figure 3. Direct calving ease evaluation vs. yearling weight evaluation (bulls grouped by deciles).

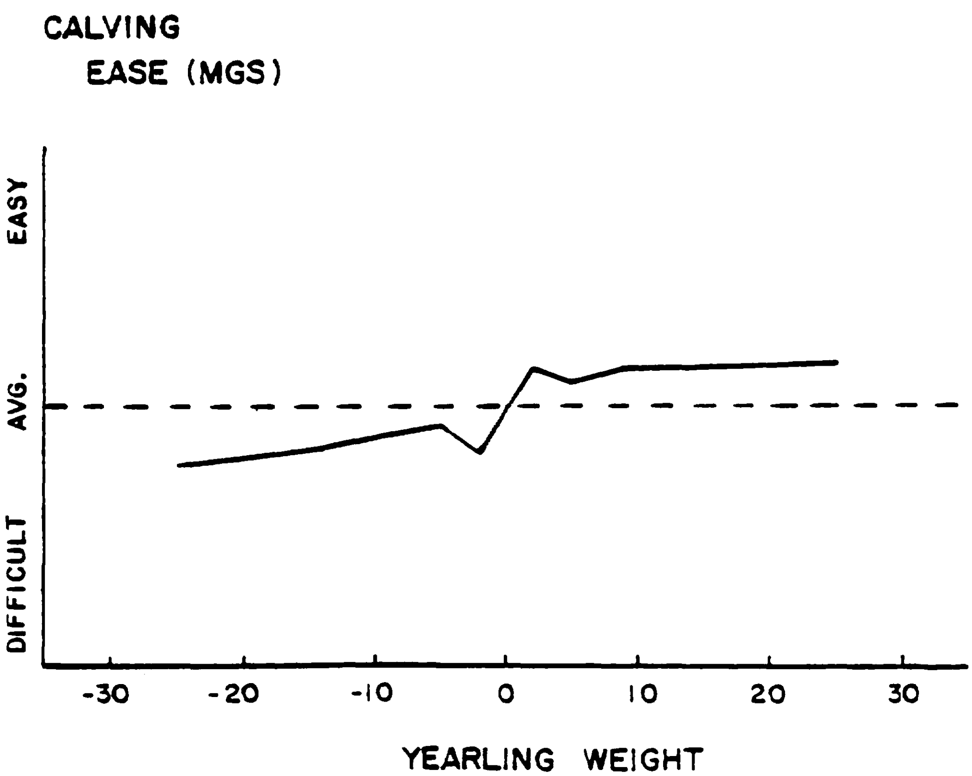

Figure 4. MGS calving ease evaluation vs. yearling weight evaluation (bulls grouped by deciles).

weights. Furthermore, as shown in Figure 3, yearling weights are negatively related to Direct CE, probably due to the large genetic correlation between yearling and birth weights. When direct and maternal effects are combined for the MGS CE, these tend to cancel as shown in Figure 4. This points out the problem of using weight trait evaluations to predict daughter's ability to calve easily.

Although Figure 1 points out the possible usefulness of birth weights as a predictor of CE Direct, birth weights alone probably do not account for all the sire differences in Direct CE. Ie., among bulls with comparable progeny birth weight statistics, what is the variation in Direct CE? To examine this, we looked at the distribution of Direct CE evaluations among the lowest 20% bulls on birth weight evaluations, the middle 20% and the highest 20%. The results are shown in Figure 5. "Heavy birth weight" bulls are preponderantly above average in calving difficulty; "light birth weight" bulls are mostly average or better on calving ease. Using "light birth weight" bulls will tend to eliminate the really difficult calving bulls; it certainly won't eliminate calving difficulty.

The obvious feature of these histograms (Figure 5) is the amount of spread and overlap within and among the groups of bulls. There were easier calving bulls found in each of the birth weight groups. In fact, about as many of the bulls in the easiest category came from each birth weight groups. Birth weight alone did not seem to identify the extremely easy calving bulls. In contrast, it did better at finding the extremely difficult calving bulls. This raises the question of what is the purpose of a calving ease sire evaluation. Is it to identify bulls to avoid using on heifers? If so, then birth weights are a pretty good indicator, but at the price of growth potential and possibly lowered maternal CE performance. Or is it to be used to change the population, a much more difficult task because of the interrelationships between the components of calving ease. It seems to us that to make much of an impact on CE will require that calving ease data be collected and sire evaluations used to identify exceptions to the general patterns. We will illustrate what we mean with what we found in the process of developing a sire evaluation for direct and maternal CE.

In keeping with the long-standing practice of the ASA, we considered CE scores taken on first calf heifers to be a trait different from scores taken on older cows. We did, however, treat them as correlated traits in a multiple trait evaluation. The rationale for doing this was that first calf CE is the trait of concern and that data from older cows are of importance only to predict first calf CE. A multiple trait evaluation uses all the data but first calf records receive much more weight than do scores on calves out of older dams. In essence, the data from older cows come into play only for sires with few first calf records. The traits were analyzed with a model that included both the sire and MGS of the calf so that both Direct and MGS evaluations were obtained simultaneously. This is important because it removes at least some of the effects of non-random mating. Our analyses show that sire and MGS are equally important in causing differences in calving difficulty; non-random mating could be important.

Our estimates of heritabilities and genetic correlations are presented in Table 3. The heritabilities are low for first calf scores and extremely low for later calves. For both, the maternal component is larger than the direct component. The magnitudes, however, are disappointing. They are expected to be low; lower than estimates from experiment stations. With field data, there are thousands of people collecting the records not all of whom are as precise as we might wish. An additional factor, however, is the nature of the data. We performed a standard "linear" analysis of CE scores comparable to what is done with traits like weaning weight. CE scores are not like weaning weights. These could take on only four values: 1, 2, 3, or four and most of them were "ones". Thus part of the reason for our low estimates is that we are not adequately describing mathematically the nature of the data. Theoretically, it is possible to use more realistic models (Gianola and Foulley 1983) and with such procedures there is reason to expect to uncover more genetic variation. Work proceeds at making these procedures practical

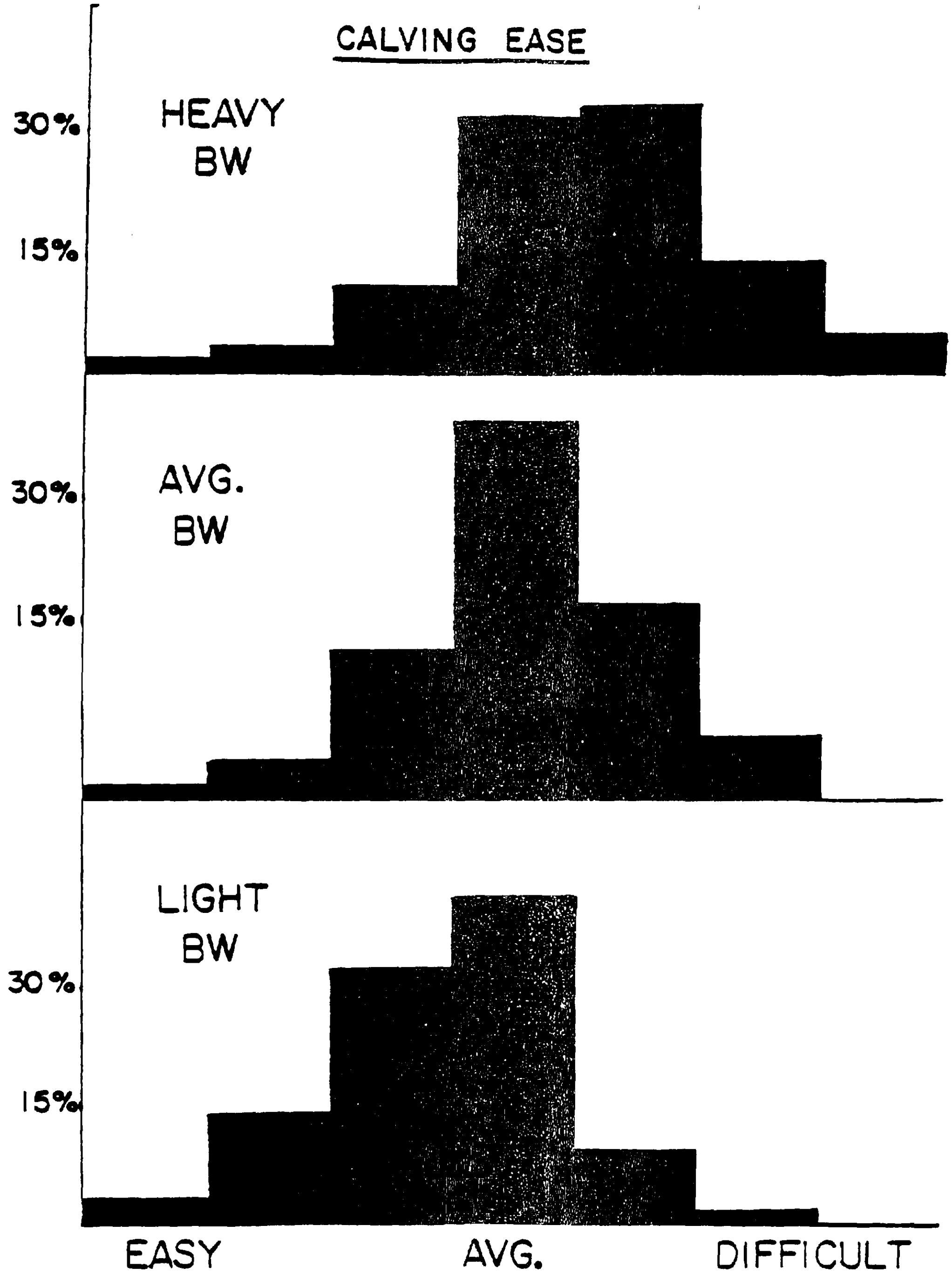

Figure 5. Distribution of direct calving ease evaluations for bulls categorized as siring calves with light, average of heavy birth weights.

and we are optimistic that they will be of considerable value for traits like CE.

The correlations tell two stories. The first is that the direct and maternal components evaluated in first calf heifers are highly correlated to the analogous components measured in cows. This is important; CE scores from cow calvings are useful to predict CE in first calf heifers. The second is that direct and maternal components are negatively related which is a reflection of the positive genetic correlation between birth weight and mature weight. The size of cow-size of calf phenomenon. Though large, the correlation is far from perfect. A correlation measures general tendencies and exceptions exist. This one is big enough to make looking for the exceptions challenging.

Table 3 pertains to separated direct and maternal components. As pointed out earlier, the performance of a bull's daughters depends on both direct and maternal components, ie., the MGS effect. To answer the question of how do the daughters of a bull that is superior for Direct CE perform, we need the correlation between Direct CE and the MGS effect. Our estimate was -.27. The daughters of such a bull would be expected to experience a bit more difficulty than average. The implication from a size point of view is that the expected reduced size of his grandprogeny is more than offset by the reduced size of his daughters.

Now, just for curiosity, let us look at how Simmental breeders were discriminating among bulls. To do this, we calculated trends in sire and MGS usage. The average Direct CE evaluation of the sires of the calves born in each year was calculated. These were weighted averages; if a sire had 100 progeny in a given year, his evaluation was included 100 times. Thus these averages reflect tendencies of breeders to use particular kinds of bulls more heavily. A similar calculation was done for the maternal grandsires of calves born in each year. The MGS effect was broken into its direct and maternal components. The trends are shown in Figure 6. The sire trend shows some evidence that Simmental breeders were using bulls whose progeny were born with less difficulty. Interestingly enough a similar plot of birth weight evaluations shows almost the same pattern, bump for bump, with a net decrease in birth weight from 1973 to 1983 of just over 1 lb. The direct component from the maternal grandsires follows a pattern similar to that for sires but is half as large and has a two year lag period. This is just a reflection that the sires of calves in one year are the grandsires of calves born two years later out of first calf heifers. The largest change was in the maternal component. Size of the cow? The average yearling weight evaluation of a MGS in 1983 was 16 pounds higher than the average yearling weight evaluation of the MGS of the 1973 calves. It all seems to fit together. A slight increase in Direct CE with a larger increase in Maternal CE. A slight decrease in birth weights and a larger increase in yearling weight. The former in spite of a negative correlation between direct and maternal components of calving ease. The latter in spite of positive correlation between birth weights and yearling weights. It appears to us that Simmental breeders have been collectively searching for bulls that don't fit the general pattern. Our personal biases are that this could not be accomplished without a published sire evaluation.

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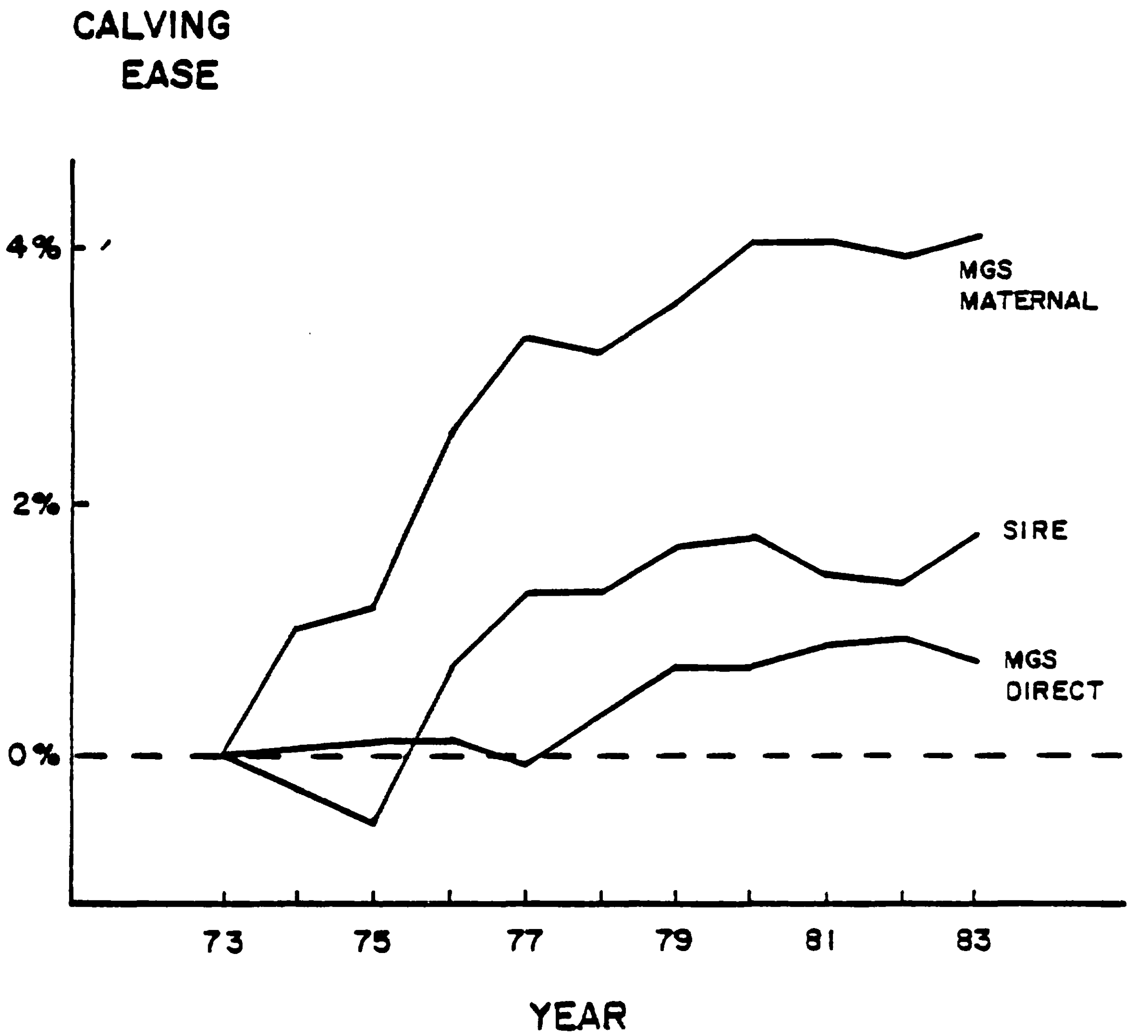

Figure 6. Trends in sire and MGS usage for the components of calving ease.

FACTORS AFFECTING CALVING DIFFICULTY AND IMPLICATIONS TO BREEDING AND MANAGEMENT PROGRAMS

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Over the past 10 to 15 years much research has been done on factors affecting calving difficulty. This paper will review some of those factors but is not a comprehensive review of the subject. A comprehensive review of calving difficulty has been published by Meijering (1984). Research has determined that calving difficulty is a extremely complex traits and affected by many genetic and environmental factors. Figure 1 illustrates the complexity of this trait and serves to point out many of the interacting factors that affect dystocia.

Dystocia or calving difficulty have been shown to result significant increases in perinatal mortality of calves. Philippson (1976), Menissier and Foulley (1979) and Patterson (1979) all reported that dystocia is the primary cause of calf mortality. Patterson observed that dystocia accounted for 45.9% of total death losses and was the most significant cause of death during the first 3 days post partum (table 1). Dystocia also reduces subsequent reproductive performance of cows (tables 2, 3 and 4) (Brinks _et al_, 1973, Laster _et al_ 1973, Foulley _et al_ 1976 and Patterson _et al_ 1981). Cause increase losses of affected cows and may reduce milk production (table 5) (Foulley _et al_ 1976).

Of all factors studied that affect calving difficulty birth weight has consistantly been shown to be the single most important factor associated with calving difficulty. In general a linear relationship between birth weight and percent assisted births has been observed (Burfening _et al_, 1978) in young cows where most of the dystocia occurs and it also appears as a threshhold effect if birth weight is related to major assistance in young cows (hard pulls and caesarean sections; Figure 2) and also appears as a threshhold effect in older cows. The phenotypic correlation between birth weight and calving difficulty is commonly reported to be around 0.3 to 0.4 (Rice and Wiltbank, 1970; Philipsson, 1976; Burfening _et al_, 1978). The genetic correlation between calving difficulty and birth weight in first calf heifers has been reported to approximately .9 (Philipsson _et al_, 1979) and is lower (.4) between second calf and older cows (Burfening, _et al_ 1983).

Since birth weight is an easily measurable moderately heritable trait (h^2=.40; Woldehawariat _et al._, 1977) selection of bulls with low age of dam adjusted birth weights to use on heifers has been shown be effective in reducing the birth weight of their progeny and decreased. The should result in the incidence of dystocia. However strictly paying attention to birth weight of sires can lead to undesirable effects. If one studies progeny data presented in sire summary selection of "heifer bulls" based on birth weight alone can significantly decrease other returns. Take for example the data shown in table 6 from the 1985 Polled Hereford Sire Summary a breeder can find sires that have low EPD for birth weight and are breed average or better for 205-day-wt or other growth traits. Further, the heifer breeds are not always the best to use in terms of total performance. Ansotegui and Roberson (1984) used Longhorn as an advertised "heifer breed" and easy calving Angus bulls at the Montana State Prison. They found no difference in calving difficulty or birth weight between the two breeds but the Angus calves had a 6 day shorter gestation length and were 18 kg heavier at weaning. These results clearly show that just selecting a breed for ease of calving can decrease subsequent performance (table 6). Also although EPD for birth weight are good indicators of expected calving difficulty and the correlation between the two traits is very high it is not perfect. The following examples come from the Simmental Sire Summary and show bulls that are either harder or easier calves than their birth weight EPD's would indicate (table 7). From a simple evaluation of the results it would appear that approximately 15% of the bulls fall into this category.

Dystocia occurs about twice as frequently in bull calves as in heifers calves. After correcting for the differences due to birth weight, the difference in dystocia between the sexes was reduced but still significant (Belic and Menissier 1968; Philippson 1976; Gregory et al 1978). Most authors suggest that since bull calves are heavier muscled, heavier boned and relatively broader difference in the shape of the calves might be responsible for the sex difference observed. However measurement of calves at birth generally have failed to increase the accuracy of predictions of calving difficulty over that of birth weight alone (Laster et al 1974; Philippson, 1976; Scholote and Hassig, 1979) and it is possible that male calves may have effects on their dam other than those related to size and shape of the calf (table 8).

Although there is no direct evidence relating effect sex of calf on dystocia for causes other than birth weight or calf shape it is possible that the male calf may influence the endocrine system of its dam differently than the female calf. Reports by O'Brien and Stott (1977), Osinga (1978) and Erb et al. 1981 all suggest that lower blood and urinary estrogen levels in the cow prior to parturition result in increased incidences of dystocia. Further, Osinga (1978) associated lower urinary estrogen levels with the size of the calf increased the incidence of dystocia while Erb et al 1981 associated lower blood estrogen levels with dystocia that could not be traced to fetal-pelvic incompatability (FPI) (Figure 3). These results could also explain why bulls calves have more dystocia than heifer calves after adjustment for differences in birth weight and why some sire groups have more or less dystocia than would be expected based on their progeny's birth weights.

Many other factors have been studied as to their effect on birth weight. Nutritional level of the dam during late gestation has been studied extensively. Many of the studies confounded the effects of protein and energy restrictions and are difficult to interpret in light of more recent findings. However Laster (1974) and Bellows and Short (1978) observed that increasing the energy level of the ration increased birth weight of the calf but had no effect on the percent assistance required at birth. Corah et al 1975 studying the effects of prepartum energy restriction using isonitrogenous diets found that energy restrictions reduced birth weight but had little effect on calving difficulty (table 9). Further calf losses were increased due to increased suspectibly to disease and subsequent reproductive performance of the cow was decreased. Bellows et al 1979 observed that increasing the level of proteins in isocaloric diets prior to calving increased birth weight and the percent cows requiring assistance (table 10). He has postulated (Bellows, personal communication) because of the varying levels of protein in hay fed to cows during late gestatiton that this may be the cause of part of the year to year variation observed in birth weight and calving difficulty reported by ranchers using the same sire on the same cows in two consecutive years. Therefore balancing a ration for energy alone may cause cows to be over fed protein and increase the percent assisted births.

Season of birth and region of the United States have also been shown to affect birth weight and calving difficulty. Burfening et al 1980 observed that calves born in the late spring had heavier birth weights, more calving difficulty and longer gestation lengths than those born in the fall (Figure 4). The data were further analyzed with gestation length as a covariate. Gestation length was significant source of variation but the monthly patterns of birth weight and percent assisted births followed the same pattern of high birth weights in the spring and low birth weights in the fall. This would indicate that differences in birth weight and dystocia due to season of the year were somewhat independent of gestation length. Hanford et al (1985) reported significant differences between regions of the U.S. in calving difficulty and birth weight. However no significant sire by region of the U.S. have been observed for the calving difficulty or birth weight when sire was classified as the sire of the calf (Burfening et al 1982) or the maternal grandsire of the calf (Hanford et al 1985).

Gestation length has been associated with calving difficulty with more difficulty occurring with longer gestation. Correlation between gestation length and dystocia range from .04 to .25 (Menissier et al 1981; Philipson 1976;Burfening et al 1978 and Price and Wiltbank 1978) and the genetic correlations between gestation length and calving difficulty tend to be low to moderate (Philipson 1976; Menissier et al 1981 and Burfening et al 1978). However we observed that when both birth weight and gestation length were included in the model, gestation length no longer affected calving difficulty. The standard partial regression coefficients for birth weight and gestation length on calving difficulty score were .573±.01 and -.004±.01, respectively. Birth weight of calves appears to be a more effective selection criteria than gestation length because as previously stated the genetic correlation with calving difficulty is higher than gestation length (r_g .9 and .7 vs. .3 and .2 for birth weight and gestation length, respectively; Menissier et al 1981 and Burfening et al 1978) and birth weight is much easier to measure under field conditions with beef cattle.

Up to this point I have primarily discussed the effect of the calf on calving difficulty but the cow also plays a major role in calving difficulty. As pointed out by Drs. Pollack and Freeman in their presentations, maternal effects relating to calving difficulty are also heritable and may be more important than the direct effects. Most research has been directed toward the relationship of pelvic area to calving difficulty; however other factors associated with the dam may also relate to calving difficulty such as maternal preparation for calving.

Much research has been directed toward the relationship of pelvic size to dystocia but unfortunately the results are still conflictory and difficulty to interpret.

Growth and development of the heifers from weaning to breeding has been shown to effect calving difficulty. Bellows (1978) observed that growing heifers on a low plane of nutrition from weaning to breeding as a yearling not only reduced the pregnancy rate (table 12) but increased the rates of calving difficulty and decreased pelvic area in the low feed heifers (table 13).

Age of the heifers at first calving also affects dystocia. Calving difficulty is lower in first calf 3-year-olds than 2-year-olds. Further results from data from the American Simmental Association indicates that age of the heifer in months significantly affected the percent assisted births within the 2-year-old group while birth weight remained fairly constant (Figures 5 and 6). These data suggest that maturity of the heifer probably resulting in an increased size associated with increased pelvic area resulted in less calving difficulty.

Many researchers and producers have shown that pelvic size generally expressed as pelvic area is related to calving difficulty. Correlations between pelvic area and calving difficulty score range from -.10 to -.45 (Rice and Wiltbank, 1970 and 1972; Bellows et al 1971 and Price and Wiltbank, 1978c; Table 14). Several authors discuss the relationship between calving difficulty and pelvic area but fail to present the correlation (Ward, 1973; Singleton et al, 1973; Laster, 1974 and Philipsson, 1976). The heritability of pelvic area (table 15) ranges from .2 - .6 (Couteaudier as cited by Menissier et al, 1981; Benyshek and Little, 1982; Nevelle et al, 1978 and Philipsson et al, 1979). However the genetic relationship between pelvic area and calving difficulty is not as well documented in the literature. Menissier et al (1981) reported a positive genetic association between calving difficulty and pelvic opening and that the relationship is higher than maternal birth weight. "Further based on the heritabilities and genetic correlation Menissier et al (1981) reported that selection for 18 month weight leads to an increase in the maternal component for birth weight and a relatively smaller increase in pelvic opening thus causing a reduction in the pelvic opening/birth weight ration. Therefore selection of breeding females on their growth potential cause disequilibrium between the two maternal components, pelvic opening and birth weight (direct and maternal). Further the effectiveness of calving assistance tends to exacerbate the disequilibrium by supressing important biological barriers imposed by natural selection."

Pelvic area is a trait expressed in males as well as females but I can find no data published to date relating pelvic area in males to pelvic area in either half-sibs or progeny groups. If selection is going to be effective for this maternal component of calving difficulty then it would be useful to understand the relationship of pelvic area in males and females so perhaps it could be used as an indicator trait in bulls been selected to produce replacement heifers. Researchers with this data need to get it analyzed and published so that it can be evaluated for its usefullness in selection program.

Little work has been published on external body measurements of the cow and their relationship to calving difficulty even though there is a great deal of interest among many breeders in our part of the country on external body measurements. The repeatibility of many of the external measurements is low (Doornbos et al., 1984) thus making the measurements difficult to use. Further, the genetic correlation between the external body measurements and calving difficulty (table 16) are generally very low thus not making them very useful for selection purposes (Philipsson, 1976a).

In conclusion, Figure 1 shows that calving difficulty is an extremely complex trait which is influenced by both direct effects of the calf, maternal effects on the calf and the cow herself. Although a large amount of research on calving dfficulty has been done, methods to decrease dystocia are still not clear. Antagonism between selection for increased growth rate which results in increased birth weight and the associated increase in calving difficulty are obvious, and sire selection to decrease birth weight of calves should decrease dystocia. Using EBV to improve our estimate of a sire's genetic potential for birth weight or calving difficulty should help decrease dystocia in his progeny. However, the effect of this selection when his daughters begin to produce remain unclear at this time.

The maternal complex associated with calving difficulty need a greater research effort. It has been shown that nutrition of the dam during her early growth and during late gestation can effect calving difficulty. Further, it has been suggested that selection for increased pelvic size may be effective in reducing dystocia. However these results appear to me to be very contradictory and in the long term may actually lead to an increase in the antagonism between size of the pelvic opening and birth weight.

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TABLE 1. CALF LOSSES PER TIME OF DEATH AND LARGEST LOSS CATEGORY

Time of Death in Days	Total Loss (No.)	Total Loss (%)	Largest Loss Category (No.)	Largest Loss Category % of Loss Within day	Largest Loss Category % of Loss total loss	Category
0	513	57.4	357	69.6	40.0	Delayed and difficult birth complex
1	48	5.4	19	39.6	2.1	Delayed and difficult birth complex
2	26	2.9	8	30.8	.9	Delayed and difficult birth complex
3	27	3.0	9	33.3	1.0	Delayed and difficult birth complex
4	18	2.0	4	22.2	.4	Euthanasia
5	11	1.2	6	54.6	.6	Accidental death, Disease
6	13	1.5	6	46.2	.7	Disease
7	14	1.6	6	42.9	.7	Disease
8	15	1.7	4	26.7	.4	Disease
9	13	1.5	5	38.5	.6	Disease
10	10	1.1	4	40.0	.4	Disease
11-41	87	9.7	35	40.2	3.9	Disease
42-101	51	5.7	25	49.0	2.8	Cause of death no determined
102-Wean	47	5.3	23	48.9	2.6	Cause of death no determined
Total	893	100.0	511	-	37.2	

TABLE 2. EFFECT OF CALVING DIFFICULTY AS A 2-YEAR-OLD ON SUBSEQUENT PRODUCTION AS A 3-YEAR-OLD (BRINKS ET. AL., 1973)

Calving difficulty as a 2-year-old	Calves weaned as 3-year-olds (%)	Calving interval (days)	Weaning weight
Difficult	63	357	350
Normal	77	344	396
Difference	14	13	46

TABLE 3. EFFECT OF DYSTOCIA ON ESTRUS DETECTION RATE ANDCONCEPTION RATE (LASTER ET. AL. 1973).

		During AI period[a]			Total
	No. cows	Defected in estrus, %	Conception rate, %	Conception to AI %	conception rate % [b]
No dystocia	1423	74.3	69.2	89.8	85.3
Dystocia	466	59.9	53.6	83.7	69.4
Difference		14.4**	15.6**	6.1*	15.9**

[a]45 day AI season
[b]70 day breeding season
**P<.01
*P<.05

TABLE 4. EFFECT OF CALVING DIFFICULTY ON 2-YEAR-OLD COWS ON SUBSEQUENT FERTILITY IN FRANCE (FOULLEY ET. AL. 1976).

	Charolais			French beef breeds[a]		
Type of assistance	No. cows	Percent pregnant[b]	diff.[c]	No. cows	Percent pregnant[b]	diff.[c]
No assistance	238	91.2	0	97	85.6	0
Very difficult	146	79.5	-11.7	130	76.9	-8.7
Caesarean	94	60.6	-30.5	52	51.9	-33.7

[a]Maine-Anjou, Charolais and Limousin breeds used in a crossbreeding experiment
[b]60-70 day breeding season
[c]Difference from no assistance group.

TABLE 5. EFFECT OF CAESAREAN ON CALF WEIGHTS AND DAMS MILK PRODUCTION (FOULLEY ET. AL. 1976)

	Age in months		
	1 m	3.5 m	6 m
Daily milk (lbs/day)[a]	-5.2*(48%)[b]	-2.6*(-23%)	-2.4*(-26%)
Calf weight (lbs/day)	+2.8(+3%)	-2.6(-1%)	-2.2(-.06%)

[a]Measured by weight-suckle-weigh
[b]Difference between 20 cows with caesarians and 76 cows without caesarians

TABLE 6. TRAIT LEADERS FOR BIRTH WT FROM AMERICAN POLLED HEREFORD 1985 SIRE SUMMARY

Birth		Weaning		Yearling		Maternal	
EPD	ACC	EPD	ACC	EPD	ACC	EPD	ACC
-13.7	.83	- 7.6	.84	+ 0.3	PE	+21.3	.68
- 6.5	.91	+15.4	.89	+29.8	.86	+13.5	.62
- 4.7	.87	- 5.0	.91	+ 3.5	.86	+16.5	.72
- 4.5	.82	- 4.1	.82	- 3.3	PE	- 0.3	PE
- 3.6	.87	+ 2.8	.86	+13.2	.35	- 0.2	.33
- 3.0	.81	+29.5	.81	+17.6	.72	+18.9	.38
- 3.0	.81	+17.9	.80	+43.7	.79	+ 9.2	.44
- 2.7	.81	+13.2	.85	+29.8	.86	- 4.8	.74
- 2.6	.81	+12.2	.81	+40.1	.58	+ 5.0	.39
- 2.4	.84	+26.0	.83	+29.8	.83	+14.7	.68
- 2.3	.90	+27.3	.90	+35.8	.65	+16.9	.70
- 2.3	.81	- 3.2	.81	+ 0.6	PE	+ 3.6	.48
- 2.2	.84	- 1.5	.84	+ 0.5	PE	- 1.1	.39
- 2.1	.92	+20.4	.94	+29.2	.92	+16.4	.80
- 2.1	.84	+ 8.1	.83	+17.7	PE	+14.1	.45

TABLE 7. RELATIONSHIP BETWEEN SIRE EPD'S FOR CALVING EASE AND BIRTH WEIGHT

ASA sire No.	Birth wt No. Progeny	Birth wt ratio	1st calf ease No. progeny	1st calf ease ratio
216	10072	97.3	1083	92.6
332963	1748	97.6	373	84.6
398615	2578	97.9	538	92.3
380812	1760	101.3	365	102.7
11	9136	101.3	1547	98.4
19042	1331	101.5	368	97.7
4	3713	101.6	663	102.4
411852	1330	103.0	364	105.9
6167	1411	103.3	613	98.8
146342	1886	103.5	767	106.1
66300	2331	100.4	1069	99.5
171430	1553	100.4	334	108.8
19036	1524	100.7	379	99.8

TABLE 8. EFFECT OF VARIOUS CALF MEASUREMENTS ON CALVING DIFFICULTY

Trait measured	Schlote and Hassig (R^2)	Laster (1974) (b^1)
Birth wt	.37	.022*
Width of shoulders	.41	-.018
Muscling of shoulders	.43	--
Width of chest	.45	--
Heart girth	.45	--
Width of hips	.46	.009
Chest depth	.46	.013
Wither height	.47	-.008
Width of thurls	.47	--
Muscling of hindquarters	.47	--
Length of head	.47	--
Body length	.47	.002
Circumference of cannon bone	.47	--
Width of head	.47	--

TABLE 9. EFFECT OF RESTRICTING PREPARTUM ENERGY ON COW AND CALF TRAITS (CORAH ET. AL. 1975)

Item	Energy level High	Energy level Low	Difference
Prepartum wt change (lbs)	79.4	-12.8	92.2
Birth wt. (lbs)	67.3	62.9	4.4
Assisted births (%)	27	28	-1
Calves alive at birth	97	90	7
Milk production (kg/day)	10.6	11.0	-0.4
Weaning wt. (lbs)	352	325	27
Percent in estrus by 40 day postpartum	41	26	15

TABLE 10. EFFECT OF PROTEIN ON CALVING DIFFICULTY AND SUBSEQUENT REPRODUCTIVE PERFORMANCE (BELLOWS ET. AL., 1979)

	Protein level Low	Protein level High
Body wt. 12 hr post calving	814	902
Calving difficulty		
score	1.6	2.2
incidences (%)	42	58
Birth wt. (lbs)	73	84
Post partum interval	64	66
October pregnancy	78	73
205-day wt of calf	438	462

Low = 79% NRC
High = 138% NRC

TABLE 11. EFFECT OF REGION OF THE UNITED STATES ON CALVING DIFFICULTY AND BIRTH WT. HANFORD ET AL. (1985)

Region of U.S.[a]	Calving Diff. (score)	Percent Assists (%)	Birth wt (kg)
1	1.84	53	37.8
2	1.79	53	36.5
3	1.75	47	36.2
4	1.46	35	34.8

[a]1=MT, ND, SD; 2=KS, NE; 3=TX, OK; 4=GA, LA, AL, MS, FA

TABLE 12. FEED EFFECTS ON HEIFER REPRODUCTION (Bellows, 1978)

Data	Winter gain Low	Moderate	High
No. head	30	29	30
Winter gain (lb./day)	0.6	1.0	1.5
Feed required (lb./day)[a]			
Hay	10.2	10.6	11.4
Grain[b]	--	1.9	4.4
Summer gain (lb./day)	1.3	1.2	0.9
Body wt. (lb.)			
End winter (5/6)	414	481	558
Begin breeding (6/15)	458	527	584
October (10/15)	629	667	708
Puberty age (days)	434	412	388
Percent in heat:			
Prior to breeding season	7	31	83
During breeding season	73	66	17
After breeding season	20	3	0
Percent bred and conceived:			
First 20 days	30	62	60
Second 20 days	10	21	20
Third 20 days	10	3	7
Not bred	20	3	0
October pregnancy (%)	50	86	87

[a]Calculated on weighted average basis.
[b]Ground grain mix: 70% barley; 12.5% linseed meal; 12.5% wheat bran; and 5% molasses.

TABLE 13.EFFECTS OF REARING NUTRITION ONREPRODUCTION,PELVICAREA, AND CALVING DIFFICULTY IN HEIFERS (Bellows, 1978)

Item	Winter gain group[a] Low	High
No. heifers	30	59
Avg. daily gain - winter (lb.)[b]	0.6	1.3
Avg. daily gain - summer (lb.)[c]	1.3	1.0
October pregnancy (%)	50	86
Precalving pelvic area (cm^2)	240	252
Calving difficulty (%)	46	36

[a]All heifers handled the same after winter period.
[b]December 6 to May 6; see Table 6.
[c]May 7 to October 17.

TABLE 14. CORRELATIONS OF PELVIC AREA WITH CALVING DIFFICULTY

r	Reference
-.45*	Couteaudier (cited by Meijering, 1984)
-.34*	Rice and Wiltbank (1970)
-.22*	Bellows et al, (1971)
-.18	Bellows et al, (1971)

*(P<.05)

TABLE 15. HERITABILITY OF PELVIC AREA

h^2	Reference
.53	Benyshek and Little, (1982)
.04	Nevelle et al, (1978)
.24	Nevelle et al, (1978)
.40	Couteaudier (cited by Menissier et al, 1981)
.20	Philipsson et al, (1979)

TABLE 6. EFFECT OF ANGUS VS LONGHORN SIRES ON CALVING DIFFICULTY, BIRTH WT, GESTATION LENGHT AND WEANING WT. (Ansotegui and Roberson, 1984)

Trait	Angus	Longhorn
No.	51	50
Birth wt (kg)	30.8	30.3
Calving difficulty (score)	1.34	1.32
Gestation length (day)	275.8	281.5**
Weaning wt (kg)	184.1	166.1**

**P<.01

TABLE 16. GENETIC CORRELATIONS BETWEEN VARIOUS BODY MEASUREMENTS AND CALVING DIFFICULTY (Philipsson 1976c)

Trait	r_g
Chest girth	-.16±.27
Wither height	.08±.23
Hip height	-.15±.23
Hip width I[a]	-.08±.25
Hip width II[b]	-.48±.21
Thurl width	.08+.26
Pin bone width	-.21+.27
Vertical dist. hip-thurl	-.33±.24
Horiz. dist. hip-thurl	-.11±.26
Vertical dist. hip-pin bone	-.30±.23
Horiz. dist. hip-pin bone	-.08±.23
Vertical dist. sacrum-thurl	-.33±.22

[a]Maximum width between tuber coxae
[b]between dorsal tops of tuber coxae

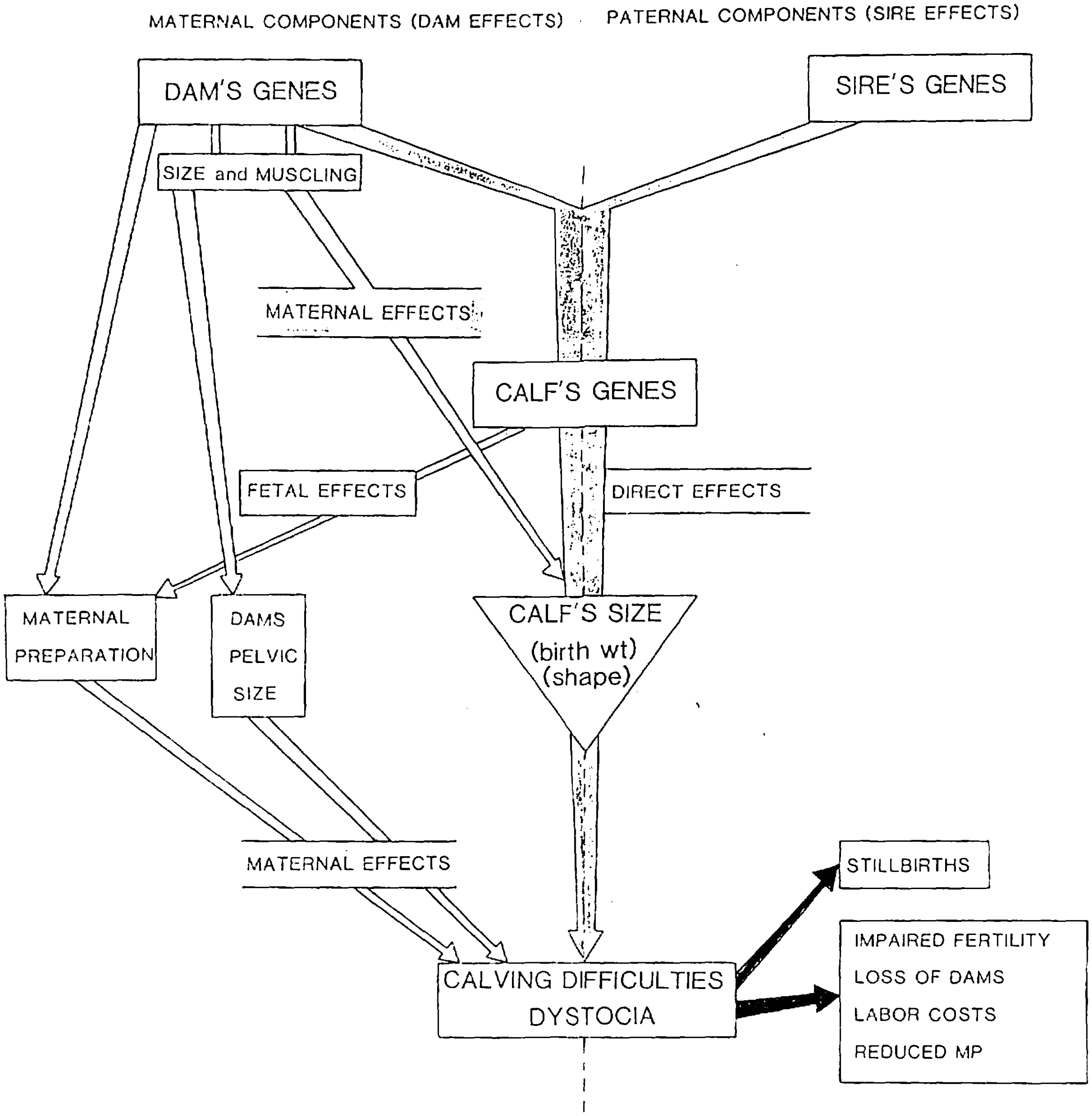


Figure 1. Paternal and maternal factors affecting calving difficulty (redrawn from Menissier, et al., 1981, and Philipsson, et al., 1979).

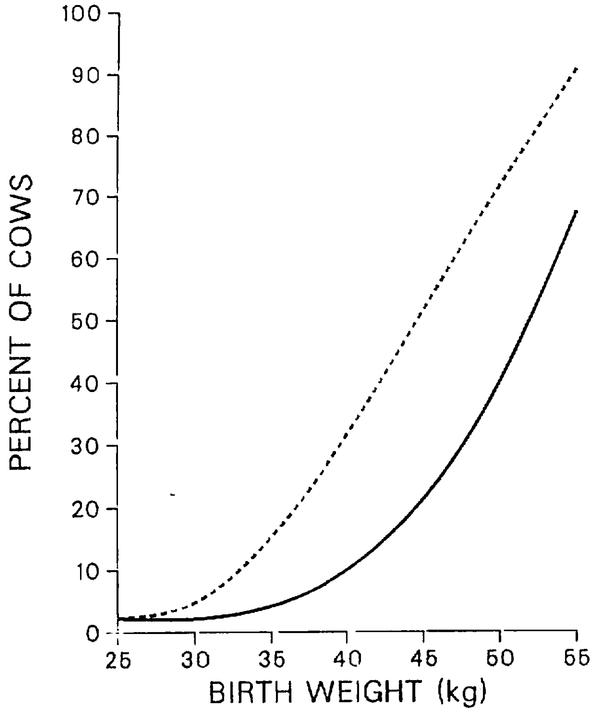


Figure 2. Relationship between percent assisted birth and birth weight for 2-year-olds requiring major assistances (scores 3 and 4,---) and caesarean sections (score 4; ——).

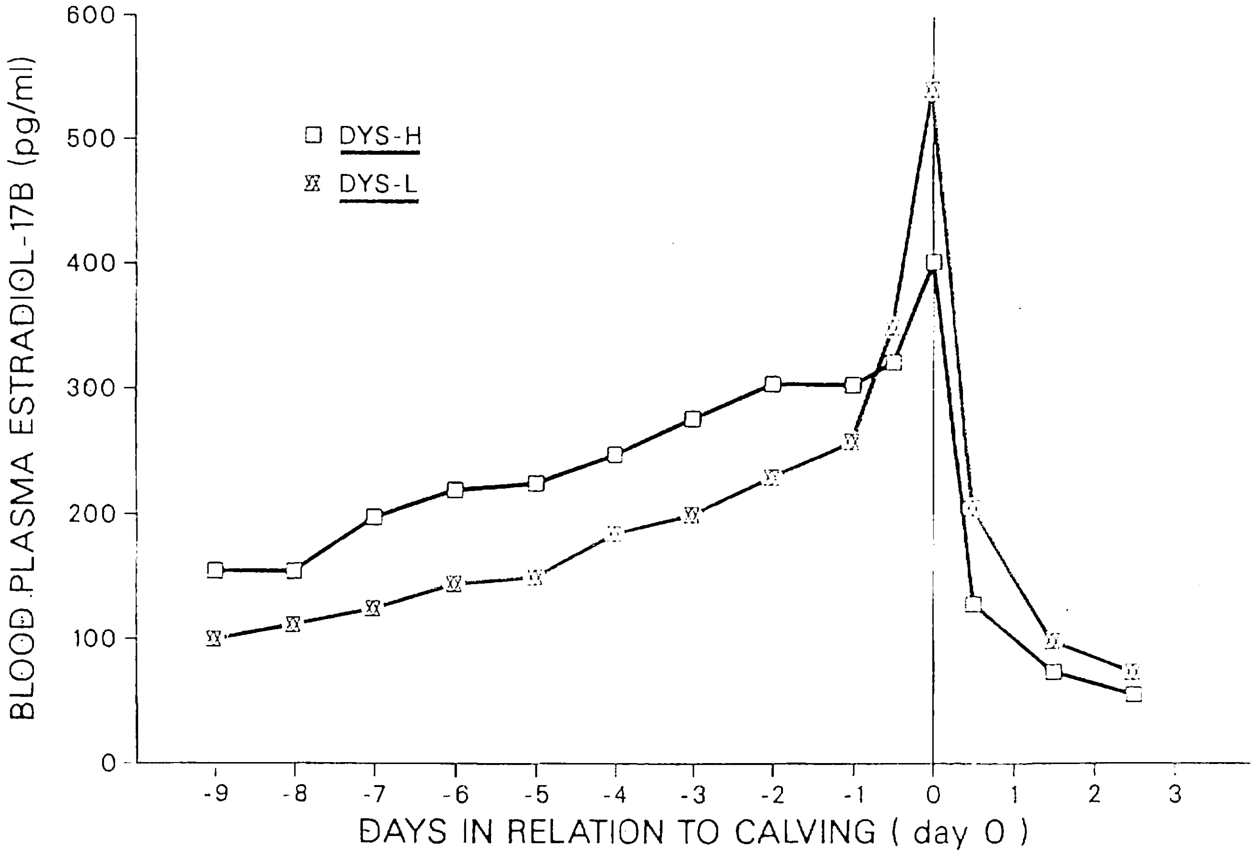


Figure 3. Relationship between blood estrogen levels prior to calving and calving difficulty for calves in FPI (DYS-H) and no FPI (DYS-L) (redrawn from Erb *et al.*, 1981).

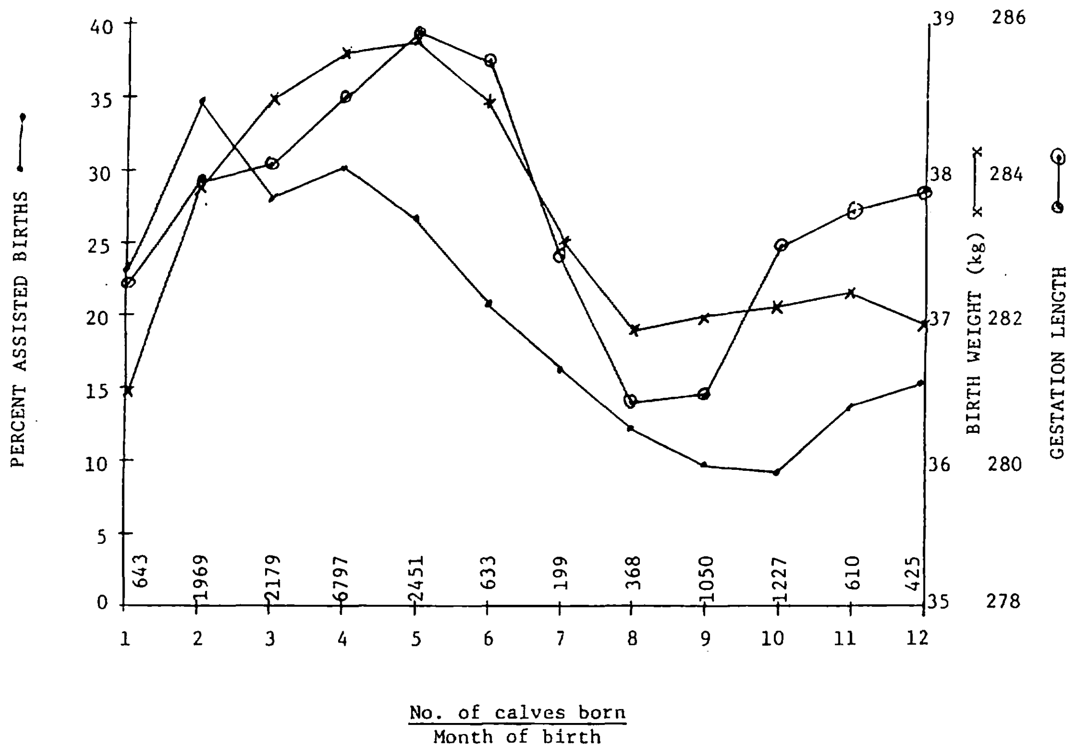


Figure 4. Effect of month of birth on percent assisted births, birth weight and gestation length.

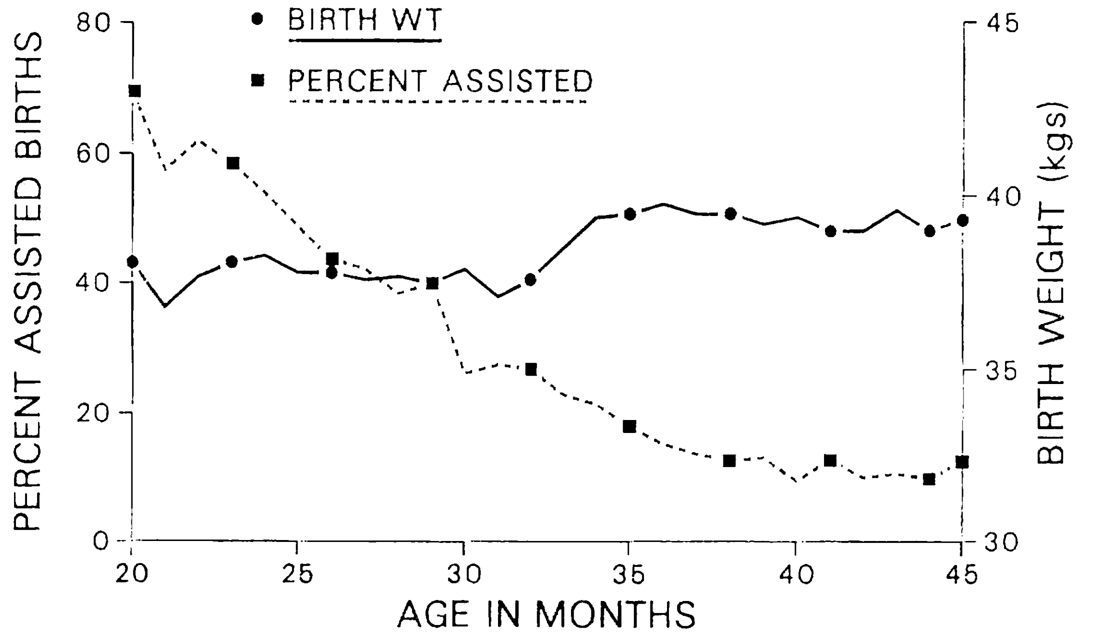


Figure 5. Relationship between age of the cow in months and percent assisted births and birth weight for bull calves.

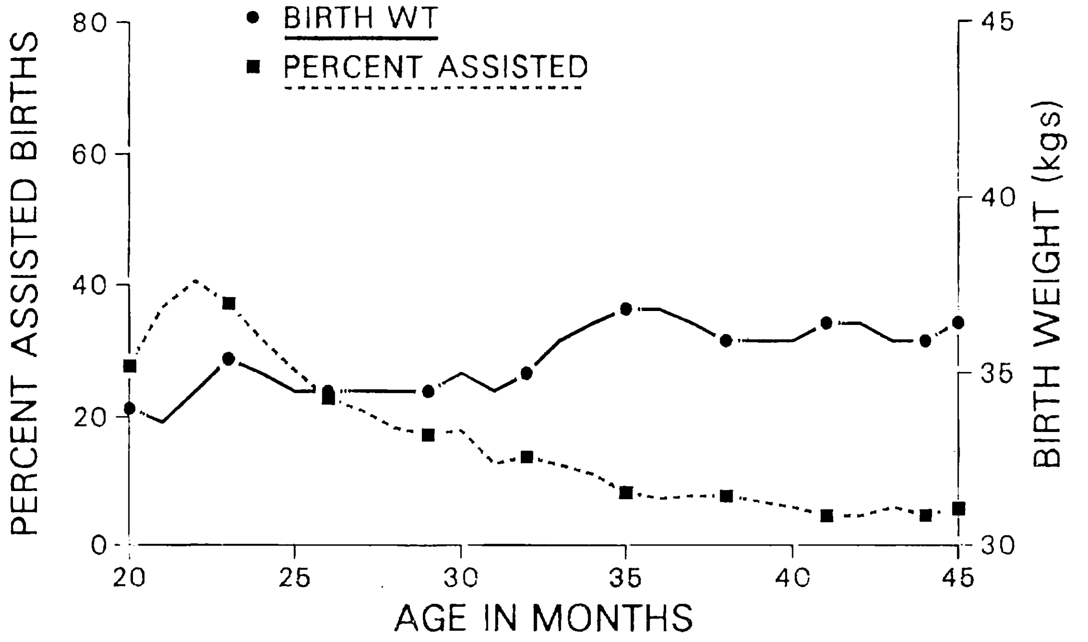


Figure 6. Relationship between age of the cow in months and percent assisted births and birth weight for heifer calves.

OPTIMUM PRODUCTION FOR THE SEEDSTOCK INDUSTRY

by

H. H. Dickenson
Executive Vice President
American Hereford Association

The topic assigned me is "Optimum Production for the Seedstock Industry." Now, this is a difficult assignment for me--for I have enough problems in defining this concept for the breed I represent--not to mention the task of defining it for the wide genetic base of the entire seedstock industry.

In fact, this whole business of optimum production and systems approach is, in the vernacular of the sports industry, "on a roll." Suddenly, it's the topic of discussion at every meeting. There are times when I think we are taking a very simple concept and making it a very complex subject. The philosophy of this concept is easy to convey and is readily accepted by producers. The problem comes in trying to be specific enough to make it readily applicable for potential practitioners.

As I try to verbalize this concept at this particular meeting, several pertinent questions come to mind.

1. Why me? Although I have made several talks on the subject at field days and sales--this audience involves most of the really capable speakers on this subject. Much of what I will have to say was stolen from talks given by many of you.

2. Why now? Is optimum production a concept that has just come of age? Why was it not advocated 5 years ago, 10 years ago?

3. Why tomorrow? What is so magic about optimums that we feel it should be such an integral part of the future? What does the crystal ball tell us about the future of livestock production that convinces us that optimums are so essential?

4. Why here? BIF represents the performance industry. Are optimums a part of performance and if so, how do we work it into a system that for the most part has dealt with maximums as a goal?

I don't have the specific answers to these questions but I will try to generalize on some of the aspects of our business as I see their influence on the optimum production concept. If

I stray beyond the confines of my topic it's because I find it necessary to substantiate the forces which motivate this production concept.

As I see it, the optimum production concept is a result of the times. The economic incentive for this practice is apparent today just as the incentive for maximums was a part of our economy a few years ago. This doesn't mean that optimum production wouldn't have been an advisable practice 10 years ago. In fact, some did practice it 10 years ago. They were considered non-progressive. Today they are considered survivors.

This fall, my college graduating class has its 30-year reunion. While this event recalls many fond memories, it also provides me with a time span to reflect on the changes that have occurred in agriculture during my career with this vital industry. This 30-year period, probably better than any other equivalent time span, reflects the tremendous changes that have taken place in this industry--principally as a result of advanced technology which has led to gigantic increases in production. And when interfaced with the major social, economic and political changes on a global basis, the impact on our vocation and on our lives has been enormous.

Ag Productivity Influences Nation's Affluence

The first and primary impact we can consider is the effect this increased production has had on the affluence of this nation. In a relatively short period of time, we have evolved from a nation where virtually the entire population was engaged in food production to today's demographics that shows only 2% of our population in the food production sector. Consider these facts.

When the Pilgrims landed at Plymouth Rock, there were an estimated 1 1/2 million Indians living and occupying the same land we live on today. They were the new world's original farmers. But all of these 1 1/2 million Indians spent their entire time in search of food.

Today there are just a few more American farmers--maybe 3 million. But these 3 million farmers produce enough food on this same land to feed themselves and 230 million more Americans with enough left over to supply much of the rest of the world. In the past 30 years alone, technological advancements have tremendously accelerated this productivity. Thirty years ago, one farmer fed 18 people. Today he feeds 80 people with a big surplus left over.

This marvelous production story is the basis for this nation's affluence. Man's economic activity begins with food. The money and time left after obtaining food is used to provide life's other luxuries which measure wealth and affluence. The cheaper the cost of food and the fewer people required to produce it, the greater the affluence of the general population.

And America is the world's greatest example of this tremendous food production and its impact on American affluence. Some 98% of our population is free to follow other walks of life as a result and over 85% of their disposable income can be devoted to items other than food.

This affluence is a direct result of the farmer and stockman's productivity. In the past 30 years, agriculture productivity has increased 3 1/2 times compared to a 1 1/2 increase in industry. And this has happened with just 1/3 as many farmers as was evident 30 years ago. In the animal segment, beef marketed per breeding female has increased by 65%. Milk yields have doubled, eggs laid are up by 35% and pigs reach market 20% younger and 15% leaner. So make no mistakes about it. Those involved in American agriculture have played a monumental role in the affluent status of this nation.

Incentive for Maximums

These tremendous productivity increases have been accomplished under a maximum production concept. It's been more output per man hour of labor, more pounds of beef per cow, more milk per cow, more bushels per acre and so on. The maximum production concept was fueled further by the opening of a giant export market in the late 60's and early 70's. This export market signalled an exceleration of technology and its utilization by producers. The American farmer was told to produce more and more for the world needed every mouthful and would pay for it.

Agriculture found itself in a growth market and maximum production was advocated to meet the growing needs. In the next 15 years, U.S. ag exports tripled. By 1981, two out of every 5 acres producing farm products was producing for the export market. One third of our total farm output was exported. The American farmer could do no wrong. The more he produced, the more he had to sell and it always appeared more would be needed the next year. The incentive was there for maximum production.

Maximum goals for the farmer had a spin off affecting the livestock industry as well. The introduction of Continental breeds coincided with this maximum concept. Direction of the English breeds was switched to maximums for the same reason. Crossbreeding took on new zest in an effort to market more pounds. Maximum production also gave the performance movement the toe hold it needed for maximum growth was the basis of most performance programs and that fit well with the maximum production concept.

The result of the maximum concept created an artificial environment for U.S. agriculture. Corn farmers in the fertile areas of this nation found they could produce 300 bushels per acre using improved seed, better equipment and pouring on fertilizer regardless of cost. Irrigation turned desert country into grain fields. Livestock people discovered that the use of 2,600 pound bulls and 1,600 pound cows could indeed produce more individual calf pounds. And if the biggest parents of different breeds were used in crossbreeding the pounds produced increased dramatically. A by product was the demand for land which began to increase in value 15% to 20% annually. Net worth grew proportionately but so did farm debt. During the 70's, wheat reached $5.00/bushel and calves sold for over $1.00/lb. and beef consumption reached 130 pounds per capita. Cost of production was not a major factor so long as we were in a growth market. And we knew we were in a growth market--the politicians told us so. The bankers encouraged us, the economists confirmed it--and the producers believed it. The incentive was there. Maximum was the goal. Increased net worth was the reward and "braggin rights" about the biggest and the most was the center of conversation in the barber shops and cafes where farmers and stockmen assembled.

Export Demand the Catalyst for Current Economics

But early 1981, things changed dramatically. The catalyst was the decline in the world market demand. In the next four years U.S. exports were cut in half, beef prices declined, land values fell and banks began to foreclose. Today's U.S. agriculture is in serious trouble. Maximum production has put us in a giant surplus situation with no market to sell to.

The state of American Agricultural exports are becoming as rickety as an old barn badly in need of major repair. Raised in splendid style, U.S. ag exports were a real show place in the 70's. But the time when the world beats a path to our door for food is apparently over--and the U.S. ag export "barn" is beginning to list to the lee side of the prevailing trade winds.

The result is lower prices for virtually every commodity to the point that costs of production now exceeds prices received. In fact the business of controlling costs have become the number 1 concern of producers of both grain and livestock. And for good reason. If prices for our product had kept pace with cost of production:

Calves would bring $1.13/lb.
Wheat would sell for $7.43/bu.
Hogs would trade at 90¢/lb.

The outlook for sustained price increases for any of our products is pretty bleak because the immediate future of the export market is bleak. Now you might argue that the weak export market is just a short lived quirk in the world economic picture and that it will eventually right itself. You can point out that embargoes and the strength of the dollar has temporarily disrupted the market. But you also have to consider the changes taking place in agriculture on a world wide basis. Better seed and new techniques have turned many food importing nations into food exporting nations. India and China are examples of two which have achieved near basic food self sufficiency. The EC nations have a giant surplus which they are willing to sell on the world market for prices under the production cost. Other nations, such as Brazil and Argentina are tapping vast land reserves to produce exportable products as the only means of stabilizing their currency and trade problems. Japan wishes to become self sufficient in beef production even if it means controlling per capita beef consumption and preventing imports. Saudi Arabia is producing wheat at unbelieveable production costs simply in an effort to achieve food self sufficiency. And sadly, the nations yet unable to feed themselves haven't the resources to buy the food or the distribution system to get it to the hungry. The U.S. food industry faces continued price resistance from bargain hunting customers and also competition from other food producing countries out to claim former U.S. customers at substantially lower prices.

A Mature Beef Industry

NCA has aptly described the U.S. cattle industry as a "mature industry." A mature industry is one that has leveled out in growth of cow numbers, in per capita consumption of the product, and in prices received for that product. Where, then, does profitability in this industry come? Most now agree it comes from reducing cost of production. The recent NCA Profit Conference said the average breakeven price for calves marketed was 80¢/lb. While the conference admitted the prospects of seeing any sustained price increase over this breakeven figure was not realistic, it did show where just a 10% adjustment in several key production factors could reduce breakeven price by 25¢/lb. Such a reduction in breakeven price is the only assured route to profitability.

For most of the 30 years I have been associated with the meat animal industry, we have devoted most of our efforts toward designing a product to capture the top market price. We have chased this elusive target with little consideration to the cost involved. Coffee shop talk has played a key role in disseminating information as to which breed, cross or type will top the market. Steer shows and judges have designated themselves as the sculptors of this ideal.

The truth of the matter is that for commercial producers, they are simply players in this game we call the market system. As a player we rely on free pricing, the allocation of resources on the basis of supply and demand and the attitudes and voluntary choices of consumers. It's called free enterprise. In a growth market it works in our favor and maximum goals are sensible. In a mature cattle industry, the emphasis is on costs because market prices become stable and any fluctuation, premium or discount, is based on supply and demand.

Incentive for Optimums

The result of all this is that we now realize production practices must change. What is now called for is optimum production practices. While we realize the importance of keeping beef cattle type in line with general market requirements, we know that the prospects of higher prices for any one breed, crossbreed, or type will have little long range affect on overall profitability.

In simple terms, optimum production means adapting production potential to available resources and in so doing reducing cost of production. This may mean less pounds of calf per cow calving but more net pounds per acre of resources.

A mature industry with stable market prices means selling 450 pound blue calves with a $50 breakeven price is significantly more profitable than 600 lb. purple calves carrying an $80 breakeven price. And we know these breakeven differences exist through proper understanding and utilization of the optimum production concept.

Now, assuming that optimum production should be our goal in the future, I can tell you from experience that it is a readily accepted concept by commercial cattlemen. It makes sense to them. Matching production to available resources is a common sense approach. Cutting costs is a recognized and desired necessity.

The concept is saleable and that's more than we can say for many of the production concepts offered in the past. The problem comes in defining it in more specifics for any one operation. Optimum is more difficult to define than its counterpart, maximum. Webster defines maximum as: "The greatest or most or the upper limit of variations." In the cattle industry such a goal may be hard to reach but it is a clear and understandable goal. Webster defines optimum as: "The best or most favorable degree." In the cattle business this is a very difficult goal to establish and may never be reached. Herein lies our problem with putting optimum production into practice.

While it's been relatively simple to send a signal to the industry that we need a 1,200 pound steer with .3 inch fat and a 14 sq. in. ribeye, or a 60" show steer, or a 1,300 lb. yearling weight, it is considerably more difficult to describe the optimum genetics needed for the varying environments and conditions of this country. One man's environment may best accommodate large frame, heavy milking cows while another's may best lend itself to small frame, low milking cows. In either case, the producer should not opt for the others goals regardless of price predictions, barn talk, etc. If he properly practices optimum production, he will survive in this industry.

I believe optimum production for the commercial cattlemen is his best alternative for profitability, given the long range forecast for this industry. I think it can and should be sold. I think it will be readily accepted. But to make it work on the individual operation requires a better handle on evaluating those resources and understanding and describing the genetic packages available. But without doubt, the commercial cattleman should adopt optimum production and put maximum concepts behind him if profitability is to return to this industry.

Different Goals for Seedstock Industry?

By the same token, I believe we may be heading for trouble in the seedstock industry if we practice optimums under this same concept as the production of commercial cattle. In fact, I never considered optimum production as applying to seedstock producers. I'll try to explain why.

Unlike the commercial industry, the seedstock industry does not operate under the same controls--either on a prices received basis or a single customer requirement. While the commercial cattleman's product sells to a standard customer (feedlot) and in a narrow price range ($2-$3 swing on a given market), the seedstock man's customers have widely varying needs and at a fairly wide price range. Whereas, the commercial man practices optimum production in an effort to keep costs below prices received, the seedstock producer will have expenses beyond the natural limits of his resources in an effort to receive top prices. These are the economic differences that are at least apparent to me.

From a genetic standpoint, there is and will continue to be a need for a wide range of genetic packages available to the commercial man. To a degree, these parameters can be narrowed to the needs of a general area of the country since most bulls sell within a 300 mile radius. But still, the needs of commercial men in that area will vary considerably. Add to this the fact that most of the seedstock heifers and a significant percent of the bulls have the potential of selling to other purebreed breeders and the demand for cattle considered outside the optimum limit broadens ever further. In fact, the successful seedstock breeder has the potential of a national or even international market and I see no reason why he shouldn't strive for that goal. I doubt he can reach it if he limits the genetic potential of his breeding program to coincide with the limitations of his environment.

Just consider a few of the basic results of matching seedstock production to available resources. If this was practiced every seedstock producer in Cherry County, Nebraska would either all have one breed designed as a set type or all seedstock breeds would be reduced to a single type in that area. If this became fact, there would be little demand for these seedstock cattle by commercial men in that area for the genetics offered wouldn't be any different than the genetics that existed in that area's commercial cattle.

Please don't misunderstand what I'm trying to say. I will be the first to admit that many in the seedstock industry have tried to take genetics beyond acceptable biological limits. I will admit that this is not the correct course. However, I think most of us will agree that the outer limits we are talking about deals principally with frame size. And there has been an economic reason for stretching this trait to its biological limits. Our customers were seeking that trait at its maximum. This trend is changing because the incentives have changed but I don't think it means the seedstock industry should completely change its overall goals as engineers of the industry.

Seedstock breeds should be different. There should be differences within the seedstock breeds. I think this is true today even though we have made inadvisable efforts to make them all alike and as a result we have overlapping among breeds in all the trait areas. But breed differences need to remain if for no other reason than to accommodate the commercial man practicing optimum production.

Production Specification

I do think however that each breeder must think about being able to specify what his seedstock genetics will do in the herd of the buyer. Along this line, breed associations probably need to decide what their breed should be known for, what it can best contribute, draw up general parameters, and be able to specify in general where the breed fits in the industry.

If the industry could accomplish the task of specifying the attributes of each breed, then crossbreeding could better adapt itself to the commercial industry's optimum production concept.

For the seedstock industry, I think the optimum production concept means specification of the seedstock product to meet varying commercial optimum requirements. To do this, I personally see nothing wrong in the pursuit of maximums in certain trait areas, realizing that the maximum for that trait will be dependent on its repercussions on other complimentary traits.

I don't know how we can hope to sell seedstock performance if we advocate optimums at a time when we can't really define what is optimum. For better or worse, the seedstock breeders pursue certain goals in performance and usually that means maximums for traits such as growth and milk production. The selection differential that exists within a breed for such traits usually means that a portion of the population is below the line that is acceptable by the industry and a portion is on the outer upper limits. It's been my experience that the portion on the upper limits do not harm the breed as a whole nearly as much as do the ones on the lower limits.

When we boil it all down, the only trait that is giving us serious concern is frame size--that's the controversial area. It's also the only trait we could change rapidly if we so desired. Our concern with frame size comes from its impact on calving ease, feed utilization, and perhaps carcass weight on the extreme end. But certainly we are not overly concerned with growth rate within an acceptable frame size. I also doubt that too much milk production is really a major concern for the industry at this point in time. The other important traits such as fertility, puberty, soundness, longevity, etc., are certainly optimum considerations but we really don't have a good measuring stick for these areas of beef production.

I think the seedstock industry should concern itself with developing an accepted method of product specification rather than being concerned with practicing optimum production. A seedstock breeder or a seedstock breed should be able to specify what his or its bulls will contribute--or take away--in the herd of the buyer. To do this, the seedstock breeder must be competent in two distinct areas. He must be able to analyze the genetic needs of his customer and that will vary from customer to customer. And he must be able to document the contributions his bulls can make on that genetic base. The commercial man's needs are to match genetics to his resources. The seedstock breeder must be in a position to document whether his bulls meet the genetic needs of that customer.

To date, researchers have not done enough in the area of analyzing breed assets and reporting how they can best be utilized. There have been numerous breed comparisons in certain trait areas. Breeds have been labeled sire breeds, maternal breeds, and terminal breeds. But these trait comparisons and descriptive terms really don't help the commercial producer. He needs more information on how he can utilize unique breed genetics in his herd.

If the seedstock industry is to continue as a meaningful part of the beef industry, we will continue to maintain separate distinct breed differences. If registered cattle are to play a meaningful role in the optimum production concept for the commercial industry, product specification for the individuals and for the breed must come of age. A breed's genetic population is made up of individuals but that population or breed has characteristics of its own. We need to do a better job of product specification for both the individual and the breed.

The purpose of seedstock cattle breeders and the breed organizations is to improve the genetic potential of their cattle to increase profit in the commercial herds. The job of

BIF has been to encourage documentation of this genetic potential, produce it in uniform fashion, and assist in the analysis and processing of such data. I think all mentioned have done their job well. The genetic potential is available. Much of it is documented. It is fairly uniform in the way it is processed and recorded. Has this improved the status and image of the seedstock industry?

Unfortunately, the facts indicate it has not. In the 30-year span I mentioned earlier, the number of breeds and thus the genetic variation available has quadrupled. The documentation and reporting has increased several thousand percent. But we are recording and selling fewer registered animals than we did 30 years ago. The seedstock image is not good. The future is uncertain. Changes in our approach to seedstock production must be forthcoming.

I believe the optimum production concept, or systems approach, if properly utilized by the commercial industry could enhance the seedstock image for it requires documented genetics. But I have trouble understanding how optimum production, or the systems concept, can be aptly applied to seedstock production.

I think the beef industry would be better served if we concentrated on selling the optimum concept to the commercial industry and begin to advocate the product specification concept to seedstock breeds and breeders.

GENETIC IMPROVEMENT NEW ZEALAND STYLE

PAPER PRESENTED TO BEEF IMPROVEMENT FEDERATION OF U.S.A.

May 1-3 1985 Madison, Wisconsin. James.I.S.Innes.

Haldon Station is in the Central South Island of New Zealand, and has been owned by my family since 1904, I am the third generation to own it.

35,000 acres in total, of which 1000 is irrigated. 1,000 in lucerne and 15,000 acres is topdressed and oversown hill country. Rainfall is 14 inches with 140 days of below zero winter. Similar climate to the Northern States of U.S.A. but with very dry summers.

The station runs a fleet of helicopters that are used for various station activities including a Helicopter Skiing Operation throughout the winter. Primarily the Helicopters are used for the recovery of feral deer from our mountain lands.

"DEER FARMING' is in a "boom" stage in N.Z. at present. The economics of this industry are much greater than any other form of land use, hence the rush for farmers to diversify into deer farming. The products from this industry are velvet antler and venison, which is currently worth $NZ 7 per kilo carcass weight to the farmer.

20,000 Merino sheep, of which 14,000 are breeding ewes, are also run on the station along with a flock of Booroola Merino sheep. The Booroola flock of 300 ewes is probably the most fertile flock of sheep in the world. The average ovulation rate of these ewes is over 7. Rams and embryos from this flock are exported to many countries throughout the world.

The Genepool cattle breeding programme, which is the reason you have asked me here to speak about, is also run from Haldon Station. To give you some idea of the scheme before I get involved in the details. Base population of approximately 30,000 Hereford cows on 50 different properties, are continually screened for high performing cows. Nucleus Herd run at Haldon is approx 400 cows. Two hundred bulls will be sold to the industry 1985 season.

In 1967 the first Open Nucleus Group Breeding Scheme was started in N.Z. with sheep. Today 30% of the sheep in N.Z. are influenced by group bred rams.

In 1970 27 commercial Hereford breeders representing approximately 20,000 cows formed Genepool,an Open Nucleus G.B.S.with Hereford cattle.

As many of these breeders had been recording to some degree in their herds,it was an easy task to identify and pool into one herd the highest performing 200 cows from this population.

Over the next 5-6 years many cows of differing and unknown production levels were sent to the Nucleus Herd (NH) by breeders.

This exercise not only screened out the higher performing cows -

but gave the breeders an indication of what the productivity of their herd was. The lower producing herds obviously could make no genetic contribution at this stage. It has been interesting to observe over the past 12-15 years the efforts made by various breeders to improve their herds. Some of the original low performing herds are already in the top group.

Cows have continued to be screened from this base population, which now involves approximately 30,000 cows and 50 breeders. The selection of cows to enter the Central Herd is much more sophisticated than in the earlier years. It now takes a high performing,well adapted cow, with very good records to be able to enter the Nucleus Herd and stay there.

The objectives of this scheme are to breed Hereford cattle under a strictly commercial High Country environment and put selection pressure on fertility and mothering ability in the females,and fertility growth and soundness in the males. It is important to base this operation in the toughest enviroment that was practically possible.This sounds like old hat and with out giving it too much thought, every stud breeder thinks he is doing just this. Unfortunately this isn't the case in the majority of cases.

Our policy on selection criteria from the outset has been.

1. FEMALES.
Selection based on fertility and mothering ability in a harsh environment. Growth in females is not taken into account at any stage.

2. MALES.
Bulls are selected for
(a) Serving capacity and fertility traits.
(b) Breeding index at 550 days which takes into account dams BV(MAB) as well as growth rate.

From these objectives you will see that we are committed to breeding a functional animal that is adapted to a specific environment for a specific purpose.

We have approx 50 contributing herds, with more joining each year.These breeders send their highest performing cows to the NH from time to time. Not every year, but when they consider they have cows that would be able to withstand the competition in the NH.

Breeders retain ownership of their cows and their progeny at all times. All heifer calves are returned to their owners herds at weaning.This saves grazing costs and responsibility for the NH operator. It is only a small percentage of these heifers that will have high enough performance to stay in the NH.Better that they are screened on their own farms, then come back to NH.

All bull calves are retained to 18mths for performance testing. At this stage they are subjected to Serving Capacity Testing and Scrotum measurements. Bulls with scrotum circum of less than 32cm are culled.

Bulls with fewer than three mountings (full ejaculation)in a 20 minute yard test are also culled.Those that pass the test are scored on the number of mounts successfully performed in this 20 minute test. The best bulls have up to 10 mounts. Obviously in this test we are also able to detect any penis deformities or structural problems that may hinder a bulls ability to serve a cow.

Data over the last five years have shown a very high relationship between servicing capacity score and subsequent ability to get as many cows in calf as possible in a 42 day breeding season.

We have had the NH screwed down to a 42 day breeding season for 7 years now. There are many obvious advantages to a shorter breeding season, but not very many herds would be able to achieve acceptable levels of fertility with such a short programme.

The variation between bulls in this trait is very large.From 0 to 96. We have found that 82-86% seems to be the level that the "GOOD" bulls achieve, there are a few that are up in the 92-95% area but very few.

For all the years that I have been associated with beef catlle (all my life) we as breeders have paid little, if any, attention to this very important area. We have heard, and most of us have used, all the excuses for low calving percentages. Bad winters, poor conditions last summer,etc.I have even heard stud breeders say "He is a slow breeder,so we don't give him too many cows".

We have in most cases not considered that perhaps the bulls may be poor performers. Perhaps some bulls have more headackes than others!!! In some instances breeders and researchers have attempted to semen test bulls as a means of fertility testing bulls. We did this for a number of years but it was a total waste of time and money.

The serving capacity test and scrotum measurement procedure is a much more accurate indication of bulls fertility. I am confident that identification and selection for bulls fertility will have a greater influence on overall beef cattle productivity over the next decade,than any other Beef Cattle Breeding technology available to us today.

SELECTION CRITERIA FOR BULLS;

The following criteria are used to identify the "Best" 12-15 bulls each year to be retained for progeny testing.

(1) Serving capacity

(2) Scrotum size

(3) Udder score of dam

(4) Breeding index at 18 month's of age.This takes into account the dam breeding values.

(5) Eye pigmentation must be above 80%.

Any bull that has any form of deformity is culled.(In particular feet) The remainder of bulls that meet satisfactory performance levels are sold by public auction.

Proceeds from the sale of these bulls are the property of the owner of the bull.The bulls that are retained for progeny testing must be sold the next year at the sale as rising 3 year olds. These bulls are sold with a "right to buy back" clause. Should any of the progeny tested bulls after the completion of the test be requested for further use the company has the right to buy back these bulls.

PROGENY TESTING;

There are arguments for and against the need for progeny testing in a programme like Genepool. Some say that by using different young bulls every year, turning the generations over is all you need to do. We are more or less doing that.

The Central Herd is mated to progeny tested bulls for the 1st heat of the breeding season then covered up by the young bulls for the remaining period.

But there is a need for progeny testing in our programme because the "BEST" bulls based on fertility, growth and subsequent milking ability of their daughters are used via AB in the contributing herds as well as having semen available for sale. We now have a demand for semen from these bulls.

The major part of time and money in Genepool is spent on organising and running our progeny test programme. Initially we ran the programme by using young bulls with AB in many different herds with reference sires. This was stopped after a number of years due to a lack of accuracy on various properties.

It is very simple procedure to sit in an office and ask breeders to become involved in a progeny test or sire proving scheme.

Breeders always show great enthusiasium at the start of a programme.

"New and better bulls are always at the front of their minds."

But it is a different story when you go to collect the data 2 and 4 years later. Coupling this with our obsession for bull fertility, we have given away the mass AB programme for progeny testing. There is little point in progeny testing a bull through AB if you also want fertility information. A natural mating programme is the only possible way.

Over the last 5 years all our progeny testing has been done through natural mating. Each bull being given 70/80 cows for a 42 day breeding season. In the initial years we used many bulls from various parts of the world over the Nucleus Herd. These bulls had varying degrees of information to back them up. We had so many disappointments that we now do not use any outside bred bulls in the NH unless they have been through the progeny test.

As these bulls are only available via AB it is not possible for us to check the bulls fertility. Growth and subsequence female performance are the only criteria we can collect on these bulls.

DATA COLLECTED IN PROGENY TESTS.

All male progeny are only weighted to 450 days.

Female progeny are all retained till after their 1st calving.

Information collected is:

- Growth to 450 days
- Eye pigmentation
- Calving % at 1st calving in 42 days season
- Udder confirmation at 1st calving.
- Re breeding interval
- Weaning weight calves
- Feet score as 2.5 yr old.

As a bull is 6 years old in some cases before this test is completed, we assess bulls throughout the period, and if performance on certain traits looks outstanding, we take a gamble and bring them back early.

COST AND WHO PAYS.

Genepool operates as a Co-operative Company, it is a non profit making organisation. It only collects enough money to pay administration fees.

These fees come from commissions on bull sales and semen sales. As the gross sales of Genepool bred products increases, the commission % decreases.

As the productivity in the contributing herds increases and the breeders become more confident in bulls they are producing, more and more bulls are being made available to the industry from this source.

This is having an influence in the structure of the Bull Breeding Industry in the South Island of New Zealand.

SUMMARY

In a programme like Genepool genetics are the easy part - the ability to deal with people is the making or breaking of such a scheme.

The progress that can be made in animal breeding through the use of large populations and attention to detail is obvious to all.

As I say frequently "Genepool is only applying pure logic to Cattle Breeding", and the exciting part is that it is really working.

It is unfortunate that genetic principles tend to be left behind in too many breeding programmes in favour of preconcieved ideas.

THE BEEF COW--WHAT PURPOSE?

P.D. (Doc) Hatfield, Brothers, Oregon

For a large animal veterinarian, the beef cow provides a livelihood by virtue of her many functional defects. Too much of a veterinarian's time is spent on calving problems, foot problems, prolapses, bad eyes, and udder disorders--all a result of inadequate genetic makeup.

After 10 years of veterinary practice, my wife, Connie, and I traded our irrigated ranch and veterinary practice in Montana for a year-round grazing operation on the high desert in Central Oregon. We believed cattle could be bred and managed to work on their own in a natural environment.

Goals were set to breed fault-free functional cows that would work for us and fit our environment. Characteristics these females had to possess to fit our ranch follow:

1. Have a good disposition.
2. Breed in 45 days as a yearling.
3. Delivery a calf at 2 years of age without assistance when mated to a sire of her own breed.
4. Have strong mothering instincts.
5. Have good teat and udder conformation.
6. Have sound feet and legs.
7. Breed back for her 2nd calf in a 60-day breeding season.
8. Have milk to wean a heavy calf as a 2-year-old (a calf that will fit in the same load with the calves from the old cows).
9. Calve every year thereafter in a 60-day calving season.

To hear some experts talk, one would think that the only reason the cow-calf producer exists is to provide steers for the feedlot, and providing efficient feedlot steers is a very important part of the cow-calf business. However, to expect much economic improvement at the cow-calf level by producing bigger, faster-gaining feedlot steers is wishful thinking.

The reason it's wishful thinking is because, objectively speaking, the cow-calf segment of our industry is a by-product business. The financial justification for our existence is to utilize some "waste" feed product that has no value until it is run through a cow. Beef cows can compete with soybeans, pigs, and chickens only if a large part of their diet comes from inexpensive roughage that would otherwise go to waste.

In our area, that roughage is bunchgrass. In the Midwest, it is cornstalks and other crop aftermath. In the wheat country, it is straw bunches and gulleys that can't be farmed. In many areas, cow-calf production creates a by-product income from the land speculation on ground that was never meant to economically produce beef. Finally, a major part of our beef production is a by-product of the recreation business produced by people with full-time outside jobs who get a bigger kick out of raising a few cattle than they do out of playing golf.

What does it take to make a by-product business work? Not putting a great deal of time or money into the operation has to be a major point.

For the past nine years, we have made our living converting desert bunchgrass into beef. Some years the desert cooperates better than others, but always we are adjusting our cattle and ourselves to better fit the desert. Our ranch still contains the remnants of old abandoned homestead cabins--testimony to those who failed trying to change a hostile environment to fit their needs. Our program is to adapt our cattle to what we have; not change what we have to fit a type of cattle that may be popular at the moment.

A more appropriate title for this talk would be "Manipulating grass, time of calving, and breed of cattle so your cows will perform on what your ranch can produce." The discussion will illustrate our philosophy of a cattle ranching operation. Produce the optimum forage from your land base. Then harvest that crop with cattle. No other environment will be exactly like ours and most will be much different. However, the principles for matching cattle to forage are the same everywhere. Try to apply the thinking part to your ranch environment as the discussion progresses.

Each year on this ranch, we have the use of 14,000 acres of soil, approximately 12 inches of moisture, below-freezing temperatures every month, and abundant sunshine. Our primary job is using these raw materials to produce year-round digestible forage in a manner that improves the environment for the future. This forage is then harvested with cattle. There is no farming, haying, or irrigating and our cattle are on grass 12 months of most years.

Production-related work on the ranch involves two major activities:

1. Manipulating bunchgrass to produce forage with year-round value.
2. Breeding trouble-free, athletic cattle with nutrient requirements that fit that grass.

Thanks mainly to the homesteaders, our ranch is divided in 23 units. These units support some plant growth most years from March through July; however, the majority of our grass crop for the year is grown in May and June. During May and June, grazing management is highly intensive. A major goal of that management is to prepare high-quality regrowth for later use during the dormant period.

During this critical period of fast growth, all cattle run together in one herd and move to fresh pasture every few days. A key consideration is moving to fresh pasture soon enough to avoid eating regrowth on plants bitten the first day of grazing. The decision on which pasture to move to next is based on what type regrowth we can expect to produce while, at the same time, meeting the physiological needs of the plant.

We have a general idea where our next moves will be but routinely change the original grazing plan when weather dictates a move to a different unit would benefit both the plants and the livestock.

During the fall, winter, and early spring, the cattle are divided into three or four herds. They will be grazing on regrowth that was prepared in April, May, and June. They may stay in the same unit several weeks without moving at this time of year.

To do the best possible job of converting our grass to beef with a cow-calf operation, it is obvious from Graph #1 that fertility is our number one concern. For any cow to efficiently perform in our environment, she must calve every year in March or April. The very best time for us to have a calf born is the last week of March. A cow calving at that time has had one month where the grass supplied most of her nutrients.

After calving, when her nutrient requirements double, the grass also supplies her needs. By mid-May through July when the feed is at its best, she has enough nutrients to support maximum milk production, gain weight, and breed back--all with only a little mineral supplement. The calf is also big enough by then to eat a lot of that hard desert grass and make maximum weight gains. By September when the grass starts to get tough, the calves are big enough to wean. The cow can go on making her living on the grass with only minor supplementation, as this is her lowest time of year where nutrient requirements are concerned.

Maximum nutrient value is produced in grass by grazing it at a time when full regrowth will not quite occur. A rough picture of the difference in grass quality between our managed and unmanaged grass is shown in Graph #2.

Once we have done our best to provide quality year-round forage, we select (through artificial insemination and ruthless culling) cattle that have nutrient requirements similar to the year-round nutrient values of our grass. It isn't the ranch's job to produce what the cow needs to perform; it is the cow's job to perform on what the ranch can best produce. She needs to perform with a bare minimum of outside supplemental feeding and labor.

With this philosophy, performance information and breed characteristics are looked at in the light of how they fit the year-round forage resource. beef cows exist to convert forage to food. What can be done with a cow in a hothouse situation where everything she needs is served with a pitchfork and bucket may have little bearing on profit in the real world. High milk production and extreme growth rates are of value to a cow-calf operator only if an inexpensive feed source to support that performance is available.

What type cow do we need to harvest this grass? The following impossible program is not meant to be funny or cute. Its purpose is to point out the constant trade-offs involved in any beef selection program. Think along with the graph in Chart #1.

From weaning time in September until calving time in March, the ideal cow would be a 900-pound 1950 model Hereford-Angus cross, with lots of hair and 3 inches of backfat. Wintering costs are the biggest out-of-pocket expense that ranchers in our area have to pay. This type of cow could winter with very little supplemental feed in our harsh area.

At calving time in March, the ideal would be to drop the Hereford and switch to a Tarentaise-Angus cross. We also would need to modernize the Angus half to about 1970. It would be optimum to stay with this Tarentaise-Angus cross until she was bred in early June.

After breeding, the ideal for one month from mid-June to mid-July would be a Simmental or Brown Swiss crossed with a 1980 model Angus. At this time of year, we have the strongest feed in the world, and this breed combination could really convert it.

From mid-July to weaning in September, we would need to switch back to the Tarentaise crossed with the 1970 Angus in order to better match the declining forage quality but still keep the milk production at a high level.

At weaning, we would have made a full circle and be back to the 1950 model Hereford-Angus cross for maximum wintering efficiency.

With this cow program, we could consistently wean 600-pound calves at 180 days of age, winter their mothers for about $20 per head in supplement costs, and quite easily have over 95 percent conception in a 45-day AI period.

Unfortunately, we can't switch breeds and types within breeds at a moment's notice. After experimenting with many breeds and types through our 100 percent AI program the past 17 years, we have settled on the following combination to tailor a cow for our environment. We use Hereford, Red Angus, and Tarentaise, staying away from the more modern-type Hereford and Angus.

We use these breeds and types for the following reasons:

Hereford--has the most generations of adaptability to range conditions, has a good hair coat, and the ability to lay on external fat for wintering ability. Late puberty, average milking ability, and eye problems are its main drawbacks.

Red Angus--calving ease, early puberty, and adequate milk production are strong points for our operation. Disposition and the occasional dumpy throwback are the main negatives for us.

Tarentaise--introduced into the United States in 1972 from the French Alps. They are the smallest, most athletic European breed, being about the same size as our better Hereford and Angus cattle. They are cherry-red in color with black pigmentation around the eyes and body openings.

They were originally imported for their maternal traits:

* Have the ability to breed at an early age;
* Be mature and in almost full production at 2 years of age;
* Be able to breed back under practical range conditions;
* Significantly improve teats, udders, and milk production.

In addition to their maternal traits, Tarentaise:

* Increase the rate of gain of their offspring over that of the British breeds, but not to the extreme of the larger European breeds;
* Improve carcass quality by reducing fat and increasing length.

Negatives for the breed would be their unconventional conformation and inability to put on condition in the summer for use in the winter. Tarentaise are, by far, the hardiest of the European breeds we have used but they, like the other European breeds, have been barn-wintered for generations and lack the fat cover and hair coat that give the Hereford-Angus cross that competitive edge for winterability.

Our goal from this breeding program is a 1,000- to 1,500-pound cow that will produce a 475- to 550-pound steer calf at six months of age. We have weaned a few calves at 600 pounds, but have often culled their mothers for failing to breed back in our 60-day AI season. We don't have the environment to support that level of growth. If all our cows produced that heavy a calf, we'd soon be out of business. Anything below a 450-pound calf is hurting us as those mothers are loafing and changing our bunchgrass into fat on their back instead of milk for their calf.

Other environments will obviously support heavier weaning weights and more growth than ours, but with the introduction of the large European breeds we have all the growth and milk most practical cow-calf environments will support right now today. Unfortunately, most purebred breeders and AI organizations have not yet recognized this fact, as they charge forward to win the size and milk contest.

The theme of this talk is matching cow-calf production with forage. Optimum performance for this segment of the industry in any environment will not necessarily produce the fastest gaining, highest yielding carcass steer for the feedlot segment. Our breeding program produces a 500-pound weaner steer calf at six months of age that will make a low choice yield Grade 2 or 3 1,200-pound steer at 14-16 months of age under feeding programs in common use in our area. That is an acceptable commercial product for today's market. Through our AI program, we could immediately increase the feedlot performance, but in the process would produce a cow unsuited for our environment.

One of our main programs is producing replacement heifers. We winter and breed all heifers in a 45-day AI program with no cleanup bulls.

Again, to fit our winter-feed resource for both the weaner heifer and her mother, we need to wean a 450- to 525-pound heifer calf at six months of age. This weight weaner heifer can be wintered on our grass from October through March with approximately three-quarters of a ton of purchased alfalfa hay as protein supplement. We must have a heifer that will reach puberty at 600 pounds, which is our target weight for May. We have the month of May for a breeding flush on our top-quality grass before we start AI in June.

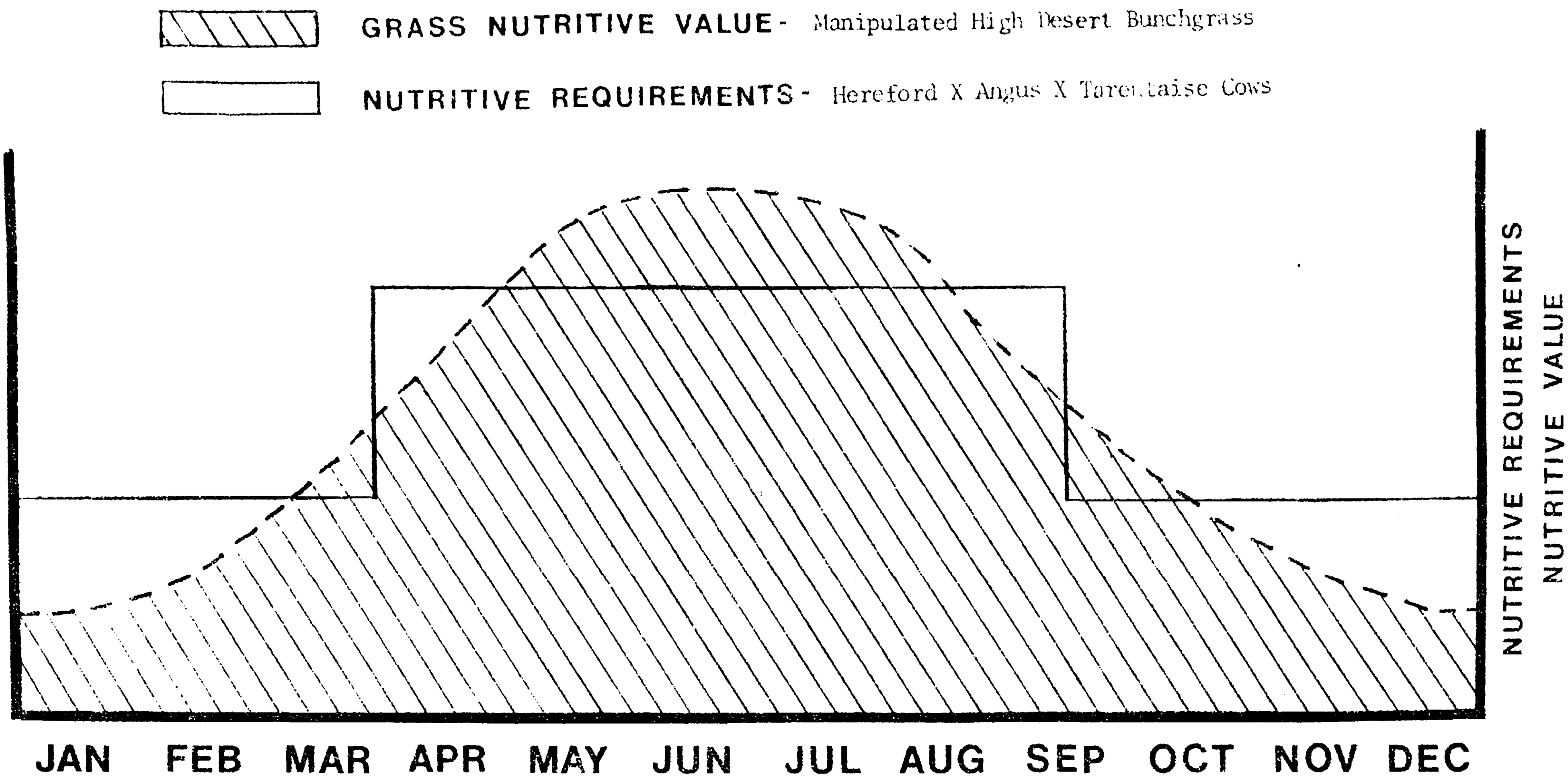
By September, our heifer will be a bred heifer weighing 800-850 pounds. Our area is good for yearling gains, but for the calving season to match the feed supply, the yearling heifer has to make most of her gain after she is bred. This requirement effectively eliminates the Brahma composite breeds and European carcass breeds from our program as they need to weigh over 600 pounds if they are to be in heat at 15 months of age. We could haul in feed and make our heifers weigh 800 pounds at 15 months of age. Then any breed would show heat in our AI season. That would be against our philosophy of selecting cattle to work on what our ranch can produce. We are in the grass raising and harvesting business, not the feedlot business.

The second critical performance trait for our operation is the ability to raise a marketable calf as a 2-year-old and breed back for a calf at 3 with a

12-month calving interval. This is the point where we lose the large European dual-purpose breeds. They are milking heavily and still growing. We cannot economically provide adequate supplement to support their growth and milk. Too many of them never show heat in our 60-day AI season with no cleanup bulls.

Our operation is simpler than most cow-calf ranches. Due to our environment, we do not have the option to economically raise anything but grass. Most ranches also have the possibility of raising hay, silage, winter grain crops, etc. Basically though, all ranches are the same in that most of the products to support a beef animal must come from the soil. The cow's only logical function is as a harvesting machine for the optimum crops that ranch can produce.

Our environment is harsher than most a good bit of the year and, for a short time, no other is as good. Everyone's criteria will not be the same as ours; but by setting standards, selecting breeds that have a chance to meet those standards, and ruthlessly culling those that don't, real progress can be made. We have developed a herd of cattle that look surprisingly alike even though no effort has been made to select on visual appraisal.



Cows Calve

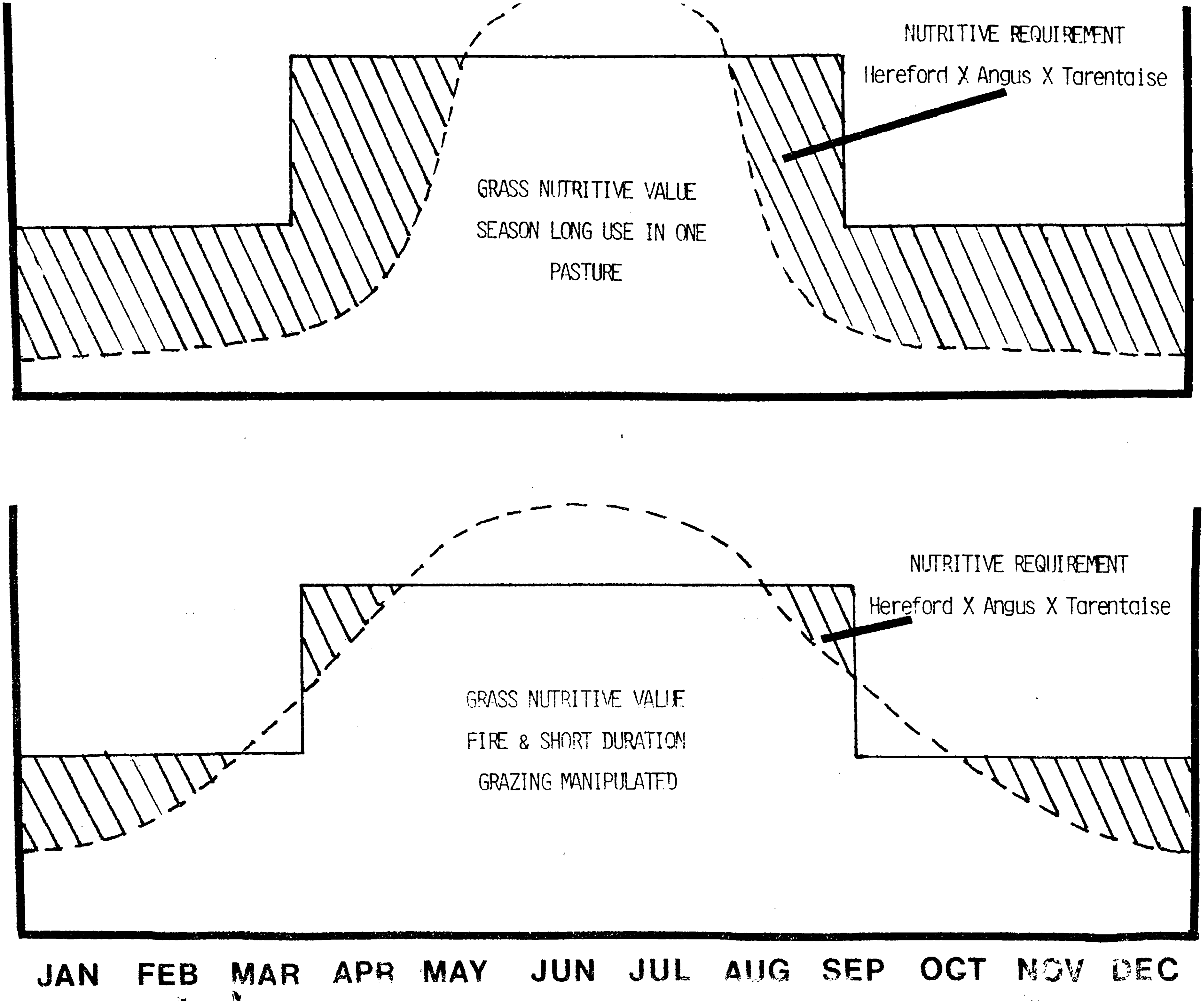
Breeding Season

Calves Weaned

The last of the year old grass eaten out to make room for fresh new grass for next 12 mo. useage. Grass quality improving.

Cattle moved to new pasture every few days to prepare regrowth for Sept-March use. Grass quality excellent everywhere.

Cattle put where the grass is best. Moved less often. Youngest animals weaner heifers, PC yearlings and 2 year olds get the best available. High quality grass may be limited.


NUTRITIVE REQUIREMENT
Hereford X Angus X Tarentaise
GRASS NUTRITIVE VALUE
SEASON LONG USE IN ONE
PASTURE
NUTRITIVE REQUIREMENT
Hereford X Angus X Tarentaise
GRASS NUTRITIVE VALUE
FIRE & SHORT DURATION
GRAZING MANIPULATED
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

CRITICAL POINTS IN USING CROSSBREEDING TO INCREASE PROFIT

D. R. Notter
Virginia Polytechnic Institute and State University

Introduction

One of the most critical points in using crossbreeding in commercial beef production relates to an understanding of the objectives of a crossbreeding program. All breeding programs must have purpose if they are to succeed; they cannot be haphazard or inconsistent or driven by anything except a long-term view of direction and purpose. Thus, in retrospect, I would like to retitle this presentation to deal directly with that need. Let us now consider "Crossbreeding With a Purpose."

The Crossbred Perspective

Let us first review why we got involved in crossbreeding in the first place. What were the advantages and why was it such a good idea? That is, let's get crossbreeding in perspective and move on from that perspective to discuss how we use crossbreeding to increase profit.

Original work on effects of crossbreeding Hereford, Angus and Shorthorn cattle was conducted in the 1960's at Nebraska (Gregory et al., 1965; Cundiff et al., 1974a,b) and Virginia (Gaines et al., 1966). In a summary of Nebraska research, Cundiff and Gregory (1977) reported that pounds of calf produced per cow exposed was increased by 8.5% when straightbred cows were allowed to produce crossbred instead of straightbred calves. Likewise, crossbred cows producing three-way-cross calves weaned 23.1% more pounds of calf per cow exposed than did straightbred cows producing straightbred calves. Subsequent analysis of the entire production system (Notter et al., 1979c) suggested that crossbreeding among comparable British breeds reduced costs per cwt of weanling calf marketed by 5.4% through use of the crossbred calf and by 11.8% through use of the crossbred cow and calf.

Several important conclusions can be drawn from this early research.

(1) Crossbreeding utilizing three adapted British breeds with approximately comparable performance levels for the primary production traits clearly increased performance above that of any of the component breeds.
(2) These increases in performance translated directly into increases in economic efficiency and net profit.
(3) Nearly two-thirds of the increase in rate of calf production and over half of the decrease in cost of production were attributable to the crossbred cow. Thus, much of the advantage of crossbreeding can only be realized in programs that allow systematic use of both the crossbred calf and cow.

(4) Most of the advantages of crossbreeding arose through increases in fitness traits such as calf survival, reproductive fitness, mothering ability and longevity. Improvements in these traits are likely to be advantageous in almost all production-marketing situations.
(5) These early results pertained to crosses among similar, adapted breeds, not to wide crosses of divergent types.

Heterosis in crosses among comparable biological types is only one of the potential advantages of crossbreeding. In addition, crossbreeding allows use of complementarity among breeds (Fitzhugh et al., 1975) such that different breeds can be used in the crossbreeding system in roles that are most consistent with the strengths and weaknesses of the specific breeds. The classic example of complementarity is terminal-sire crossbreeding in which females of moderate size and with maternal characteristics appropriate to the production environment are mated to sires of a larger (and often less-well-adapted) breed to increase the growth rate of the progeny. The primary advantage of terminal-sire crossing is clear: cows are allowed to produce calves that are inordinately large in relation to the size and annual maintenance requirements of the cows. The primary disadvantage of terminal-sire crossing has likewise become painfully clear: if the size difference between sire and dam types is too large, calving difficulty and calf mortality will increase and may negate the potential gains from crossbreeding.

Notter et al. (1979c) investigated effects of progressive increases in the size of the terminal sire breed on economic efficiency at weaning and slaughter (figure 1). When all cows (including yearling heifers) were bred to the terminal sire, clear limits existed on the maximum tolerable size difference between sire and dam types. [Note that here and throughout, the size of a breed or type will be defined as the mature weight of cows of that breed or type.] However, if calving difficulty was avoided by mating yearling and 2-yr-old cows to bulls of a smaller type, production costs to slaughter were predicted to decline continuously over a wide range of terminal sire sizes. Note also from figure 1 that weaning costs did not decline as consistently as did slaughter costs. This result reflects the slower maturing rate of the larger types to a constant weaning age and suggests that much of the advantage of terminal crossing is realized postweaning. Thus, for weanling calf producers, there is little advantage in using terminal sire breeds with mature cow weights more than 400 lb above the mature weight of the commercial cows unless a substantial price benefit accrues to progeny of the terminal sire. This maximum tolerable size divergence would decrease to perhaps 200 lb if young cows were mated to the terminal sire.

Figure 1 also shows that the effect of terminal crossing on production costs is relatively small (1 to 2%) compared to effects of heterosis (2 to 5%). In addition, terminal crossing will change the type of calf that is produced, and these changes can, in some cases, result in undesirable changes in calf value that can compromise achieved reductions in production costs. In particular, crosses in figure 1 involving a 1,100 lb dam type and a 1,760 lb sire type would be expected to produce steers that would reach the U.S.D.A. choice quality grade at minimum

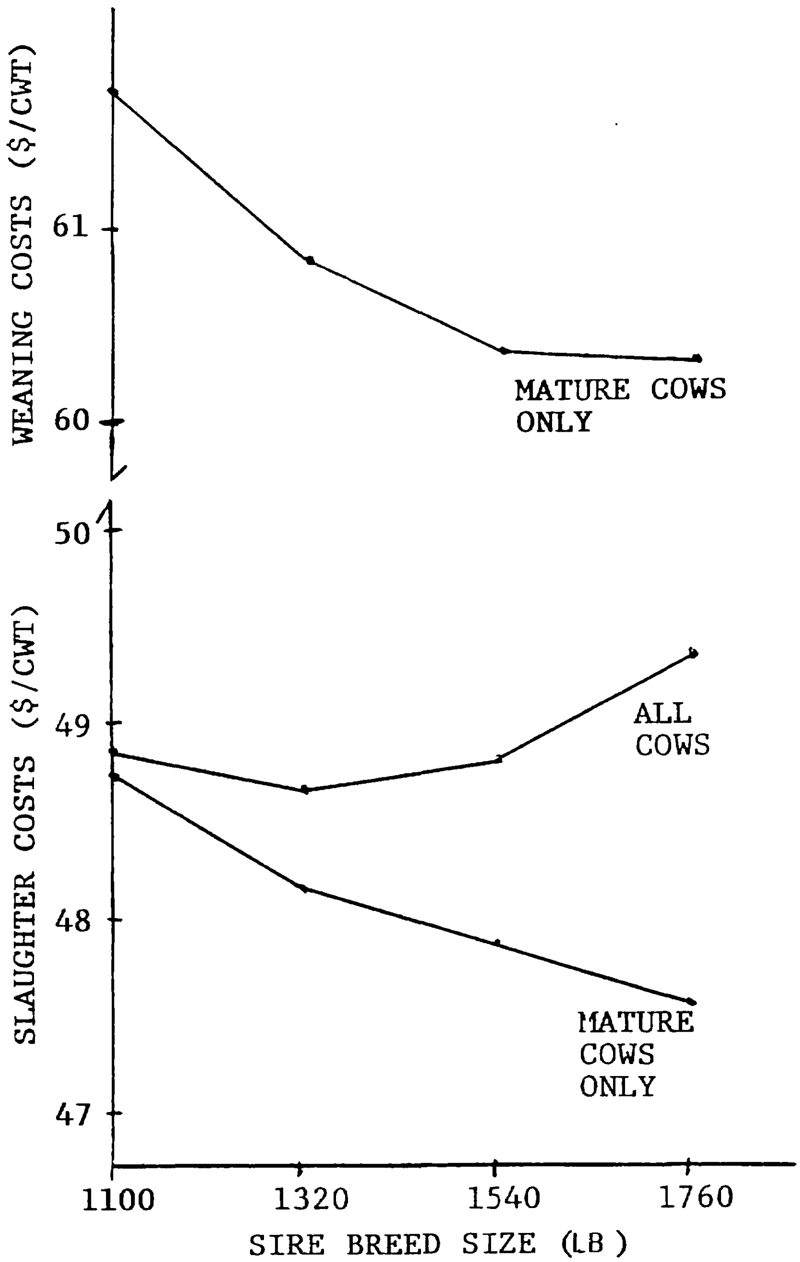


Figure 1. Effects of sire breed size on costs of production at weaning and slaughter in terminal crossing systems using an 1,100 lb cow type and sire types of the size indicated. A size type is specified as the mature cow weight for the type. Results are presented for system in which either all cows or only mature cows are bred to the terminal sire type.

weights of 1,400 to 1,450 lb. Under current conditions in many markets, these heavy steers would be discounted by $3 to $5 (or more), thereby completely wiping out the observed reduction of less than $2/cwt in cost of production.

Environmental adaptation must also be considered in designing crossbreeding systems. In a classic Australian study, Frisch (1976) has shown that the most productive breed group in a harsh, dry tropical environment will differ in response to differences in the level of environmental control imposed by the management system. The question of adaptation is especially important with regard to the crossbred cow. Several studies have shown that cows with 50% Holstein breeding may function very well in areas of plentiful forage (Marlowe and Oliver, 1979; Fletcher, 1984) but become progressively less desirable in more restrictive environments (Deutscher and Whiteman, 1971; Holloway et al., 1975).

Thus, terminal-sire crossbreeding systems appear likely to improve economic efficiency if three conditions are met.

(1) All types used in the crossbreeding system must be sufficiently well-adapted to effectively fulfill their roles in the system. This may involve relatively modest levels of adaptation such as those required for a sire breed in a relatively benign environment with a short breeding season or the high levels of adaptation needed for dam types on desert range.
(2) The size divergence between sire and dam types must be small enough to hold calving difficulty to a manageable level. In most cases, a divergence of 400 lb appears acceptable. This divergence can be larger in systems using Brahman-cross cows (because of negative maternal effects of the Brahman on birth weight) but should be smaller in systems using Brahman or Brahman-cross sires (because of large direct effects of the Brahman on birth weight).
(3) Resulting crossbred calves must be accepted in the market at both weaning and slaughter.

Strategies for Increasing Calf Weaning Weights

In light of the above discussion on effects of heterosis and complementarity on the production system, let us now consider three alternative strategies for increasing weaning weight in commercial herds. These include: (1) increasing overall breed size in straightbreeding, (2) terminal sire crossbreeding and (3) increasing milk production. Probable effects of changes in mature size on calf weaning weights were derived from general relationships presented by Taylor (1980). These relationships are consistent with those observed in beef cattle in the U.S.D.A. Germ Plasm Evaluation Program (Smith et al., 1976; Gregory et al., 1978, 1979; Cundiff, 1984).

Increasing Weaning Weight by Increasing Breed Size. A 20% increase in mature size in a straightbred cow herd is expected to increase annual cow costs by about 15% (i.e., in proportion to the .75 power of cow weight; Notter et al., 1979b; Jacobs, 1983) but to increase calf weaning weight at a constant age by only about 10.5% because of the slower maturing rate of larger types. Thus, as noted above, much of the more rapid growth of larger types is not realized until after weaning, indicating that producers should (and must) receive higher prices at weaning for the less mature progeny of larger types. These considerations suggest that in order for a 20% increase in breed size to increase profitability at weaning, a minimum increase in calf price of 4% (or $2.40/cwt on a base price of $60.00/cwt) is required. An analysis of data from Virginia graded feeder calf sales, however, suggests that price increases of this magnitude are unlikely unless the original cow herd is producing small-framed calves. In that data, medium-framed calves were 5.8% larger than small-framed calves and sold for an average of $5.16/cwt more. In contrast, large-framed calves were 7% heavier than medium-framed calves but sold for only $1.54/cwt more. Further, this price advantage for large-framed calves was observed to decline from $2.58/cwt in 1982 to $1.38/cwt in 1983 and $.67/cwt in 1984.

Increasing Weaning Weight by Terminal-Sire Crossbreeding. Under this scenario, an increase in sire breed size of 35% (385 lb from a base of 1,100 lb) is expected to increase progeny weaning weight by 9.5% and to decrease production by about 1% ($.60/cwt) and would therefore be advantageous so long as price did not decline by more than 1%. Analysis of Virginia prices, however, shows an inconsistent picture of the value of these larger calves. In 1982, exotic (Simmental and Charolais) crosses were worth $1.86/cwt more than British-breed crosses, an amount consistent with their simulated greater value postweaning. However, in 1983 the price advantage for exotic crosses dropped to $.11/cwt and in 1984 they were worth an average of $.40/cwt less than British crosses. This change apparently reflects discrimination at slaughter against the heavier, leaner, later-maturing exotic crosses in this Mideastern market such that by 1984 postulated savings in production costs were almost completely wiped out by price discrimination. Even though such discrimination appears unwarranted, it must be considered in designing crossbreeding programs and effectively reduces the optimum size divergence between sire and dam types.

Increasing Weaning Weight by Increasing Milk Production. An increase in weaning weight can occur without an increase in growth potential if the milk production level of the cow herd increases. Simulation results (Seldin, 1983) suggest that if weaning weight is increased by 9.5% (comparable to that discussed for terminal crossing in the preceding section) by increasing milk production, costs of production are expected to decline by up to 4% ($2.40/cwt), provided the increase in milk production can be accommodated in the management system without an associated decline in cow fertility. Notter et al. (1979c) further suggested that economic efficiency to weaning was likely to increase with increasing milk production as long as the pounds of calf weaned per cow exposed also continued to increase. Analysis of feeder calf prices over an intermediate weight range suggested that a 9.5% increase in calf weight at a constant frame size was likely to be accompanied by a decline of only 1% ($.60/cwt) in price. Thus, in this scenario, if calf weight could be increased by 9.5% by increasing milk production without losses in fertility, such a strategy would be advantageous so long as price did not decline by more than $2.40/cwt, a discount that appears unlikely to occur.

Conclusions. Results of these three hypothetical situations suggest that the most straightforward way to increase the profitability of weanling calf production is through increases in the milk production of the cow herd to a level that will maximize pounds of calf weaned per cow exposed. This goal is probably best achieved through use of a crossbred cow where the specific optimum crossbred type will vary with the production environment. Terminal crossing can lead to additional, smaller increases in profit, but must be used in a way that minimizes calving difficulty and avoids price discrimination against the resulting crossbred progeny.

Using Crossbreeding to Meet Market Specifications

As discussed above, market requirements and pricing considerations can restrict the choice of crossbreeding programs. However, we also have an opportunity to use crossbreeding systems to meet market demands in a way that will maximize economic efficiency.

Notter et al. (1979c; figure 1) have suggested that a difference of at least 400 lb in mature cow size between sire and dam types in terminal crossing can be readily tolerated if the large sire types are not bred to yearling and 2-yr-old heifers. This maximum tolerable size divergence can be combined with existing market specifications for slaughter cattle to delineate desirable sire and dam types for use in crossing. Carcasses that are lighter than 550 lb or heavier than 850 lb are difficult for packers to merchandise; thus, slaughter cattle outside a live weight range of 900 to 1,350 lb are likely to receive substantial price discounts, even if those cattle are properly finished. Figure 2 (Notter, 1984) shows the relationship between sire breed size and cow breed size as a function of market demand and the maximum tolerable size difference.

As an example, assume that cows of an 1,150 lb mature weight type are bred to bulls of a similar type for the first two calf crops and are then bred to a 1,550 lb sire type for subsequent calvings. Also assume for purposes of illustration that the target slaughter weight for steers is equal to the mature weight of a cow of the same type (i.e., that steers of an 1,150 lb mature weight type reach choice grade at 1,150 lb) and that heifers weigh 100 to 150 lb less than steers at slaughter. In this system, calves from the first two calf crops would go to market at weights of about 1,150 lb for steers and 1,000 lb for heifers. Calves from the terminal cross would go to market at weights of about 1,350 lb for steers [= 1/2(1,150 + 1,550)] and 1,200 lb for heifers. This system would produce cattle covering almost the entire range of acceptable slaughter weights, but with very few cattle outside this range. Note that an increase in cow size would result in production of terminal-cross steers that would be outside the acceptable weight range (>1,350 lb) or would necessitate use of a smaller terminal sire type which would in turn reduce the desired divergence of 400 lb between sire and dam types. Thus, little would be gained by increasing cow size. Note also that increases in sire breed size above 1,550 lb would likewise result in production of animals outside the acceptable market weight range unless the increases were accomplished without increased calving difficulty in order to allow compensating reductions in cow breed size.

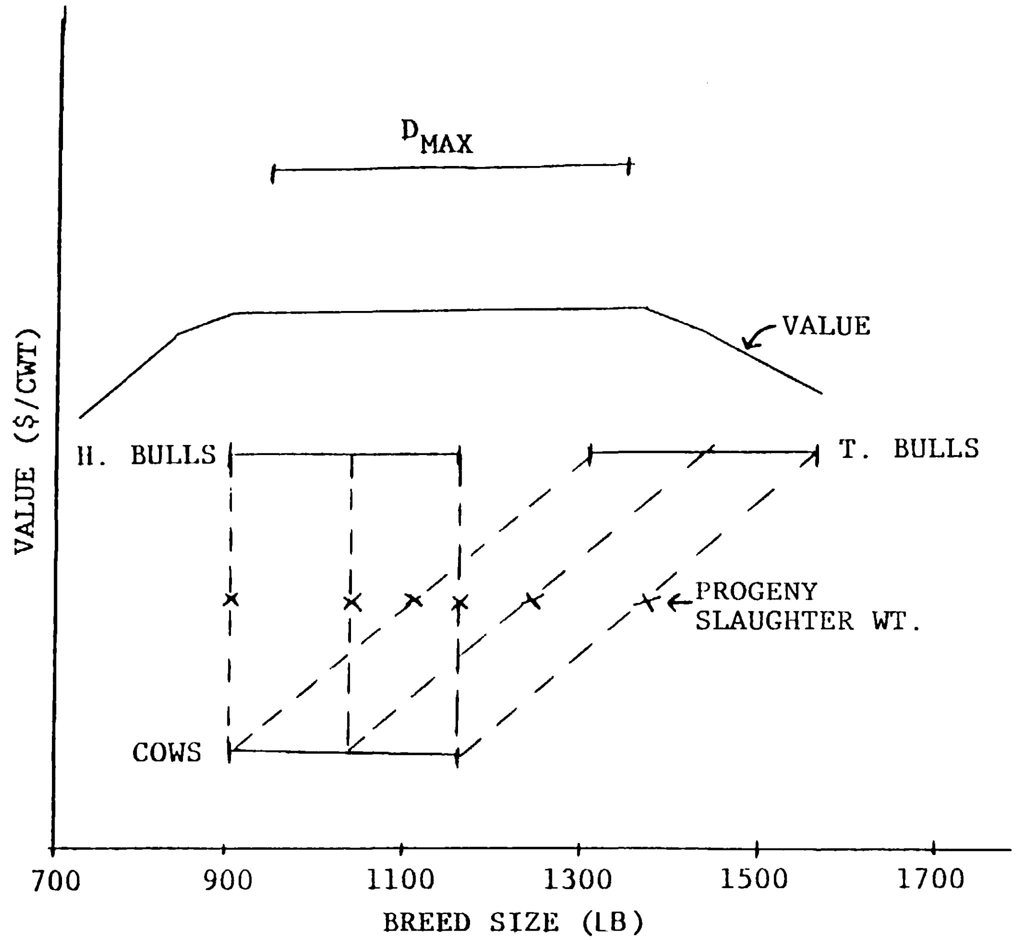


Figure 2. Options for production of crossbred slaughter progeny as a function of product value, sire breed size, dam breed size and the maximum acceptable size divergence between sire and dam (D_{MAX}). The system involves use of both moderate-sized sires (H or "heifer" bulls) for use on young cows and large terminal (T) sires for use on older cows to produce market progeny (X). Taken from Notter (1984).

The above example, coupled with the concepts shown in figure 2, suggests the following conclusions: 1) the desired mature weight for commercial cows is likely to be in the range of 900 to 1,150 lb and should increase only as the market becomes willing to accept heavier carcasses, and 2) increases in sire breed size above those shown in figure 2 are also not indicated unless market weights can be increased or unless calving difficulty can be controlled to allow increases in sire size to be accompanied by decreases in cow size, with 900 to 950 lb as a practical minimum size.

The Crossbred Cow

All of the preceding conclusions argue strongly that profitable commercial crossbreeding programs must have a productive, adapted cow herd at their center. Effects of maternal heterosis further argue that this base cow should be a crossbred if at all possible. If these crossbred cows have milk production levels consistent with maximization of weight weaned per cow exposed in the environment in question and if they are of an intermediate size (figure 2), the producer has tremendous flexibility in selection of sire types to meet specific production or marketing requirements. Thus, perhaps the most critical consideration in setting up a crossbreeding program is to design the program in a way that will assure continued maintenance of a productive, adapted crossbred cow herd.

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MERCHANDISING BEEF IMPROVEMENT

James H. Leachman
Leachman Cattle Company, Billings, MT

The history of animal breeding shows that successful operations are those which practice a balanced combination of three things: genetics, management, and marketing. Our family was interested in being able to succeed, not during the short run or during one era of the cattle business, but through different times, and to do this we practiced a balance of these three factors.

GENETICS

I'm not here to speak today about genetics. But to touch on it a little, you people have developed successful formulae for genetic improvement. The successful breeders that are here today, those who were recognized last night, have used those formulae. The major difference between them and the other people in the country is that these people know that those formulae increase their probablity of succeeding. They don't breed their cattle as if they were playing blackjack or craps by the house rules in Las Vegas. They know that these formulae give very predictable results when properly applied.

In our own operation, we have tried to apply those formulae as much as we possibly can. Sire proofs have played an important part in selecting sons that we use in the herd. This slide shows a worksheet that I use . On it is the progeny data, in condensed form, on all the bulls that we have access to within our herd. It shows the number of progeny, birth, weaning, and yearling ratios for our herd and other herds. In recent years we have placed an emphasis on having as large a spread as possible between birth and yearling data. This slide shows the data on a bull named Leachman EBV 3531. It shows that his progeny were 2% under our herd's average birth weight and 4% over the average yearling weight, giving him a six point spread.

Because our customers should and do crossbreed, we have been systems oriented. We knew that we had to have more than one line of cattle to keep them as repeat buyers, so we developed a system called optimum mainstream crossbreeding. This system uses compatible breeds, but breeds that still have enough variance for selection within them and complementation between them. We require those lines, regardless of their breeds, to be polled, pigmented, and performance tested. We use Angus, Red and Black, South Devon, Simmental Baldy, and Salers HybRED. Currently, we are developing professional black lines in each of these strains. To accomplish much of this, we are going to a cooperative breeding system whereby we work with breeders, breeding, management and marketing systems that are compatible with ours. This is a picture of the MacDonalds from Three Forks, Montana, who have a Simmental herd whose cattle fit very well into our program. Select bulls from their program are marketed in our annual sale under a cooperative venture.

MANAGEMENT

I think with many things, whether it's the muscles of your body, your mind, or your pocketbook, sometimes you need to stretch them to really test them and to develop the procedures or policies that are really needed to be implemented. In our own operation, we are involved with the logistics of large numbers. What may be very easy to do with 100 head we make very difficult by trying to accomplish with 1000 head! We try to balance the old ways, the proven ways, the ways of our ountry, with modern techniques. In this slide we see a cowboy who range calves three to four hundred cows in a four section pasture. He has been taught that records are important. He has been taught that calves have to be weighed, and if they are not weighed, he is not to guess. He has a piece of wire that's through the corner of every tag. The tags are preprinted, prenumbered, and sorted to help him in his job.

Our experiences have led us to develop policies, procedures and methods of handling data. This slide shows a cardboard sheet that contains eight hundred numbers. Our help are told that they can never make a list of cattle that is not in numerical order; there is never to be an animal that does not have a unique number, or identification; they are never to work a group of cattle without a prenumbered list; and they must write with an indelible pen. Note that the cardboards are actually paste ups of computer printouts, necessary to make them useable in the elements. In this slide we see one girl who was able to accurately verify all the cows we synchronized on this particular day, as they passed through the chute behind her, because she had all 1,250 numbers on two pieces of cardboard.

As I travel, I see many great examples of performance data, but I don't think the system is made for the outdoors, in fact, it's very cumbersome even in the kitchen. So we have tryed to develop systems where we have everything that we want to know about an animal on one line. And that is on some type of form that is durable outdoors. Then I want all that information in one book. This slide shows that particular book which has all the breeding, pregnancy, calving, and calf data for our entire herd. I carry that book, along with others in a cardboard box, and basically have all the records on all of our cows in my vehicle. Again, on one line there is all the information on breeding, calving, and pregnancy check for one entire season. That same book can be used in the field while we verify all the birth data at branding time. In fact, I use it wherever we work cattle for whatever reason. I use it as an illustration that we have a need for systems which are useable and handy. This photograph was taken during a break in the middle of working cattle. I think that our orientation and dedication to performance is evident in the fact that this cowboy, given the opportunity, is looking down through the data.

MARKETING

Now on to the area that we're really here today to talk about, marketing. What is marketing? It is simply identifying and producing to satisfy a need. The question that I raise in agriculture, especially, is "Do we market what we produce, or do we produce what we can market?" There is a distinct difference. To relate that to animal breeding, look at a breeder, proposing his philosophies on why you should buy this animal. Ask yourself, "Is that what he believes and is trying to sell or is he selling what he has?" When people had small cattle and were changing them to larger cattle, you heard people still say that the smaller cattle were right; but the minute they had a large one, they then became an advocate of the larger cattle.

What I say to you is that I think we need to produce for market, we need to produce to satisfy needs. We don't need to produce products, pile them on the ground, and expect somebody to come to buy. Years ago, we did some market research, and we have done much since, studying any and all data we could get our hands on. From that we've felt that there was a need, again, if only for ourselves, to define what we thought was a professional bull. Although it's a lengthy definition, it says, "A Professional Bull, regardless of breed or breeder, should be professionally bred, managed, measured, marketed, and guaranteed in sufficient numbers, and at an affordable price to maximize net commercial production through an optimum level and combination of maternal and growth traits in as trouble-free a genetic package as possible, and one that is unrelated to the customer's cows so as to produce heterosis." From our market research we learned that we had to go out into the field and carry the information and the knowledge that you people have given us. We developed a system of presenting our data on our bulls on one line. I think we took the ultimate step this year, in a catalogue of some 1180 head of cattle, there was not one single pedigree. The data was complete. We gave the sire and the sire of the dam, but I don't know of any seedstock sale, at least of that magnitude, that never printed a pedigree. I think we did the people a favor.

Many times I have people ask me, "What is the great granddam of that bull?" or "What is the 4% that's in that 96% Red Angus bull?" And I have to say to them, "Do you know who your great great grandmother was?" The performance data for the programs that we have taken, and the things that you people have done have allowed us to describe our cattle accurately and to supply them to people for specific needs, to supply cattle by specifications. Because we can group those cattle in uniform groups, which have been enabled by massive population genetics and A. I., we have developed a system which allows commercial breeders to buy bulls at auction. That system allows a breeder to take as many bulls within a pen, at his last bid price in catalogue order. In fact, those bulls are grouped so that if you have bought the bull in the ring and you like his performance and the price that you have committed for, you can literally close your eyes and buy the next bull secure that he will be almost an identical twin. We have people who buy two bulls that way, or thirty-six bulls.

That data has allowed us to communicate with customers all over the world. People that we have never met, that have never seen our cattle, or ever been to our operation, and I'm talking about people that are in your back yard. People that you maybe have felt that you could not sell a yearling bull to, or a $1,500 bull, or an unregistered bull, or whatever. In this past sale there were over two hundred buyers and fifteen percent were sight unseen purchasers. Many of our most satisfied customers are, in fact, sight unseen purchasers.

Our philosophy is that we want to produce more bulls, better bulls, for less. In what other industry do the merchants or the manufacturers, or the retailers sit around at the bar at night and say, "I've got the most expensive washing machine?" If they did, they would probably not have the market share that they would want, and they would not be successful. But that's what we, as purebred breeders, have done in the history of purebred breeding. We have bragged about what that one bull brought, and we have bragged about our averages, but that's not really what the consumer or commercial man wants, and that's not what our banker wants. He's more interested in the net. We have a philosophy at our place, and if you had as many bloody bulls as we do, so would you. It goes that the best bull is a sold bull, no matter for how much or to whom.

On to some other points related to marketing that I would like to relate to you from our research and experiences. You've heard the statement, "The buyer is always right." Well, I don't believe that. I don't believe that you will keep your customers satisfied by practicing that belief. On the contrary, our position is that we freely express our feelings to potential customers. In the last couple of days, in casual conversations with Jim Innes from New Zealand, he's expressed the view that although there were some things and some breeds that could be put into those cattle that would improve them, he had to consider his customers, his traditional, wealthy customers who wanted them the way they are. I would propose to him that in the long run, to succeed, he sould do what he thinks is right. He needs to educate his consumer so that he can make the changes that should be made. The war on performance that you people have fought has been a great one, and you have done many things, but as you've studied the leading seedstock in this country, even those from some of the great performance breeds with mandatory performance, you'll find many of these weaknesses. We have had to go out, and that's one of the reasons I'm willing to speak here today, and tell these people that there is tremendous literature available today, in a language that they can understand, that explains the programs. We give slide shows and seminars, which talk about the characteristics of what we think successful bull buyers are. We have programs that discuss why bulls are so important, how they can crossbreed, how they can use data. We have a talk that says that when the wind blows, even turkeys fly. If you ever want to know how to identify breeders who don't use performance data, you can always tell because they carry a turkey under their arm for spare parts.

We don't have the intellectual ability or education of you people, nor do many of our customers. So, what we try to do is simplify philosophies and principles, and speak to them in a language that we can communicate in, and that they can understand. This is a slide that I use to illustrate crossbreeding, and I think it's one that people understand and can relate to. It may not be totally correct from a theoretical standpoint, but I still think it makes the point. If you take an Angus bull that weighs 400 pounds and mate him to a Hereford cow that weighs 400 pounds, you would expect the mature progeny to weigh 400 pounds, but it weighs 500 pounds. That 100 pound difference is attributable to heterosis, the chemical kick! Another point that I try to make with this slide is that it might be a better route to net profit than trying to mate that 400 pound Hereford cow to a bull that weighs 800 pounds to come up with a 500 pound progeny.

We have material that we've developed: a newsletter that goes to over 5,000 people, a catalogue that must be an inch and a half thick, and 150 copies of our own video which are in continuous rotation in schools, 4H clubs, FFA clubs, colleges, cattlemen's associations, urban groups, commercial groups, friends, you name it. The video is a very new way of communicating, but if my children are evidence of the way the young people relate, I think it's a way we can communicate with them.

This slide was taken exactly the same time as the opening shot in our "Hell Bent for Leather" video which is now in some six countries communicating the message of Leachman Cattle Company. That message is basically one of merchandising beef improvement. Basically, every hour of my life is spent merchandising. If I'm on a plane with a businessman, or if I'm downtown talking to bankers, with an exhibit, or lawyers. I think always, werever we are, should be communicating and merchandising beef improvement.

Although I come from a very traditional purebred background, I think that we have been fairly liberal and progressive with our breeding philosophies, and to me, the purebred industry today is missing many of the major points. I have a whole series of slides in this area of which I only have a couple to show. They ask questions such as, "Why do purebred breeders dislike measuring pounds?" "In 1985, why do breed associations not have mandatory performance requirements?" In the merchandising of beef improvement, I think there is unfair competition out there. There's competition out there that does not use performance data, yet the things that you and I do cost money, time and effort. But we're at an unfair disadvantage to those people who do not follow the performance way. I would propose to this group that there must be some positive way of providing an incentive to take those breeds, those associations, and those breeders who practice performance testing and put them into an elite group which recognizes the fact that they follow BIF recommendations. This would be a positive, not a negative move. I don't think that breed associations can, nor will, be measured by the standards that they've been measured by in the past: numbers of members and registrations. I think the data already shows that with declining numbers at this time and in the future, such standards will not work. I think that not only do we have to be concerned about breed improvement, but we need to be concerned about breeder improvement. There has to be not only breed improvement, but economic improvement. To say it a different way, what's more important is the quality of the breeder, not how many breeders. It doesn't matter what location or area of the country, or what their size, it's the quality and the philosophies of their program that will count. I think that breed associations would be better off with stronger members, who in turn could support a strong association. I don't think you can run away form situations or problems. I think that the height situation, if it had been addressed by this group right here at an earlier date, and if procedures and philosophies had been expressed so that the data could be used for what it is and not what it is, so that it could be adjusted just like the other data is, then we would not have the height problem, the frame problem, that we have today.

I think that we're at a very important intersection in the cattle business. As a producer, I don't have, again, your experience or capabilities, but I think I have the heartbeat of the commercial cattleman as much in my hand as anybody in the nation. What you proposed years ago has succeeded in my mind, and maybe even faster and to a greater extent than you thought. We've moved our cattle; I think we've moved them in an alarming way in growth. I'm not sure that any segment of the industry needs the cattle a lot bigger than they are. You know, it doesn't take a very big animal to make a 1,050 to 1,250 pound steer. Yes, there are cattle out ther that are not big enough, but do we need to make the big ones bigger to make the small ones bigger? I doubt it. I think we're going down the road at 100 mph. The road is capable of that speed, and the cars are capable of it. But, if we travel at that speed, and if we take our eyes off the road for one split second, we're going to have a wreck. I think that's the way many of us are managing our breeding programs at this time. I don't think that the environment, the feeder, the packer, or the consumer wants cattle all that big. This slide was taken in January, 1975. We graze our cattle year round. That year I had 1,200 replacement heifers of which 600 were somewhat of this kind. I personally calved them during the daylight hours, had over 90% of them calved, tagged, nursed, and turned out, but weaned less than a 50% calf crop. I learned from that lesson ten years ago. We decided that we're going to go in a little bit of a different direction. I think the challenge to this group, with their brain power, is to come up with different ways to continue to make progress, and continue to be progressive, that don't require making the cattle bigger and bigger, or heavier and heavier, beyond an optimum point.

If I were able to have my new video here today, for the pleasure of Jim from New Zealand, I would give you a helicopter viewpoint of our test facility. The thing that I can relate to you is that I have never been more excited or on a higher high in the cattle business than I am today. I would like to share with you some of the kind of people we deal with. This slide shows a cowboy from Elk Mountain, Wyoming. He is a cowman, and nothing but that. He purchased 25 bulls at our sale and has 90 of our bulls all together. After our sale that night, he stuck a finger in my rib and said, "Jim, this is no big deal." I asked, "What do you mean, Pete?" And he replied, "I just got done selling two million dollars worth of fat cattle." Well, yes, 2,200 head weighed 1200 pounds and sold on the rail. What you have been proposing, is working! People are starting to be able to successfully merchandise breed improvement. There is more vertical integration. There are people holding the product longer to get the value added.

This pictures a gentleman from Colorado whose program I understand. He started by going to Clay Center, and from their data and advice, has designed a composite breed that allows him to efficiently produce a high quality meat product that he plans to market under the ranch's own trademark. The ranch is owned by the designer, Ralph Loren, and the trademark is the well known Polo design. Their plan is to merchandise meat as a high quality product. They purchased twenty bulls.

Here is a gentleman from Oklahoma who owns butcher shops and is in the meat distributing business. For the second year in a row, he bought two potloads of replacement heifers.

Young people can't make it in agriculture? I don't consider myself that young, but I was broke when I started this project. It's been built through a couple of recessions, a couple of droughts, two record winters, a record flood, and probably the depression of my life. Here are some young people who I know who started during these difficult times and are succeeding. The man in this slide is Russ Danielson's brother-in-law. He has a great herd of cattle, one of the best herds of cattle of any breed in the state of Montana. He actually lives in Squaw Gap, North Dakota, but nobody likes to claim North Dakota. He had a bull sale this spring, standing room only, where eleven-month old bulls, with complete performance eata, averaged $1,600, and not a single one of those bulls was a purebred. He is succeeding.

In this slide, the gentleman on the right is a manager of a large ranch at Prairie City, Oregon. They are on a three breed rotational cross. We've sold bulls to them for about ten years. They've exhibited the Champion Carload of replacement bred heifers at Denver for the past two years. They have changed one of their breeds because the cattle they were buying in that breed were too big, and have gone to a different line within our product line.

Here we have Fred Johnson, from Augusta, Montana, who manages the J. B. Long Ranch, a ranch that's run under very strict business and performance principles. He's taken our catalogue and condensed the data into a little piece of cardboard. He knows exactly the bulls that he wants. There is no romance in his operation whatsoever, but he'll pay $2,000 to $3,000 for the very best performance bulls he can find.

This gentleman is shown coming out of the seminar on crossbreeding which we held and which Rich Whitman from the Simmental Association headed up. The thing I can say to you is that never in the history of the cattle industry have the people been more receptive to the philosophies that you are proposing. And they are in a better position to understand them and to merchandise their beef imporvement. The man here owns not only a large ranch in southern Wyoming, but also a couple of farms down in the valley of Colorado because he feeds out all his cattle and sells them on the rail.

In this slide there are ranchers from the sandhills of Nebraska. They've bought bulls for ten continuous years.

For the first five years, they thought they were crossbreeding, but they sold all the heifers, and as you all know very well, they were missing the main advantage of crossbreeding. But since that time they have begun to keep the females and are now truly crossbreeding.

The thing that's true about all these people is that they are all part of the industry out there that has decided that they have survived and that they are going to succeed. They're a little different from the people we've known in the past, and I would say to you that they are actually dealing from strength, because they are effectively merchandising the beef improvement that they have had in their herds.

It's a time for cattle people to quit fighting amongst themselves, whether it's purebred organizations or breeders within those organizations, or whatever it may be. I've always said that when we get into meetings, cattlemen's meetings, we need to leave our competitive differences outside. This slide shows a fence between my ranch and the highway to Billings. It's been cut between every post. We no longer have the margins that will allow that kind of loss. We cannot afford to fight amongst ourselves. We need to tell our sons to leave their guns at home. We need to provide opportunities to our sons that are compatible and comparable to what they can obtain in other industries. We need to be competitive. We need to find new products and new ways of marketing those products. We need to come together and work together, even though we are economically many small, independent producers, to support whatever groups which are working towards common goals.

In closing, the only thing I ask of you, as a group, is that while you develop new performance programs, which you have always promised to be genetically sound and theoretically correct, you remember that we, the producers, must be able to successfully use those programs in our herd from a management and marketing standpoint. Whoever developed the system of ratios which automatically puts half of my bulls under 100 was not a marketer. What other company produces one hundred products and begins by saying that fifty of them are no good? I think you need to determine new ways that measure the cattle as effectively as you were measuring them, but ways that allow us to market more effectively. And when the history of this era is closed I hope that we, at Leachman Cattle Company, can say that we did our small part in helping merchandise beef improvement. Thankyou.

WHAT I HEARD ON MY TRIP TO THE TOWER OF BABEL

H. A. Fitzhugh
Winrock International
Morrilton, AR 72110

My presentation will be an overview of the BIF sponsored workshop, "Systems Approach to Beef Improvement and Management," held November 18-20, 1984 at Winrock International. The purpose of the workshop was to evaluate the appropriate role of BIF in implementing a systems approach to beef improvement.

My title, "What I Heard on My Trip to the Tower of Babel," reflects some of the confusion about systems. Some of the jargon -- maximize versus optimize, holistic -- is not well known among cattlemen. Some of the tools of the systems approach, such as computer modeling, have been emphasized rather than the practical applications. Generally speaking, the systems approach provides a strategy for making decisions about the system with due consideration of the full set of factors -- biologic and economic -- which affect the system. Cattlemen concerned with making a profit from beef production certainly do their best to consider all factors which affect their operations; thus, they do their best to follow a "systems approach."

This point led to general agreement among the workshop participants -- seedstock and commercial producers, animal scientists and extension specialists -- that the primary goal of beef improvement should be increased profitability. This goal is obtainable by increasing productivity and reducing costs at the herd, rather than the individual level.

The value of the systems approach was illustrated by Tom Cartwright in his summary of important lessons learned from systems analysis:

> Changing genetic potential for primary production characters (size/age, maturing rate/size, and milk production) causes herd production changes that tend to have counterbalancing effects on net herd productivity, biologic, or economic.
>
> Intermediate values for primary production characters tend to be optimal, but vary for different production/economic conditions.
>
> Optimal values for the primary characters tend to increase, as nutritional quality, availability, and stability (across seasons and years) increase.
>
> There is an optimal set of levels for primary characters that best synchronizes with each set of production/economic conditions.
>
> Levels for primary characters must also be synchronized with one another to form an optimal set.

Increasing efficiency of production involves increasing herd offtake (gross revenue), decreasing herd input (costs) or both. Selecting to attain optimal levels for the primary (production) characters tends mainly to increase herd offtake while selection for the secondary (soundness) characters tends mainly to decrease inputs required.

Dave Notter described mathematical tools available to cattlemen interested in applying systems analysis to improve herd productivity and profitability. As computers become more readily accessable, the practicality of the tools increases. He urged that BIF encourage and monitor the development and improvement of these tools to help cattlemen apply a systems approach to beef improvement.

Work group discussions led to general agreement on the following recommendations:

1. Optimize rather than maximize performance. There are no ideals which fit all production and market situations. In fact, extreme types tend to be at greater risk whenever production environment or market requirement change.

2. One or a few traits should not be emphasized to the exclusion of others. For example, over-emphasis on size may be to the detriment of soundness. Traits which seedstock producers should consider include libido, scrotal circumference, maternal traits, puberty, mothering ability, cow efficiency, calving ease along with growth rate, hip height, and mature size. Commercial producers should consider puberty, disposal reason, and cow efficiency.

3. Emphasis should be placed on measurement of inputs and outputs at herd level and on estimating herd efficiency. Focus should be on net impact on productivity and costs at herd level when selecting individuals.

4. A first attempt was made to formulate guidelines on the appropriate levels (optimal ranges) for different traits which would fit needs of different production environments and breeding programs. Production environment was defined by level of nutrition available and degree of climatic-disease stress. Breeding programs were rotational, maternal lines and sire lines. Ranges were suggested for milk yield, cow size, ability to store fat, adaptation to stress, calving ease, and lean yield. This initial effort should be a useful basis for future consideration and modification of guidelines.

Results from the workshop have been published in a 40-page proceedings. These proceedings provide a basis for the BIF Systems Committee (chaired by Jim Gibb) to develop guidelines and recommendations for BIF consideration.

Not all the doubts and disputes were resolved at the end of two days of intensive discussion. However, the workshop did generate genuine enthusiastic support for BIF to pursue efforts to implement the systems approach to beef improvement.

SIRE EVALUATION COMMITTEE REPORT
1985

Dr. Larry Cundiff, Chairman, opened the meeting at 2:10 p.m., May 2, 1985. He reviewed the agenda for the meeting which was as follows:

1. Reports from representatives of the several member organizations on their plans for sire evaluation analyses and reports for the year, 1985. These included Simmental by Dr. Quass of Cornell; Angus by Dr. Doyle Wilson of Iowa State; Polled Hereford by Dr. Britt Middleton of APHA; and Limousin, Brangus, and Hereford by Dr. Larry Benyshek of University of Georgia.

2. Brief comments on two technical notes to be published in the annual proceedings of BIF by Dr. Keith Bertrand and Dr. Brad Skaar.

3. Brief statements on current problems concerned with beef sire evaluation and discussion of these.

Dr. Cundiff noted that the sire evaluation guidelines were completed at last years meeting and would appear in the new publication of the Guidelines probably by the mid-year BIF board meeting. Brief summaries of (1), the reports follow.

SIMMENTAL: Dr. Quass said that two multiple trait analyses (one with birth, weaning, and yearling gain and two with first calf calving ease and all later calving ease scores) were conducted. The general model included contemporary groups, age of dam effects, direct sire groups, sires maternal sire groups, maternal grand sires, and residual. Yearling gain analyses did not include the maternal factors. The male relationships included were sire and maternal grand sire. Thompson's accumulated group model was used. The approximate predection error variance was calculated using

$$\underset{\sim}{C}^{ii} = C_{ii}^{-1} + C^{-1}_{ii} \left[\sum_{j \neq i} C_{ij}\, C_{jj}^{-1}\, C_{ji}\right] C_{ii}^{-1}$$

where i and j refer to sires.

ANGUS: Dr. Wilson said that first direct birth weight, weaning weight, and yearling gain (yearling weight) single trait analyses would be conducted using a contemporary group, sire group, sire, dam and residual model. Using the solutions for sire group and sire direct effects, the model contemporary group, sire group, sire, maternal sire group, maternal grand sire, residual dam, and residual would be used to solve for maternal sire group and maternal grand sire (direct and maternal partitioned). Thus, maternal expected progeny difference would be available along with the direct effects.

POLLED HEREFORDS: Dr. Middleton said that the Polled Hereford Young Sire Test Program and the Field-Data Evaluation would be continued. The single trait model for sire evaluation includes contemporary groups, dams within herds, sire group, sire and residual. The model for maternal weaning weight (daughters first calf) includes contemporary group, maternal sire group, maternal grand sire, and residual. Bulls with progeny data for any of the four traits (BW, WW direct, WW maternal, and Yearling gain [YW] are included in the A-inverse for all traits. Publication was discussed.

LIMOUSIN, BRANGUS, AND HEREFORD: Dr. Benyshek said that a multiple trait reduced animal model had been used to analyze the first two breeds and would be used on the field data of the third breed. Detail of the procedure and model appear in the technical note from the University of Georgia. He stated that to have comparable EPD's on young sires (18 mo.) of the breeds would be desirable for the commercial producer. EPD's for the direct and maternal effects on several traits for all animals of a breed was indicated to be quite useful. Problems of computation were discussed.

Next, short presentations of the technical notes were made followed by long awaited coffee.

Then several questions were brought up for discussion by the committee. These questions were as follows:

1. How can this committee respond to the systems emphasis by developing sire evaluation procedures for the traits involved in the reproduction complex. The point was made that measures would need to be incorporated into the several performance programs.

2. Can back years be cut from the sire evaluation analyses? Dr. Henderson responded by noticing that the dairy procedure does not eliminate data and noted the problems if it were eliminated.

3. Questions concerning the breed structure and the use of F in the A^{-1} matrix were raised.

4. The use of old designed data (Dr. Quass noted it could be included with a different residual), the use of more commercial herd data in sire evaluation, and the need for carcass information by the breeds was brought up.

But the hour was late. Possibly these questions will serve for future topics to be considered.

Richard Willham

BIF
LIVE ANIMAL EVALUATION
COMMITTEE REPORT
MAY 2, 1985

PRESIDING CHAIRMAN:
JOHN CROUCH, AMERICAN ANGUS ASSOCIATION

Chairman Crouch called the meeting to order and outlined the charge to the committee. The live animal evaluation committee will be required to make recommendations to the BIF Directors by June 1, 1985, concerning the inclusion of a frame score chart in the new BIF Guidelines. To update the committee Dr. Bob Schalles, Dr. Eldin Leighton and Dr. Dale Vogt were invited to present research data relating to growth rates in beef cattle.

I. Dr. Schalles, Kansas State University reviewed research that led to the present BIF frame score chart that was adopted in 1984. He indicated that additional refinement to put the right components to the equation may be necessary before final publication. The inclusion of growth measurements from frame score 8 and 9 cattle is being done.

II. Dr. Leighton, University of Maryland Foundation presented a summary of Wye Plantation data on growth rates of bulls and females (summary enclosed). The need to define the objective of using height measurements to (1) characterize an animal, or (2) as a collection of a group to describe a population was presented. TEXT: See pp 91-93

III. Dr. Vogt, University of Missouri presented a summary of Missouri data regarding frame scores. Data presented was from weaning data collected on 43,957 Angus, Hereford, and Simmental cattle.

IV. Discussion: Greg Martin asked the committee if the purpose of frame score was to describe (identify) cattle or to define biological size. It was concluded by the committee that the purpose would be to categorize cattle within a population. Other questions and comments included:

a. How important is frame score for females?
b. Is there enough existing data to make up frame score charts?
c. Frame score charts should be limited to cattle between 7 and 18 months of age.
d. Are frame score charts currently used by industry adequate, and would BIF published frame score charts only add additional confusion?
e. Should BIF discourage the use of a frame score chart and standardize height at weaning, yearling, and 18 months of age?

Chairman Crouch assigned a committee of Schalles, Leighton, Vogt, and Dr. John Massey to finalize a recommendation regarding the use of height measurements to categorize cattle and present the report at the next meeting of BIF.

Approximately 60 people were present at the meeting.

Respectfully submitted.

Russ Danielson
NDSU

Hip Height and Frame Score: Adjusting for Differences in Age

Eldin A. Leighton
University of Maryland
Beef Improvement Federation Annual Meeting
Madison, Wisconsin - May 2, 1985

The set of traits which form the criteria for selecting replacement breeding animals remains the prerogative of the cattleman, the producer who owns the herd and makes all management decisions. Many will argue on both sides of the issue about the merits of selecting to increase hip height, to decrease hip height, or to hold hip height at some constant level, but because that is a central decision of a specific breeding plan, it will not be addressed in this paper.

Age differences among calves will often account for much of the variation observed when measuring the hip height of each calf in a group on one particular day. Other causes of variation include sex, plane of nutrition (often designated as contemporary group), and the sire and dam responsible for producing the calf. When the objective for measuring hip height is to assess genetic differences among calves, it is essential that variation caused by age, sex, and contemporary group be removed so that the remaining differences represent only genetic differences among calves. The same reasoning also holds when the objective is to use hip height as a means of describing the height of the calf when it is one year old. Because selection usually occurs within sex and contemporary group, these sources of variation are automatically controlled.

Frame score has been arbitrarily defined as a means of grouping together cattle of the same hip height at a year of age with the idea that all cattle in the same frame score should be similar in muscle composition and grade. This also is a separate issue which would evoke many discussions, both for and against. The fact remains that cattle are being classified into frame score categories based upon their attained hip height at one year of age. Because most calves are not exactly 365 days old when measured, it is necessary to devise some method for predicting the hip height that would have been observed if the calf had been measured at exactly 365 days of age.

Description of Data. To determine an acceptable method for adjusting hip heights to a common age, records were available from 164 bull calves and 172 heifer calves born in the Wye Angus herd in 1983 and 1984. The calves were born in the spring, managed in their respective groups until weaning at an average age of 205 days, and then maintained on separate growing rations by sex until they were about one year old. Bulls were placed on a typical postweaning gain test for 140 days. In 1983, the warm-up period following weaning was 21 days in length while in 1984, the warm-up period lasted only 14 days. Heifer calves were managed in a similar way except that they grazed on winterpastures and received supplemental feed as high quality alfalfa hay or corn silage instead of concentrate. The heifer calves were not given any warm-up time following weaning, but rather immediately began the 140 day test. The hip height of each bull calf was measured at weaning, at the beginning of test, and at each 28 days to the end of test for a total of seven different hip heights recorded on each calf. Because the heifers were not given any warm-up period, their corresponding heights were recorded only six times from weaning to the end of test.

Adjusting Hip Height to a Common Age. Two important questions required an answer as a first step toward developing an age adjustment procedure for hip height at 365 days of age: (1.) over a reasonable range in age around 365 days, is a linear adjustment satisfactory, or must a quadratic adjustment be used to properly account for differences in age among calves, and (2.) can one equation be developed and used for all cattle of the same sex, or should a separate equation be developed for each animal? Both these questions were answered by computing an analysis of variance within sex as outlined in Table 1. For either sex, the model using only a linear term to explain growth in height around one year of age accounted for more than 99 percent of the variation indicating that a linear adjustment is probably satisfactory over that range in age. The question of one model for all calves versus a separate model for each calf has two parts: are all calves of the same sex increasing in height at the same rate for a given age, and is the intercept equal for all calves? From Table 1, it is noted that for the calves available for this study, the intercept was equal among all calves of the same sex, but the rate at which each calf increased in height was quite different from one animal to the next. This leads one to conclude that for these calves, one common intercept but separate slopes should be included in the model to predict hip height at 365 days of age (HH365). This model was fitted using a generalized least-squares procedure which accounted for the correlation between successive heights for the same calf but assumed that each calf was unrelated to any other calf in the study.

Table 1. Analysis of variance for the appropriate model to adjust hip height to 365 days of age.

	Bull Calves			Heifer Calves		
Source	df	Sum of squares	F	df	Sum of squares	F
Equal intercepts	163	174	0.95	171	171	0.85
Equal slopes	163	250	1.37*	171	241	1.20*
Common slope	1	10,316	9,184**	1	6,447	5,477**
Residual	820	921		688	810	

*P<.06
**P<.01

Since the evidence in these data did not support the hypothesis of a separate intercept for each calf, the model was refitted by removing the term for equal intercepts. From this model, a separate prediction equation was obtained for each animal based on a common intercept and separate slopes using seven data points for each bull calf and six for each heifer. From this prediction equation, HH365 for each calf was obtained.

Frame Score and Goodness of Fit by BIF Equation. Each calf was placed in its appropriate frame score class based on HH365 computed as outlined above. A predicted frame score was then computed using the recently recommended BIF equation and each of the seven heights taken for each bull or six heights measured on each heifer. To evaluate the adequacy of the BIF equation for these data, the predicted frame scores were classified by age of the calf in months when the height was measured, and the percent of correct classifications was then tabulated as shown in Table 2. From these results, it was concluded that the BIF recommended equation was not appropriate for classifying Wye Angus calves into their correct frame score class.

Table 2. Proportion of Wye Angus calves correctly classified by frame score using the BIF recommended equation.

Age in	----Bull Calf Frame Scores---					-Heifer Calf Frame Scores-			
Months	3	4	5	6	7	3	4	5	6
6		.63	.48	.33			.50	.43	
7		.37	.48	.36		.25	.58	.52	.00
8	.00	.51	.58	.38		.44	.54	.54	.00
9	.00	.50	.59	.45		.38	.61	.49	.33
10	.00	.59	.59	.50	1.00	.44	.65	.60	.43
11	.00	.72	.70	.43	.00	.25	.72	.70	.57
12	1.00	.73	.76	.59	1.00	.25	.68	.75	.60
13	1.00	.79	.69	.75			.81	.77	
Number Calves	1	55	86	21	1	8	81	77	6

Recommended Method for Adjusting Hip Height to 365 Days of Age.

1. Hip height must be measured at two ages separated by at least 28 and no more than 56 days.

2. One of the two measurements must be made within the range of 325-400 days of age.

3. Compute the average increase in hip height per day as:

$$a = (ht2 - ht1) / (day2 - day1)$$

where ht2 = the last hip height recorded,
ht1 = the next most recent hip height recorded,
day2 = calf's age in days when ht2 was taken, and
day1 = calf's age in days when ht1 was recorded.

4. If day2 is less than 365 days, then compute:

$$HH365 = ht2 + [a * (365 - day2)]$$

If day1 is greater than 365 days, or
If day1 is less than 365 and day2 is greater than 365, then compute

$$HH365 = ht1 - [a * (day1 - 365)]$$
$$= ht1 + [a * (365 - day1)]$$

CENTRAL TEST STATION COMMITTEE

Beef Improvement Federation

May 2, 1985

Chairman Roger McCraw called the meeting to order at 2:00 pm.

Dr. Larry Olson, chairman of the sub-committee appointed to develop recommendations for conducting forage bull tests, gave a thorough report on the Edisto Forage Bull Test in South Carolina and similar tests conducted in Georgia, Alabama and Texas. He outlined the recommendations developed by his committee. There was discussion concerning the minimum length of forage tests. Dr. Curly Cook moved that the test period be a minimum of 168 days and a maximum of 270 days depending on local environment and forage availability. His motion was seconded and approved. With this change, the committee voted to adopt the sub-comittee's report as an addition to the Guidelines.

A motion by Dr. Charles McPeake that the age of calves at time of delivery to test stations should be at least 180 days (6 months) and not more than 270 days (9 months) was seconded by Olson. This motion was approved.

Dr. Keith Zoellner was appointed to chair a sub-committee to study research that has been conducted on feasibilty of testing bulls for a shorter period than the currently recommended period of 140 days. This report will be presented at the next committee meeting.

There was much discussion concerning information that should be recommended for inclusion in central test sale catalogs. Dr. Larry Nelson, Chairman, Dr. Bob McGuire and Dr. Charles McPeake were appointed to a sub-committee to develop the proposed format for sale catalog listings. Their report will be given at the next committee meeting.

Roger McCraw was re-elected Chairman of this committee and Dr. Charles McPeake was elected as Secretary.

Respectfully submitted,

Bill Swoope, Secretary

REPORT OF SYSTEMS COMMITTEE

The Systems Committee meeting was convened at 2:00 p.m. and adjourned at 4:30 p.m. on May 2, 1985, by Jim Gibb, Chairman. The agenda included:

1. A report on Integrated Reproductive Management, as a systems approach to enterprise management, by Darrell Wilkes, National Cattlemen's Association.

2. A review of the workshop, "Systems Approach to Beef Improvement and Management," held at Winrock International on November 18-20, 1984.

3. Recommendations for the new BIF Guidelines.

4. Proposed communication with other BIF committees requesting trait information needed in systems evaluation.

NCA'S INVOLVEMENT WITH INTEGRATED REPRODUCTIVE MANAGEMENT (IRM).

Darrell Wilkes explained the NCA became involved in the systems concept of beef production through their role in developing the IRM program. IRM began in the mid-1970s at a national meeting between Cooperative Extension and producer organizataions. Producers asked Cooperative Extension to provide them with a management plan for reproduction that integrated relevant information from all disciplines. This request was in contrast to their standard practice of random dissemination of information about reproduction. It soon became apparent that producers really wanted an integrated plan for enterprise management, rather than reproduction per se, that they asked for originally.

SYSTEMS WORKSHOP REPORT.

A systems workshop was held November 18-20, 1984, at Winrock International. The purpose of the workshop was to identify the appropriate role for BIF in developing and implementing guidelines for beef improvement and management based on the systems concept. Proceedings of the workshop were distributed to all present. Prior to the meeting, proceedings had been sent to systems committee members, all BIF affiliates, state extension specialists and persons attending the 1984 BIF Convention. Additional proceedings are available from Jim Gibb, American Polled Hereford Association, 4700 E. 63rd St., Kansas City, MO 64130. Hank Fitzhugh presented a synopsis of the workshop in this committee, then again as featured speaker at the noon lunch on May 3, 1985. J.D. Mankin, Jim Gibb, Rich Benson and Ike Eller, presented specific highlights of the four workgroups.

RECOMMENDATIONS.

Following the presentations and considerable discussion, the committee made the following recommendations.

1. Acceptance of Rick Bourdon's systems approach fact sheet as an official BIF fact sheet.

2. The table outlining optimal performance in different production environments be fine-tuned and included in the new BIF Guidelines. It was stressed that the purpose of the table be clearly defined.

3. Calving distribution be included in the new BIF Guidelines with example table plus an explanation of its use.

4. The systems committee should closely monitor research in the development of formulas for herd efficiency.

5. Certain trait committees are to be given a list of additional characteristics to measure. The purpose is to provide information needed to more readily apply the systems approach. Suggestions for committee evaluation of specific traits will be made by Ike Eller, Jim Gibb and Rich Benson.

Respectfully submitted,

C. Richard Benson, Secretary

BEEF IMPROVEMENT FEDERATION

Minutes of Reproduction Committee Meeting
May 3, 1985 - Madison, WI

Chairman Roy Wallace called the meeting to order at 9:10 AM. Larry A. Nelson was the Acting Secretary, filling in for Wayne Singleton. See the list attached of persons who attended and those who wish to be active members of this committee.

Wallace introduced Dr. Dale Vogt, University of Missouri, who presented results of a study pertaining to scrotal circumference (SC) of yearling beef bulls and measures of semen quality, quantity, etc. Semen evaluations on these Polled Hereford and Simmental bulls were done by Hawkeye Breeders. Dr. Vogt did not distribute copies of his presentation, but some of the results were as follows:

					No. of Bulls:		
Breed	No. Bulls	SC	Avg. Wt.	Live Sperm, %	Ex Sperm Conc.	Ex Sperm Motility	Satis. Semen
P. Hereford	37	<32	998	46.5	7	7	29
	232	32-35	1042	62.7	109	97	229
	196	>35	1064	67.2	167	159	194
Simmental	5	<32	1067	16.0	0	0	1
	130	32-38	1117	63.9	75	67	128
	129	>38	1147	68.6	118	117	128

Vogt's conclusion was that it was incorrect to use a culling level of 32 cm SC across breeds. It was asked if BIF could develop correction factors for adjusting SC to 12 or 15 months of age. Dick Pruitt (South Dakota) reported a 2.1 cm difference in mean SC of yearling bulls due to dietary energy level alone. Coulter (Canada) used an adjustment factor in 1985 of approximately .008 cm/day to adjust SC to 13 months of age.

Conclusion: More research data/results are needed to properly adjust SC of yearling bulls; adjustments probably need to be within breed rather than between breeds. Charles McPeake (Oklahoma) moved to: (1) table the recommendation of developing correction factors for use in adjusting SC to a constant age, and (2) request that the chairman appoint a committee to study the issue and report at, or before the 1986 Annual BIF Conference. The motion was duly seconded and passed.

Dr. David Notter (VPI&SU) introduced Nancy Meacham (M.S. Candidate) who presented results of a study of heritability (h^2) of calving date, calving interval and percent return to estrus. Data were made available by the American Simmental Association. The objective was to try and identify a mechanism that would lend itself to sire evaluation for fertility traits. Ms. Meacham did not distribute a copy of her results, but h^2 estimates were:

Trait	$h^2 \pm$ SE
1st calving date	.12 ± .03
2nd calving date	.07 ± .03
Calving interval	.04 ± .03
% return	.11 ± .02

Least-square means for 2nd calving date, calving interval and/or % return for two discrete variables: percentage Simmental and degree of dystocia were:

Discrete Class	2nd Calving Date, days	Calving Interval, days	Return to Estrus, %
Simmental, %			
50%	-5.1	-5.9	
75%	-1.7	-1.7	
100 (base)	0	0	
Degree of dystocia			
No assistance (base)	0	0	0
Easy pull	.1	5.2	-2%
Hard pull	2.2	6.6	-9%

In short, half-blood Simmentals had a 2nd calving date and calving interval 5 to 6 days earlier/shorter than purebred Simmentals. Also, females whose calves were born as "hard pulls" had a 6.6 day longer calving interval and 9% higher return to estrus following breeding than Simmental females experiencing no assistance at calving.

Ron Boles (Kansas) presented results of pelvic area measurements of Angus and high-percentage Simmental females. Their conclusion was that pelvic area of a yearling heifer is a poor predictor of dystocia at first parturition.

John Pollak (Cornell) discussed the presentation of dystocia information in beef sire summaries. The problem is how the producer interprets what 1.12 - .02 (or 1.12 + .02) actually means in terms of dystocia associated with a particular sire or daughters of a sire. The Sire Evaluation Committee recommended that BIF go on record in favor of calving ease ratios (e.g., 102.3 - 3.2) for expression of a trait of the sire. There was some sentiment in the Sire Evaluation Committee to recommend use of a percentage figure to predict expected dystocia when a specific sire was mated to yearling heifers. The National

Association of Animal Breeders compiles a Calving Ease Summary for Holsteins (and possibly other breeds). Breed average is just over 11% difficult first births (calves that would arrive with extreme difficulty or require considerable force to be born) if a sire was mated randomly to yearling heifers in many herds. Also reported are the number of direct comparisons (contemporaries) and the % probability that calvings will be easier than average.

Roy Wallace said that the revised BIF Guidelines should be completed by July 1, 1985 and Wayne Singleton would coordinate that activity for the BIF Reproduction Committee. Bill Borror (California) asked Notter what should be included in the revised guidelines. Notter said that we needed a better measure of predicting the future reproductive performance of a yearling heifer.

The meeting adjourned at 10:25 AM.

Respectfully Submitted,

Larry A. Nelson

Larry A. Nelson
Acting Secretary

LAN/clf

Attachment

Original sent to A. L. Eller, Jr.

Copies to: Roy Wallace
Wayne Singleton
Dixon Hubbard
Henry Gardiner

MINUTES

Growth Committee
May 3, 1985
Empire Room, The Concourse
Madison, Wisconsin

Chairman Harvey Lemmon called the meeting to order at 9:00 a.m. The first item discussed was Appendix Table 3 (p. 61) regarding birth weight and weaning weight age-of-dam adjustment factors. A motion to list these adjustment factors by breed in the table was approved. Roger McCraw has surveyed the breed associations and has the data.

A brief discussion pertained to a review of Appendix Table 11 (p. 70) for converting average weights (lbs.) during test to metabolic weight for adjusting feed efficiency values for differences in maintenance requirement. A motion to continue with the present table was approved.

Lack of consistency in presenting birth weight ratios by breed was the next topic discussed. Some breeds use a ratio above 100 to represent calves weighing more than breed average while other breeds use the inverse relationship. (This has created some confusion.) Several breeds will be using expected progeny differences (EPD's) for birth weight in the near future. However, a motion was approved recommending that birth weights above average be ratioed over 100, while birth weights below average receive ratios less than 100.

Another motion was approved to add a table to the Guidelines listing breeds and their respective methods for ratioing birth weights.

Calving ease evaluation was the next topic of discussion. Although the calving ease scoring system of 1 to 5 was not recommended for change, a motion was approved that calving ease be reported for the direct sire effect on first calf heifers and for a sire's daughters' first calf calving ease.

The heritability of birth weight was discussed briefly with no resulting recommendation. Breed associations calculate these on a within breed basis.

Respectfully submitted,

W. Dennis Lamm
Secretary

UTILIZATION OF RECORDS COMMITTEE MEETING
May 3, 1985

Steve Wolf, Chairman - J D Mankin, Secretary
(Appended to these minutes is a list of those attending the meeting)

Chairman Wolf restated that the purpose of the committee is to encourage the utilization of records collected and the procedures developed to better manage and improve beef cattle. At the meeting in Atlanta in 1984 this committee was charged with the development of a series of fact sheets that would enhance the use of records as tools in beef production. Daryl Strohbehn was given the responsibility of chief editor and would now make his report.

Daryl Strohbehn stated the following fact sheets had been proposed:

- -Beef production glossary
- -Understanding performance pedigrees
- -Understanding and using sire summaries
- -Utilizing performance records in commercial herds

These four were now camera ready for distribution to states.

Others in the developmental process are:

- -Culling commercial cow herds
- -Raising profitable seedstock bulls
- -Selection of performance seedstock
- -Systems approach to breeding
- -Causes of calving difficulty
- -Performance records in judging class

Daryl stated that there was a senior author and two others involved in the development and the sheets were reviewed by a committee of producers, research and extension people.

Brad Skaar discussed a handout of the proposed fact sheet "Records in Judging Contests." He stated that the real initiative for developing the preliminary fact sheet was that of Carla Nichols and a vote of thanks should be given to her. There were several points of discussion, some minor, one of the major points was that of presenting information on the class to contestants. A generalization of the feelings expressed by the group was that a uniform method be developed and a uniform terminology recommended. Also since there would be a wide range of contestants using some form of this information and there would need to be a way to present different amounts and levels of information. Brad agreed to do some more work on the preliminary for the National 4-H Judging Contest, presumably with the help of Carla.

Steve Wolf presented two slide sets developed by Ken Ellis for youth programs. The first was entitled "Genetics and Animal Breeding." Other than a minor comment or two the group felt this set was good for the audience intended.

The other set of slides was entitled "Selection of a Breeding Heifer." There was considerable discussion regarding this set. The consensus of the group was that: 1)some of the animal pictures should be replaced with a better animal, 2)pictures should be keyed so that different breed groups could use pictures of their breed for a breed slide set, 3)perhaps a younger looking youth should be used, 4)some clearification of EBV, etc., should be made, 5)if a sale was going to be mentioned as a source then a slide or two showing a sale in progress should be included, 6)a slide or two showing that the project heifer has a calf and then the project moves to the beginning of a business. The group commended Ken for his efforts and the slide development should continue.

Roger McCraw reported on the computer program assignment he had been given in 1984 at Atlanta, which was to take the place of the Idaho computer program that Colorado had modified some and developed it for the small computer. He commended Idaho and Colorado for developing the program and stated that it was a sound and useful program. He then asked Ray Kimsey to discuss the version and systems on which the program would run. Basicaly he stated that the program was developed to run on a CPM system and MDOS. The program would be available for IBM and compatible hardware. Roger said that the program would be available at $50 per state and states could make as many copies as they need.

There being no further business, Chairman Wolf commended all of those who had worked on projects the past year and adjourned the meeting.

Respectively submitted by

J D Mankin
Extension Animal Scientist

JDM/mw

Minutes of the Embryo Transfer Committee - BIF - 5-3-85

Acting Chairman: Larry Benyshek, in the absence of Craig Ludwig, Chairman

The following recommendations from a sub-committee (Carla Nichols, Chairperson, James Bennett, Dick Spader, Craig Ludwig and Keith Vanderwalde) were discussed by those in attendence at the meeting:

1. All e.t. calves should be clearly identified on registration papers.

2. Breed of recipient should be recorded on all calves; if possible, age of recipient should also be recorded. If no recipient age is given, individual calculations are at a mature dam equivalent. Age of dam adjustments should be calculated only in the case of the recipient being the same breed as the calf.

3. All data on e.t. calves should be reported to breed associations. E.T. calves should be treated as separate contemporary groups as follows:
   a) If the breed of recipient is the same for all calves of a flush or any subgroup and all calves are managed the same, they constitute a contemporary group and can be ratioed against each other.
   b) If calves of several flushes are all treated alike, are produced by recipients of the same breed (not necessarily the same breed as donors) and fit the breed association definition of existing contemporary groups (i.e. 160-250 days of age at weaning, etc.); they constitute a contemporary group and can be ratioed against each other.

   Then GROWTH EBV's can be calculated on e.t. calves utilizing their individual record ratios along with their ancestral and progeny data.

4. Bull calves that are postweaning tested at central test stations should be compared and included with natural calves for postweaning evaluation. A separate code should distinguish e.t. calves from natural calves such as in existence for creep vs non-creep calves.

A motion was made by Cliff Sheppard and seconded by James Bennett to send the above recommendations to the Board for consideration. The motion was passed.

Doyle Wilson initiated a discussion concerning the identification of superior cows for embryo transfer. Doyle Wilson was appointed chairman of a committee to be formed later (because of the absence of Craig Ludwig) to look into analysis procedures for identification of superior cows.

Frank Baker extended an invitation on behalf of Winrock International to host a workshop concerning genetic improvement through embryo transfer. The workshop is to be held in November or December, 1985.

Submitted
Larry Benyshek, Acting Chairman

cc: Craig Ludwig (AHA)
    Carla Nichol

1985
BIF COMMITTEE ASSIGNMENTS*

MEET May 2 (Sire Evaluation, Live Animal Evaluation, Systems, Central Test Stations) — MEET May 3 (Reproduction, Growth, Utilization, Embryo Transfer)

	Sire Evaluation	Live Animal Evaluation	Systems	Central Test Stations	Reproduction	Growth	Utilization	Embryo Transfer
Ch.	Larry Cundiff	John Crouch	Jim Gibb	Roger McCraw	Roy Wallace	Harvey Lemmon	Steve Wolfe	Craig Ludwig
Secy	Richard Willham	Henry Webster	Rich Benson	Charles A. McPeake	Wayne Singleton	Dennis Lamm	Jim Gosey	Carla Nichols
	John Crouch	Carla Nichols	Dean Freschnecht	Larry W. Olson	Ron Parker	Chuck Christians	J. D. Mankin	Larry Corah
	Craig Ludwig	Earl Peterson	Keith Gregory	Larry A. Nelson	Peter Burfening	Doug Hixon	Ken Ellis	Bill Durfey
	Jim Gibb	John Massey	David Notter	Doug Hixon	Robert Bellows	Richard Frahm	Richard Willham	Larry Cundiff
	Paul Miller	Will Butts	Bill Borror	W. M. Warren	Don Lunstra	Robert Koch	Bobby Rankin	Larry Benyshek
	Larry Benyshek	Les Holden	Frank Baker	Cliff Sheppard	Merlyn Nielson	Don Kress	Mark Keffeler	Paul Miller
	Jim Brinks	Bob Dickenson	Steve Hammack	Gerry Bowes	Mary Garst	James Bennett	Don Hutzel	Mike Davis
	Greg Martin	Harold Bennett	Chris Dinkel	A. Harvey Lemmon	Daryl Strohbehn	C. DuVall	James Nolan	Dick Spader
	Lyle Springer	Russ Danielson	Art Linton	M. K. Curly Cook	Chuck Shroeder	Tom Chrystal	Jim Leachman	Merlyn Nielson
	Roy Wallace	Martin Jorgensen	Peter Marble	Gary H. Crow	Bill Durfey	Larry Foster	John Crouch	Robert Godke
	Jack Farmer	Robert Schalles	John Brunner	Brian Pogue	Bob Sand	Joe Sagebiel	Glen Klippenstein	
	John Pollak	Ken Hartzell	Dave Breiner	Rudy Erickson	Dave Nichols	Roy Beeby	Darrell Wilkes	
	Bill Slanger	Paul Bennett	Richard Bourdon	Keith Zoellner	Jim Brinks	Glenn Butts	Wayne Wagner	
	Brett Middleton		Glenn Butts	Terry Atchison	Larry Nelson	Gene Schroeder	Bob deBaca	
	Eldin Leighton		Gordon Dickerson	Tom Saxe			Jim Gibb	
			Jim Gosey	Robert L. McGuire				
			Dave Nichols	Keith VanderVelde				
			Steve Radakovich	Bob Dickinson				
			Bill Russell	Bill Swoope				
			Darrell Wilkes	Randy Guthrie				

*Standing Committee Meetings May 2 & 3, 1985 are open meetings. Attend and participate in the meetings of your choice. If you wish to become a working member of a committee, you are welcome. Talk with the chairman of that committee.

MINUTES
BEEF IMPROVEMENT FEDERATION
BOARD OF DIRECTORS MEETING
MAY 1, 2, 3
CONCOURSE HOTEL
MADISON, WISCONSIN

The BIF Board of Directors held three directors' meetings in conjunction with the 1985 Annual Convention at the Concourse Hotel in Madison, Wisconsin. The first meeting was held on Wednesday, May 1st, 4 - 7 p.m. with dinner. The second meeting May 2nd, 6:30 - 8:00 a.m. and the third meeting May 3rd 6:00 - 7:00 a.m. Attending the board meeting was Gene Schroeder, President; Henry Gardiner, Vice-President; A. L. Eller, Jr., Executive Director; Roger McCraw ;Daryl Strohbehn; and Ken Ellis, Regional Directors; Roy Wallace; Lyle Springer; Jim Gibb; Earl Peterson; Harvey Lemmon; Steve Radakovich; Bill Borror; Al Smith; Steve Wolfe; Bill Warren; John Crouch; Bruce Howard; Glenn Butts; Darrell Wilkes; Keith VanderVelde; Larry Cundiff; Dixon Hubbard; and Frank Baker. The only director not in attendance was Craig Ludwig.

The following items of business were transacted:

1. The meeting was called to order at 4:10 p.m. by President, Gene Schroeder.

2. CLEAR AGENDA - President Schroeder asked if there were other agenda items in addition to those listed.

3. MINUTES - The Board voted to dispense with the reading of the minutes of the Mid-Year Board Meeting.

4. TREASURER'S REPORT - A. L. Eller, Jr. provided copies of the treasurer's report for the Calendar Year 1984 and for 1985 from January 1 to April 20 and explained each. Copies of these reports are attached. For the Year 1984 total cash in checking and money market accounts January 1, 1984 were $48,001.67. The balance for December 31, 1984 were $49,442.72. For the Year 1984 the total income was $16,770.22. The total expenses $15,329.17. As of April 20th the total cash in checking account, money market account, and certificates of deposit was $54,796.82 with total income to date of $9,220.20 and total expenses to date of $3,866.10. Eller moved acceptance of the treasurer's reports, seconded by Glenn Butts. Carried.

5. BIF MEMBERSHIP REPORT. - Eller reported that as of April 20th 28 State BCIA's have paid dues, 17 Breed Associations have paid dues, and 10 in the other category have paid dues for a total of paid membership to date of 55. He suggested that a second dues statement had recently gone out to those that have not paid 1985 dues.

6. DATA BANKS PROJECT - Frank Baker reported that Winrock International had completed the 1984 Data Bank's Study and again thanked BIF for their participation and financial support. He says that there is a need to update certain portions of the Data Bank Study for keeping the report current and for delivering on a request to Winrock from the Office of Technical Assessment in Washington on the genetic diversity of domestic animals both in this country and in foreign countries. Baker indicated that Winrock will follow up with questionnaires to get the needed information from BIF member organizations to update the study in the near future.

7. IDEAL BEEF MEMO PROPOSAL - Gene Schroeder introduced the subject indicating that the principals of Ideal Beef Memo have proposed that the Beef Improvement Federation consider taking over the publishing of Ideal Beef Memo that the performance people group can no longer continue with for financial reasons. Eller indicated that all information relative to the proposal mailed to the BIF office by Memo Editor, Bob DeBaca has been mailed to the BIF Directors. Gene Schroeder welcomed Jim Wolfe and Bob DeBaca to the board meeting and ask for their comments. These two gentlemen both spoke to clarify the proposal relative to BIF considering taking over the publication. Both Wolfe and DeBaca suggested that an important part of the proposal would involve BIF tieing in State Beef Improvement groups who would utilize the publication and sell advertising.

   After an adequate period of questions and answers, President Schroeder thanked Bob DeBaca and Jim Wolfe for being with the board and dismissed them.

   Frank Baker went over his survey of 10 Breed Association Executive Officers and summarized their feelings and comments. The matter of whether State BCIA'S would be in a position to use a national BIF publication was addressed. Regional secretaries, Roger McCraw, Daryl Strohbehn and Ken Ellis questioned whether their state organizations would be able to make good use of such a publication.

   Earl Peterson suggested that in order to properly act on the proposal a motion would be needed. Bill Borror moved that the President and Executive Director of BIF contact the Ideal Beef Memo principals indicating a lack of information on the part of member organizations for the board to properly consider their proposal. There was no second to this motion. John Crouch moved that the BIF accept the proposal made by the Ideal Beef Memo group. Seconded by Steve Radakovich. The motion was defeated unanimously. Eller and Schroeder will write an appropriate letter to the Ideal Beef Memo group.

8. AUSTRALIAN BEEF IMPROVEMENT ORGANIZATION COMPLIMENTARY ASSOCIATE MEMBERSHIP Eller indicated that he had received communication from the President of the Australia group asking for a complimentary associate membership and a free exchange of information between the two countries that are greatly distant. He indicated that he had written a letter complying with the request.

9. EXECUTIVE DIRECTOR POSITION - Gene Schroeder indicated that Ike Eller has asked the organization to search for a replacement sometime within the next year, perhaps to be acted on at the mid-year board meeting in Kansas City in the fall of 1985. Eller indicated that he had originally agreed to do the executive director job for a minimum of two years and at this point has been in that position for two and one-half years. Gene Schroeder appointed the following search committee that will make a report at the mid-year board meeting composed of Bill Borror - Chairman, Jim Gibb, and Dixon Hubbard.

10. BIF GUIDELINES - President Schroeder asked Dixon Hubbard who chaired a committee relative to the new guidelines to make a report. Dixon Hubbard indicated that he, Frank Baker, Ike Eller, and Roger McCraw had met at 1 p.m. May 1st. He handed out samples of a portion of the report that has already been put on word processor in his office at USDA, for comments. He reported that in putting together the new Guidelines that Frank Baker would be editor and thatthe following areas and suggested personnel would assist. Introduction - Baker, Reproduction - Wallace (Wayne Singleton), Growth - Lemmon (Doug Hixon, Bob Cook), Carcass - Hubbard (Schaffer), Live Animal Evaluation - Crouch (Webster, Schalles, Massey), EBV'S - ~~Cundiff,~~ Willham

Willham
Sire Evaluation - ~~Cundiff~~, Guidelines for Utilizing Records for Seedstock Producers - Notter, Guidelines for Utilizing Records for Commercial Producers - Lamm, Central Test - McCraw, Systems - Gibb (Bourdon), Embryo Transfer - Ludwig (Carla Nichols), Utilization - Wolfe (Gosey).

Hubbard indicated that the above portions of the new Guidelines should be to Baker by the end of June 1985 and that galley proofs would be available by the mid-year board meeting. Hubbard indicated that his office will put the entire Guidelines on word processor. Baker will edit with the help of the above committee responsible for the various areas of the Guidelines. Printing the entire Guidelines will be printed and three hole punched with the capability of updating any portion of the Guidelines when needed. Printing cost will be the responsibility of BIF.
Distribution - Eller will contact each member organization before the fall board meeting to determine the number of Guidelines each organization will need. This will be a guide to the number to be printed. It was agreed that up to 50 copies of the Guidelines will be furnished to each member organization and all over that number will be charged for at cost. Charges for the Guidelines will be set in the fall board meeting.

Wilkes moved acceptance of the above proposal including the expense of printing. Second by Al Smith. Carried.

11. FACT SHEETS - Daryl Strohbehn at Iowa State indicated that the first four Fact Sheets in camera ready copy had been mailed to the BIF office for getting out to member organizations and state extension services. These include Glossary, Understanding Performance Pedigrees, Understanding Sire Summaries, and Using Performance Records in Commercial Herds. He indicated that three or four more Fact Sheets will be coming very soon including Culling The Cow Herd, Producing Commercial Bulls, Sire Selection and Use of Performance Records in Judging Contests. He suggested that a Systems Fact Sheet has been written by Rick Bourdon and is in the review process and ask the board to approve printing of this Fact Sheet. Baker moved that BIF add the Fact Sheet on Systems. Seconded by Radakovich. Carried.

    Strohbehn suggested that the costs of the Fact Sheets to date is not known but that the bill will be sent to Ike Eller in the very near future for payment.

12. GLOSSARY OF RELATED INFORMATION FOR SUGGESTED READING TO GO INTO THE GUIDELINES - After discussion, it was agreed to let Frank Baker's committee come up with this list of other existing materials to be included appropriately in the Guidelines. Steve Wolfe will help assemble this list.

13. SLIDE SETS FOR JUNIORS - Ken Ellis reported that two slide sets have been prepared with audio tapes and ask that the board review these immediately after dinner May 1st. The review was made by the majority of the board who were very pleased with the two slide sets and appropriate suggestions were made for inclusion such that Ellis can complete these two slide sets.

14. SOFTWARE FOR COMMERCIAL PERFORMANCE TESTING - Roger McCraw reported on the project and suggested that the software is being mailed out upon requests by state extension specialists and that the process has been held up slightly waiting for a complier. He indicated that a letter has gone out to all state extension specialists involved in performance records and that disks and program documentation will be mailed to all who requests them at a cost of $50 each. Roger McCraw indicated that Ray Kinsey who is working with him on the project has been brought to the BIF meeting. Eller reported that McCraw ask BIF to pay Kinsey's travel expense and that he agreed to do this. The question was ask whether states could copy the program and handle it as they see fit. McCraw and Eller reiterated that the program is experimental and that states should use it however they see fit with a report to come to the mid-year board meeting in Kansas City.

15. PLANS FOR STANDING COMMITTEE ACTIVITY DURING THE CONVENTION - Dixon Hubbard ask all chairmen to remember that revision of Guidelines must get top priority. Gibb reported that in the Systems Committee that the report from the Winrock workshop in November 1984 would be covered. He announced that the proceedings of the Winrock Conference were published (550 copies) and that some 400 have been mailed to all who attended the 1984 BIF Convention, to member organizations and the state specialists in charge of performance programs. The cost of some $1200 for printing and mailing has been incurred and BIF had agreed in their fall 1984 board meeting to pay this cost.

    Frank Baker from Winrock suggested that Winrock would be glad to work with any other BIF committee such as Embryo Transfer to set up a conference to hammer out recommendations as was done with the Systems Committee. The board was agreeable.

16. PROCEEDINGS OF ANNUAL CONVENTIONS FOR LIBRARIES - Steve Wolfe had been charged with this responsibility and reported that he had done nothing yet but will have a report by the fall board meeting.

17. BIF MEMBERSHIP AND TEST STATION SURVEY - Dixon Hubbard reported that he sent a communication to all member organizations and extension specialists with last year's survey asking for updates. He says that most of these have come in but as soon as he gets them all he will send them to the BIF office for inclusion in the 1985 Annual Convention Proceedings.

18. ELECTRONIC DATA SYSTEMS - Eller was ask to follow up on the matter of getting the BIF Guidelines on electronic data systems such as agri-data. He reported that he has not done this, mainly because the Guidelines will be reprinted in the very near future and he thought there was no need to put the old Guidelines on a system since the new ones will be coming out.

19. ELECTION OF OFFICERS - Earl Peterson, Chairman of the Nominating Committee gave his report as follows:
    President - Henry Gardiner; Vice President - Harvey Lemmon. President Schroeder ask for additional nominations. There were none. Peterson moved that the above slate be elected by unanimous ballot. Seconded by John Crouch. Carried unanimously.

20. 1986 BIF CONVENTION - Eller reported that the convention will be held May 8 and 9, 1986 at the Hyatt Regency Hotel in Lexington, Kentucky.

21. BIF SUPPORT FOR THE HANGING OF FRANK BAKER IN THE SADDLE AND SIRLOIN CLUB - Eller indicated that Dick Willham had written a letter asking support of

BIF for having Frank Baker's portrait hung in the fall of 1985. It was learned that another individual has been selected for 1985. John Crouch moved that BIF support the nomination of Frank Baker for 1986. Seconded by Roger McCraw and carried.

22. BIF FRAME SCORE CHART - John Crouch reported that the new frame score chart which was approved by the BIF board in the fall 1984 meeting was thoroughly discussed and other data presented during the Live Animal Evaluation committee meeting. Elton Leighton, Bob Schalles, and Dale Vogt are a three man committee to look critically at the Frame Score Chart, make any changes that might be needed and provide Crouch with a revised and recommended Frame Score Chart by June 1.

23. MID-YEAR BOARD MEETING - Bill Borror made a motion to hold the mid-year board meeting October 31 and November 1 in Kansas City. Seconded by Hubbard and carried.

24. THE PROGRAM COMMITTEE FOR 1986 CONVENTION - Henry Gardiner appointed the following committee: Harvey Lemmon- Chairman, Roy Wallace, Carla Nichols, Wayne Vanderwert, Larry Cundiff and Bill Warren. He charged this committee with coming up with a program to recommend to be BIF Board in the Mid-Year Board Meeting.

25. JAMES INNES' EXPENSES - Eller was authorized by the board to settle with Innes on reimbursing him for expenses in conjunction with the trip to the BIF meeting.

26. NEW BEEF PRODUCTS - Al Smith brought up the matter of the need for new beef products to be developed and moved that BIF write a letter of support for getting new beef products developed and that such a letter go to the National Cattlemen's Association and the Beef Industry Council of the National Livestock and Meat Board. Motion was seconded by Jim Gibb and carried.

27. AWARDS FOR NATIONAL JUDGING CONTESTS PERFORMANCE CLASSES - Baker moved that BIF make a standardized plaque available for the National 4-H Contest, the National Small College Contest, and the National University Contests for winners in performance classes. Seconded by Radakovich and carried. Gibb said that Bob Whitenburg is chairman of the 4-H Contest, Harlan Ritchie of the University Contest, and Tom Reddy of the Small College Contest.

28. FUTURE BOARD MEETINGS - The board was in agreement that board meetings to be held in conjunction with future annual conventions be planned to allow more time.

There being no further business, the meeting was adjourned.

Respectfully submitted,

A. L. Eller, Jr.

BEEF IMPROVEMENT FEDERATION

FINANCIAL STATUS - January 1, 1985 - April 20, 1985

BY

A. L. Eller, Jr.

Checking Account	$ 3,172.27
Money Market	11,624.55
Certificate of Deposit	40,000.00
	$54,796.82

<u>1985 BIF Income</u>

Dues	$ 7,720.15
Proceedings	48.00
Guidelines	1.00
Interest (Checking)	32.81
Interest (Money Market)	355.73
Interest (Certificate of Deposit)	1,062.51
TOTAL INCOME	$ 9,220.20

<u>1985 BIF Expenses</u>

Salary & Taxes (Office Sec.)	$ 1,095.35
Supplies (Envelopes)	68.80
Postage	671.70
Certificates Lettering	16.25
Director Travel (Lemmon - Mid.Yr. Bd. Meeting)	514.00
Computer Software (Colorado St. Univ)	1,500.00
TOTAL EXPENSES	$ 3,866.10

BEEF IMPROVEMENT FEDERATION
FINANCIAL STATUS - CALENDAR YEAR 1984

by
A. L. Eller, Jr.

	1-1-84	12-31-84
Checking Account	85.08	336.41
Money Market Account	47,916.59	49,106.31
	$48,001.67	$49,442.72

1984 BIF INCOME

Interest	$ 4,792.89
Proceedings	306.50
Dues	9,357.50
1984 Convention	2,315.33
TOTAL INCOME	$16,772.22

1984 BIF EXPENSES

Postage	1,546.83
Printing	1,638.64
Mid-Yr. Bd. Meet. Dir. Travel(Butts)	96.50
Holiday Inn	506.63
Data Bank Study	4,000.00
1984 Conv. Speaker Travel	2,010.69
Legal Fees & St. Corporate Report	40.00
Exec. Dir. Travel	1,917.84
Supplies	110.33
Salary & Taxes (Office Sec.)	2,630.38
Plaque	37.08
Ribbons	19.75
Certificate Lettering	32.50
Performance Livestock Judging Classes (Mid-American 75.00, Kansas St. 90.00, David W. Seibert 79.00)	244.00
Livestock & Meat Industry Council 2 slide sets	500.00
TOTAL EXPENSES	$15,331.17

PAID

BIF MEMBER ORGANIZATIONS AND AMOUNT FOR DUES - 1985

June 15, 1985

State BCIA'S	DUES
Alabama	$100.00
California	$100.00
Florida	$100.00
Georgia	$100.00
Hawaii	$ 50.00
Idaho	$ 50.00
Illinois	$ 50.00
Indiana	$100.00
Iowa	$100.00
Kansas	$100.00
Kentucky	$100.00
Minnesota	$100.00
Mississippi	$ 50.00
Missouri	$100.00
Montana	$100.00
New Mexico	$100.00
New York	$ 50.00
North Carolina	$100.00
North Dakota	$ 50.00
Ohio	$100.00
Oklahoma	$100.00
Oregon	$100.00
Pennsylvania	$ 50.00
South Carolina	$100.00
South Dakota	$100.00
Tennessee	$100.00
Texas	$ 50.00
Virginia	$100.00
Washington	$ 50.00
West Virginia	$100.00
Wyoming	$ 50.00

Breed Associations	Dues
American Angus	$600.00
American Brahman Breeders	$300.00
American Chianina Assoc.	$200.00
American Gelbvieh Assoc.	$200.00
American Hereford Assoc.	$600.00
Am.-International Charolais	$300.00
American Red Poll	$100.00
American Salers Assoc.	$200.00
Am. Shorthorn Assoc.	$300.00
Am. Simmental Assoc.	$300.00
International Brangus Breeders	$200.00
North American Limousin	$300.00
Red Angus Assoc.	$200.00
Santa Gertrudis Breeders Intern.	$300.00

Breed Associations (continued)	Dues
Beefmaster Breeders Universal	$300.00
Canadian Charolais Assoc.	$200.00
The Simmentaler Cattle Breeders Society of Southern Africa	$100.00
American Polled Hereford	$600.00

Others	Dues
Nat'l. Assoc. of An. Breeders	$100.00
Performance Registry Int'l.	$100.00
Nat'l. Cattlemen's Assoc.	$100.00
Am. Breeders Service	$100.00
Midwest Breeders Coop.	$100.00
NOBA, Inc.	$100.00
Select Sires, Inc.	$100.00
Manitoba Agriculture/Beef Program of An. Industry Branch	$100.00
Beefbooster Cattle Limited	$ 70.15 ($100.00)
Agricultural Canada, Regional Development Branch	$100.00
Carnation Genetics	$100.00

BIF MEMBERS WHO HAVE NOT PAID MEMBERSHIP DUES FOR 1985
(As of June 15, 1985)

Arkansas BCIA - $50.00
Colorado BCIA - $50.00
Louisiana BCIA - $50.00
Nebraska BCIA - $100.00
Utah - $100.00
Wisconsin - $100.00

Canadian Hereford Assoc. - $100.00
American Tarentaise - $50.00

Bovine Test Center - $50.00

LISTING OF STATE BEEF CATTLE IMPROVEMENT ASSOCIATIONS

ALABAMA	ALABAMA BCIA (1964) Robert L. McGuire Head, Extension Animal Science 215 Animal Science Bldg Auburn University Auburn University, AL 36849	205/826-4377
ARIZONA	ARIZONA CATTLE GROWER ASSOCIATION (?) Tommie Martin 5025 East Washington -- Suite 110 Phoenix, AZ 85034	602/267-1129
ARKANSAS	NO BCIA	
CALIFORNIA	CALIFORNIA BCIA (1959) Judy Knowles, Secretary 6325 Tim Bell Road Oakdale, CA 95361	209/847-8419
COLORADO	COLORADO BCIA (1982) W. Dennis Lamm Extension Beef Cattle Specialist 108A Dept of Animal Sciences Colorado State University Ft. Collins, CO 80523	303/491-6903
CONNECTICUT	CONNECTICUT BCIA (?) Louis A. Malkus Extension Livestock Specialist University of Connecticut Storrs, CT 06268	203/486-2636
DELAWARE	DELMARVA BEEF CATTLEMEN'S ASSOCIATION (1984) Richard Barczewski Cooperative Extension Service 300 South New Street Dover, DE 19901	302/736-4675
FLORIDA	FLORIDA BCIA (1960) Robert S. Sand, Secretary 231 Animal Science Bldg #459 University of Florida Gainesville, FL 32611	904/392-1916
GEORGIA	GEORGIA BCIA COMMITTEE (?) Ronnie Silcox Landrum Box 8112 Statesboro, GA 30460	912/681-5638

HAWAII	HAWAII BCIA (1966) James C. Nolan, Jr., Advisor University of Hawaii 1800 East West Road Honolulu, HI 96822	808/948-7090
IDAHO	NO BCIA	
ILLINOIS	COW-CALF COMMITTEE (Perf Testing started 1955) ILLINOIS LIVESTOCK ASSOCIATION Gary E. Ricketts Extension Livestock Specialist 326 Mumford Hall 1301 West Gregory Drive Urbana, IL 61801	217/333-7351
INDIANA	INDIANA BEEF PERFORMANCE TESTING PROGRAM (1964) L. A. Nelson or K. G. MacDonald Animal Sciences Department Lilly Hall of Life Sciences Purdue University West Lafayette, IN 47907	317/494-4834 317/494-4833
IOWA	IOWA BEEF IMPROVEMENT ASSOCIATION (1960) Jim Glenn 123 Airport Road Ames, IA 50010	515/233-3636
KANSAS	KANSAS BEEF IMPROVEMENT COMMITTEE (1968) Keith Zoellner Extension Beef Cattle Specialist Weber Hall Kansas State University Manhattan, KS 66506	913/532-6131
KENTUCKY	KENTUCKY BCIA (1958) Carla Gale Nichols 803 Ag Science Center South University of Kentucky Lexington, KY 40546	606/257-7514
LOUISIANA	LOUISIANA BCIA (1961) John S. Sullivan, Jr. Extension Beef Cattle Specialist Knapp Hall Louisiana State University Baton Rouge, LA 70803	504/388-2219
MAINE	NO BCIA	

MARYLAND	MARYLAND BCIA (1955) William A. Curry Extension Livestock Specialist Animal Science Center Room 0131 University of Maryland College Park, MD 20742	301/454-7825
MASSACHUSETTS	MASSACHUSETTS BEEF CATTLE IMPROVEMENT PROGRAM (1959) J. P. Tritschler, II Extension Livestock Specialist Stockbridge Hall University of Massachusetts Amherst, MA 01003	413/545-2340
MICHIGAN	MICHIGAN BCIA (1967) William T. Magee Dept of Animal Science 102 Anthony Hall Michigan State University East Lansing, MI 48824	517/355-0327
MINNESOTA	MINNESOTA BEEF CATTLE IMPROVEMENT ASSOCIATION (1968) Charles J. Christians, Supervisor 101 Peters Hall University of Minnesota St. Paul, MN 55108	612/373-1166
MISSISSIPPI	MISSISSIPPI BCIA (1959) William M. Swoope Extension Livestock Specialist Mississippi State University Box 5425 Mississippi State, MS 39762	601/325-3515
MISSOURI	MISSOURI BEEF CATTLE IMPROVEMENT ASSOC, INC. (1958) John W. Massey Extension Beef Cattle Specialist S111 Animal Science Center, Rm S132A University of Missouri Columbia, MO 65211	314/882-7289
MONTANA	MONTANA BEEF PERFORMANCE ASSOCIATION (1956) Steven B. Church 405 Linfield Hall Montana State University Bozeman, MT 59717-22	406/994-2591
NEBRASKA	BEEF IMPROVEMENT COMMITTEE OF NEBRASKA STOCK GROWERS ASSOCIATION (1961) Jim Gosey Extension Beef Cattle Specialist Marvel Baker Hall University of Nebraska Lincoln, NE 68583	402/472-6417

NEVADA	NO BCIA	
NEW HAMPSHIRE	NEW HAMPSHIRE BEEF CATTLE PRODUCTION TESTING PROGRAM (1984) F. Carlton Ernst Extension Livestock Specialist Room 218, Kendall Hall University of New Hampshire Durham, NH 03824	603/862-2130
NEW JERSEY	NO BCIA	
NEW MEXICO	NEW MEXICO BEEF CATTLE PERFORMANCE ASSOCIATION (1956) Ron Parker Extension Beef Cattle Specialist New Mexico State University Box 3AE Las Cruces, NM 88003	505/646-1709
NEW YORK	NEW YORK BCIA (1940's) William M. Greene Extension Beef Cattle Specialist Cornell University Ithaca, NY 14853	607/256-7712
NORTH CAROLINA	NORTH CAROLINA BCIA (1959) Roger L. McCraw Extension Beef Cattle Specialist North Carolina State University Box 7621 Raleigh, NC 27695-7621	919/737-2761
NORTH DAKOTA	NORTH DAKOTA BEEF CATTLE IMPROVEMENT ASSOC, INC. (1963) Kris A. Ringwall Extension Livestock Specialist NDSU Research and Extension Center Box 1377 Hettinger, ND 58639	701/567-2997
OHIO	BUCKEYE BEEF IMPROVEMENT FEDERATION (1961) Thomas B. Turner Animal Science Department Ohio State University 2029 Fyffe Road Columbus, OH 43210	614/422-6401
OKLAHOMA	NO BCIA	

OREGON	BEEF CATTLE IMPROVEMENT COMMITTEE OF OREGON CATTLEMEN'S ASSOCIATION (1959) Steve Wolfe Route 1 Box 135 Wallowa, OR 97885	(Office) 503/886-9121 (Home) 503/886-3575
PENNSYLVANIA	PENNSYLVANIA BCIA (1957) Lester A. Burdette Extension Livestock Specialist 317 Henning Building Pennsylvania State University University Park, PA 16802	814/863-3670
PUERTO RICO	NO SUBMISSION	
RHODE ISLAND	NO BCIA	
SOUTH CAROLINA	SOUTH CAROLINA BCIA (1960's) Henry W. Webster Extension Beef Cattle Specialist 145 P&AS Building Clemson University Clemson, SC 29631	803/656-3424
SOUTH DAKOTA	SOUTH DAKOTA BCIA (1956) Donald M. Marshall Executive Secretary Extension Livestock Specialist 801 San Francisco Street Rapid City, SD 57701	605/394-2236
TENNESSEE	TENNESSEE BCIA (1956) David Kirkpatrick Extension Beef Cattle Specialist University of Tennessee Box 1071 Knoxville, TN 37901	615/974-7294
TEXAS	NO BCIA	
UTAH	UTAH BCIA (1969) Nyle J. Matthews Extension Livestock Specialist 250 North Main Richfield, UT 84701	801/896-4609
VERMONT	VERMONT BCIA (1983) Paul F. Saengerr Extension Livestock Specialist Carrigan Hall University of Vermont Burlington, VT 05705	802/656-2070

VIRGIN ISLANDS	VIRGIN ISLANDS BCIA (1977) Stephen Wildeus CVI Agricultural Experiment Station Senepol Research Program P.O. Box 920, Kingshill St. Croix, VI 00850	809/778-0050
VIRGINIA	VIRGINIA BCIA (1955) A. L. Eller, Jr. Extension Beef Cattle Specialist Animal Sciences Building Virginia Polytechnic Institute and State University Blacksburg, VA 24061	703/961-5252
WASHINGTON	WASHINGTON BCIA (1968) Wm. E. McReynolds Extension Beef Cattle Specialist 121 Clark Hall Washington State University Pullman, WA 99163	509/335-2922
WEST VIRGINIA	WEST VIRGINIA BEEF CATTLE PERFORMANCE TESTING PROGRAM (1960) Wayne R. Wagner Extension Livestock Specialist G022 Ag Science Building Box 6108 Morgantown, WV 26506	304/293-3392
WISCONSIN	WISCONSIN BEEF IMPROVEMENT ASSOCIATION (1953) Ellie Larson, President Route 1, 3427 Bohn Road Mt. Horeb, WI 53527	608/437-5660
WYOMING	WYOMING BEEF CATTLE IMPROVEMENT ASSOCIATION (1984) Doug L. Hixon Executive Secretary University of Wyoming Box 3354, University Station Laramie, WY 82071	307/766-3100

COMPILED BY: Dixon D. Hubbard, Staff Leader — 202/447-2677
Livestock and Veterinary Sciences
USDA-Extension Service
Room 3334-South Building
Washington, D.C. 20250

4/84:Updated 6/85

CENTRAL BULL TESTING SUMMARY - APRIL, 1984**

NAMES, ADDRESSES, AND CONTACT PERSONS FOR BULL TESTING STATIONS

STATE	NAME OF STATION	CONTACT AND ADDRESS	YEAR ESTABLISHED	BULLS TESTED IN LAST COMPLETE YEAR OF TESTING	NUMBER OF BULLS SOLD
ALABAMA	Auburn University Bull Test	Robert L. McGuire, Head Extension Animal Science 215 Animal Science Building Auburn University Auburn University, AL 36849 PHONE: 205/826-4377	1951	96	70
	North Alabama BCIA Bull Test	SAME AS ABOVE	1973	50	35
	BCIA Grazing Test	SAME AS ABOVE	1979	90	65
ARIZONA	NO TEST STATION				
ARKANSAS	Univ of AR Bull Test Station	A. Hayden Brown Extension Livestock Specialist Department of Animal Science University of Arkansas Fayetteville, AR 72701 PHONE: 501/575-4855	1962	59	No Sale
	Univ of AR Bull Test Station	W. C. Loe Southwest Research & Extension Ctr Route 3, Box 258 Hope, AR 71801 PHONE: 501/777-9702	1962	84	No Sale
	Univ of AR Bull Test Station	James A. Horsby Southeast Research & Extension Ctr Box 3508, UAM Monticello, AR 71655 PHONE: 501/367-3471	1977	53	No Sale
CALIFORNIA	CBCIA "On Ranch" Bull Test	C. Richard Benson Extension Beef Cattle Specialist University of California Davis, CA 95616 PHONE: 916/752-1278	1981	459	0
	Cal Poly Bull Test	Frank Fox Department of Animal Science Cal Poly State University San Luis Obispo, CA 93401 PHONE: 805/546-2619	1957	313	115
	Bovine Test Center	Jerry Maltby 11900 28 Mile Road Oakdale, CA 95361 PHONE: 209/847-6403	1979	550	235*
	West Hills College	Bill Dale West Hills College 300 Cherry Lane Coalinga, CA 93210 PHONE:209/935-0801	1980	34	0
COLORADO	Northeast Colorado Bull Test Association	Dixie Fagerlin Box 328 Holyoke, CO 80734 PHONE: 303/854-2878	1976	256	111
	Southeast Colorado Bull Test Association	George Ellicott Area Extension Livestock Spec County Courthouse Eads, CO 81036 PHONE: 303/438-5321	1973	141	86

*235 Total = 200 Private
175 Sale

**Updated June 1985

STATE	NAME OF STATION	CONTACT AND ADDRESS	YEAR ESTABLISHED	BULLS TESTED IN LAST COMPLETE YEAR OF TESTING	NUMBER OF BULLS SOLD
COLORADO (Continued)	4-Corners Bull Test Assn	Al Denham 18683 State Hwy 140 Hesperus, CO 81326 PHONE: 303/385-4574	1949	266	127
	Western Colorado Bull Test Association	Herman Soderquist Area Extension Livestock Spec Courthouse Annex 5th & Palmer Delta, CO 81416 PHONE: 303/874-3519	1981	150	76
CONNECTICUT	NO TEST STATION				
DELAWARE	NO TEST STATION				
FLORIDA	NO TEST STATION				
GEORGIA	North Georgia Bull Evaluation Center	Rick Hardin P.O. Box 95 Calhoun, GA 30701 PHONE: 404/	1969	103	67
	Tifton Bull Evaluation Sta	Robert Stewart Extension Beef Cattle Specialist Rural Development Center Box 1209 Tifton, GA 31793 PHONE: 912/386-3407	1957	121	71
	Rollins Beef Research Center	Luther Miller Berry College Mount Berry, GA 30149 PHONE: 404/232-5374 Ext. 2360	1974	95	68
	Georgia Pasture Fed Bull Test	Robert Stewart Extension Beef Cattle Specialist Rural Development Center Box 1209 Tifton, GA 31793 PHONE: 912/386-3407	1980	121	62
HAWAII	BCIA Test Station	James C. Nolan, Jr. Extension Beef Cattle Specialist University of Hawaii 1800 East-West Road Honolulu, HI 96822 PHONE: 808/948-7090	1979	133*	No Sale
IDAHO	Northwest Bull Test Station	Jim White Caldwell, ID 83605 PHONE: 208/722-6517	1983	318	140
ILLINOIS	Beef Evaluation Station	Gary Daniel, Manager Dept of Animal Industries Southern Illinois University Carbondale, IL 62901 PHONE: 618/453-3725 or 453-2079	1974	72	54
	Beef Evaluation Station	Loren Robinson Dept of Agriculture Western Illinois University Macomb, IL 61455 PHONE: 309/298-1080	1971	72	54

*133 Total = 120 On Ranch Testing Program
= 13 On Station

STATE	NAME OF STATION	CONTACT AND ADDRESS	YEAR ESTABLISHED	BULLS TESTED IN LAST COMPLETE YEAR OF TESTING	NUMBER OF BULLS SOLD
INDIANA	Indiana Beef Evaluation Pgm	Larry A. Nelson, Coordinator Department of Animal Science Room 3-224 Lilly Hall Purdue University West Lafayette, IN 47907 PHONE: 317/494-4834	1976	261	116
IOWA	Orient Bull Test Station Harold Williams, Manager Orient, IA 50858 PHONE: 515/337-5763	Jim Glenn Iowa Beef Improvement Association 123 Airport Road Ames, IA 50010 PHONE: 515/233-3636	1981	56	40
	Grundy Center Bull Test Sta Dennis Dolmage, Manager 801 12th Street Grundy Center, IA 50638 PHONE: 319/824-3586	SAME AS ABOVE	1973	301	214
	Storm Lake Bull Test Station Kruse Bros. Feedlot R.R. #1 Storm Lake, IA 50588 PHONE: 712/732-1119	SAME AS ABOVE	1976	48	36
KANSAS	Kansas Bull Test - Beloit	Willard Olson Extension Assistant Weber Hall Kansas State University Manhattan, KS 66506 PHONE: 913/532-6131	1970	604	291
	Kansas Bull Test - Potwin	SAME AS ABOVE	1982	461	223
KANSAS (Continued)	Silver Key Bull Test	Larry Stucky Route #1 McPherson, KS 67460 PHONE:	1974	32	No sale
	Colby Bull Test	Danny Simms Area Extension Livestock Spec KSU Extension Service 170 West Fourth Colby, KS 67701 PHONE: 913/462-3971	1981	142	87
KENTUCKY	Central Bull Test Station	Carla C. Nichols Extension Beef Cattle Specialist 803 Ag Science South University of Kentucky Lexington, KY 40546 PHONE: 606/257-7514	1969	134	99
LOUISIANA	Bull Testing Station at Alexandria	John E. Pontif Dean Lee Ag Center LSUA LeCompte, LA 71346 PHONE: 318/473-6520	1956	255	65
MAINE	NO TEST STATION				
MARYLAND	NO TEST STATION				
MASSACHUSETTS	NO TEST STATION				
MICHIGAN	West Michigan Centennial Bull Test Station	Richard Crissman 585 - 36th Street, S.W. Grand Rapids, MI 49509 PHONE: 616/534-4927	1974	0	No sale

STATE	NAME OF STATION	CONTACT AND ADDRESS	YEAR ESTABLISHED	BULLS TESTED IN LAST COMPLETE YEAR OF TESTING	NUMBER OF BULLS SOLD
MINNESOTA	Minnesota Bull Test Station	C. J. Christians Extension Livestock Specialist University of Minnesota 1404 Gortner Avenue St. Paul, MN 55108 PHONE: 612/373-1166	1968	133	78
	St. Croix Valley Bull Test Station *	Dewey Wachholz Animal Science Department University of Wisconsin River Falls, WI 54022 PHONE: 712/425-3809	1978	76	40
	Rolling V Central Test Sta	Dick Vrieze Route 3, Box 77 Spring Valley, MN 55975 PHONE: 507/846-2387	1984	25	20
MISSISSIPPI	Hinds Bull Test	Billie Banes, Manager Hinds Junior College Raymond, MS 39154 PHONE: 601/857-3351	1982	57	41
MISSOURI	North Missouri Center RFD #1 Spickard, MO 64679	Jerry Lipsey S111 Animal Science Center Rm S134 University of Missouri Columbia, MO 65211 PHONE:	1970	60	**
	Central Testing Station Columbia, MO 65211	SAME AS ABOVE	1960	157	**
MONTANA	Rainbow Test Center	Don Burnham 2515 Canyon Ferry Rd. Helena, MT 59601 PHONE: 406/442-4702	1982	200	100
	All Breed Center	Phil Eidel 437 U.S. Hwy 89 Great Falls, MT 59401 PHONE: 406/965-3267	1975	600	450
	Treasure State Test	Russ Pepper Simms, MT 59477 PHONE: 406/264-5694	1977	250	100
	Midland Bull Test Station	Leo McDonnell, Jr. Columbus, MT 59019 PHONE: 406/322-5597	1963	600	380
NEBRASKA	Western Nebraska Bull Test Station	Jim Gosey Extension Beef Cattle Specialist Marvel Baker Hall University of Nebraska--Lincoln Lincoln, NE 68583 PHONE: 402/472-6417	1961	320	140
NEVADA	University Main Station Field Lab	Don Albert Main Station Field Lab Kimlick & Boynton Lane Reno, NV 89502 PHONE: 702/784-4910	1968	0	0
NEW HAMPSHIRE	NO TEST STATION				
NEW JERSEY	NO TEST STATION				

* Run in conjunction with Wisconsin.
**Combine Bull Sale at Both Stations = Selling 70.

STATE	NAME OF STATION	CONTACT AND ADDRESS	YEAR ESTABLISHED	BULLS TESTED IN LAST COMPLETE YEAR OF TESTING	NUMBER OF BULLS SOLD
NEW MEXICO	Tucumcari Bull Test	Ron Parker Extension Beef Cattle Specialist New Mexico State University Box 3AE Las Cruces, NM 88003 PHONE: 505/646-1709	1961	145	87
NEW YORK	Cornell University Bull Test Station	William Greene Extension Beef Cattle Specialist Morrison Hall Cornell University Ithaca, NY 14853 PHONE: 607/256-7712	1977	85	48
NORTH CAROLINA	Butner, NC Station	Roger L. McCraw Extension Beef Cattle Specialist North Carolina State University Box 7621 Raleigh, NC 27695-7621 PHONE: 919/737-2761	1984	66	42
	Salisbury, NC Station	SAME AS ABOVE	1973	88	67
	Waynesville, NC Station	SAME AS ABOVE	1980	42	26
NORTH DAKOTA	NO TEST STATION				
OHIO	Ohio Bull Test Station	Lorin Sanford District Specialist Animal Industry 16714 SR 215 Caldwell, OH 43724 PHONE: 614/732-2381	1969	185	133
OKLAHOMA	Oklahoma BEEF, Inc.	Charles A. McPeake Extension Beef Cattle Specialist 201 Animal Science Bldg Oklahoma State University Stillwater, OK 74078 PHONE: 405/624-6060	1973	550	200
	Gelbievh Test Station	Les Hutchens 119 West Hartman Stillwater, OK 74074 PHONE: 405/377-8037	1982	100	60
	Noble Foundation	Clay Wright Ardmore, OK 73402 PHONE: 405/223-5810	1983	100	35
	Simmental Test El Reno, OK	Gary Harding Conners State College Warner, OK 74469 PHONE: 918/463-2931	1980	70	50
	Conners State College	Gary Harding Conners State College Warner, OK 74469 PHONE: 918/463-2931	1962	85	60
	Panhandle State Univ Test	Jerry Martin Goodwell, OK 73939 PHONE: 405/349-2611	1952	90	70
OREGON	NO TEST STATION				

STATE	NAME OF STATION	CONTACT AND ADDRESS	YEAR ESTABLISHED	BULLS TESTED IN LAST COMPLETE YEAR OF TESTING	NUMBER OF BULLS SOLD
PENNSYLVANIA	Pennsylvania Meat Animal Evaluation Station	Glenn Eberly, Director Fox Hollow Road University Park, PA 16802 PHONE: 814/	1973	88	51
PUERTO RICO	NO SUBMISSION				
RHODE ISLAND	NO TEST STATION				
SOUTH CAROLINA	Clemson Univ Gain Test	Henry W. Webster Extension Beef Cattle Specialist 145 P&AS Bldg Clemson University Clemson, SC 29631 PHONE: 803/656-3424	1969	53	36
	Edisto Forage Bull Test	Larry Olson Area Extension Livestock Spec Edisto Research Station Blackville, SC 29817 PHONE: 803/284-3344	1982	59	38
SOUTH DAKOTA	Top Notch Test Center	Forrest Ireland Kadoka, SD 57543 PHONE: 605/837-2578	1982	86	60
TENNESSEE	Univ of TN Bull Test Station Middle Tennessee Expt Station Spring Hill, TN	David Kirkpatrick Extension Beef Cattle Specialist University of Tennessee P.O. Box 1071 Knoxville, TN 37901 PHONE: 615/974-7294	1971	82	64
TEXAS	Livestock Performance Center	Homer Higdon P. O. Box 520 Castroville, TX 78009 PHONE: 512/677-8820	1982	875	1,000
	Sul Ross Beef Eval Center	SRSU Box C110 Alpine, TX 79832 PHONE:	1981	0*	0
	Cooke County College PHONE: 817/665-5115	Cooke County College Box 815 Gainesville, TX 76240 PHONE: 817/668-7731 x-253	1972	155	No sale**
	Luling Foundation	Archie Abramett, Manager Drawer 31 Luling, TX 78648 PHONE: 512/875-2438	1963	102	54
	Lone Star Testing Center	Sam Massey Box 518 Wickett, TX 79788 PHONE: 915/943-2217	1973	70	50
	Central Texas College	Raiford Williams Agricultural Department Hwy 190 West Killeen, TX 76541 PHONE: 817/526-1285 or 526-1245	1975	0***	0***

*This bull test program not in operation this reporting period; plan to start operations next year.
**No sales conducted -- Private Treaty.
***The facility was closed most of the year for repairs. Test started in December.

STATE	NAME OF STATION	CONTACT AND ADDRESS	YEAR ESTABLISHED	BULLS TESTED IN LAST COMPLETE YEAR OF TESTING	NUMBER OF BULLS SOLD
TEXAS (Continued)	Stephen F. Austin State University Station	Jim Gotti Agricultural Department Stephen F. Austin State University Box 13000 Nacogdoches, TX 75962 PHONE: 409/569-3705	1982	53	?
UTAH	Utah Beef Improvement Association Test Station	Nyle J. Matthews Extension Livestock Specialist Utah State University 250 North Main Richfield, UT 84701 PHONE: 801/896-4609	1969	121	53
VERMONT	NO TEST STATION				
VIRGIN ISLANDS	NO TEST STATION				
VIRGINIA	Culpeper Agricultural Enterprises P. O. Box 658 Culpeper, VA 22701 Bobby Pace, Manager PHONE: 703/547-2188	Virginia BCIA Department of Animal Science Virginia Polytechnic Institute and State University Blacksburg, VA 24061 PHONE: 703/961-5252	1958	220	148
	Red House Bull Eval Center Red House, VA 23963 James Bennett, Manager PHONE: 804/376-3567	SAME AS ABOVE	1972	160	108
	Southwest Bull Test Station Route 2, Box 177 Wytheville, VA 24382 Jack Poole, Manager PHONE: 703/228-4807	SAME AS ABOVE	1979	122	84
WASHINGTON	NO TEST STATION				
WEST VIRGINIA	West Virginia Bull Test Sta	Wayne R. Wagner Extension Livestock Specialist G022 Agricultural Science Bldg West Virginia University Box 6108 Morgantown, WV 26506-6108 PHONE: 304/293-3392	1966	281	145
WISCONSIN	Wisconsin Beef Improvement Association	Ellie Larson, President Route 1, 3427 Bohn Road Mt. Horeb, WI 53527 PHONE: 608/437-5660	1957	120	80
WYOMING	NO TEST STATION				
		TOTALS		12,661	6,875

Compiled by: Dixon D. Hubbard, Staff Leader 202/447-2677
Livestock and Veterinary Sciences
USDA-Extension Service, AP/LVS
Room 3334-South Bldg
Washington, D.C. 20250

4/84:Updated 6/85

BIF AWARDS PROGRAM

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 Giaus	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	ND	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
Kahua Ranch	HI	1976
Milton Mallery	CA	1976
Robert Rawson	IA	1976
Wm. A. Stegner	ND	1976
U. S. Range Experiment Station	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 Osteroos	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 Russel & Rick Turner	MO	1981
Oren & Jerry Raburn	OR	1981
Orin Lamport	SD	1981
Leonard Wulf	MN	1981
Wm. H. Romersberger	IL	1982
Marvin & Donald Stoker	IA	1982
Sam Hands	KS	1982
Larry Campbell	KY	1982
Lloyd Atchison	CAN	1982
Earl Schmidt	MN	1982

Milton Krueger	MO	1982	John Spencer	CA	1983
Carl Odegard	MT	1982	Bud Wishard	MN	1983
Raymond Josephson	ND	1982	Bob & Sharon Beck	OR	1984
Clarence Reutter	SD	1982	Norman Coyner & Sons	VA	1984
Leonard Bergen	CAN	1983	Franklyn Esser	MO	1984
Kent Brunner	KS	1983	Leonard Fawcett	SD	1984
Tom Chrystal	IA	1983	Fred & Lee Kummerfeld	WY	1984
John Freitag	WI	1983	Edgar Lewis	MT	1984
Eddie Hamilton	KY	1983	Boyd Mahrt	CA	1984
Bill Jones	MT	1983	Don Moch	ND	1984
Harry & Rick Kline	IL	1983	Neil Moffat	CAN	1984
Charlie Kopp	OR	1983	William H. Moss, Jr.	GA	1984
Duwayne Olson	SD	1983	Dennis P. Solvie	MN	1984
Ralph Pederson	SD	1983	Robert P. Stewart	KS	1984
Ernest & Helen Schaller	MO	1983	Charlie Stokes	NC	1984
Al Smith	VA	1983			

1985

Milton Wendland	AL	1985	Glenn Harvey	OR	1985
Bob & Sheri Schmidt	MN	1985	John Maino	CA	1985
Delmer & Joyce Nelson	IL	1985	Ernie Reeves	VA	1985
Harley Brockel	SD	1985	John E. Rouse	WY	1985
Kent Brunner	KS	1985	George & Thelma Boucher	CAN	1985

The Seedstock Breeder Honor Roll of Excellence

John Crowe	CA	1972	Joseph P. Dittmer	IA	1975
Dale H. Davis	MT	1972	Dale Engler	KS	1975
Elliot Humphrey	AZ	1972	Leslie J. Holden	MT	1975
Jerry Moore	OH	1972	Robert D. Keefer	MT	1975
James D. Bennett	VA	1972	Frank Kubik, Jr.	ND	1975
Harold A. Demorest	OH	1972	Licking Angus Ranch	NE	1975
Marshall A. Mohler	IN	1972	Walter S. Markham	CA	1975
Billy L. Easley	KY	1972	Gerhard Mittness	KS	1976
Messersmith Herefords	NE	1973	Ancel Armstrong	VA	1976
Robert Miller	MN	1973	Jackie Davis	CA	1976
James D. Hemmingsen	IA	1973	Sam Friend	MO	1976
Clyde Barks	ND	1973	Healy Brothers	OK	1976
C. Scott Holden	MT	1973	Stan Lund	MT	1976
William F. Borror	CA	1973	Jay Pearson	ID	1976
Raymond Meyer	SD	1973	L. Dale Porter	IA	1976
Heathman Herefords	WA	1973	Robert Sallstrom	MN	1976
Albert West III	TX	1973	M. D. Shepherd	ND	1976
Mrs. R. W. Jones, Jr.	GA	1973	Lowellyn Tewksbury	ND	1976
Carlton Corbin	OK	1973	Harold Anderson	SD	1977
Wilfred Dugan	MO	1974	William Borror	CA	1977
Bert Sackman	ND	1974	Rob Brown, Simmental	TX	1977
Dover Sindelar	MT	1974	Glenn Burrows, PRI	NM	1977
Jorgensen Brothers	SD	1974	Henry & Jeanette Chitty	FL	1977
J. David Nichols	IA	1974	Tom Dashiell, Hereford	WA	1977
Bobby Lawrence	GA	1974	Lloyd DeBruycker, Charolais	MT	1977
Marvin Bohmont	NE	1974	Wayne Eshelman	WA	1977
Charles Descheemaeker	MT	1974	Hubert R. Freise	ND	1977
Bert Crame	CA	1974	Floyd Hawkins	MO	1977
Burwell M. Bates	OK	1974	Marshall A. Mohler	IN	1977
Maurice Mitchell	MN	1974	Clair Percel	KS	1977
Robert Arbuthnot	KS	1975	Frank Ramackers, Jr.	NE	1977
Glenn Burrows	NM	1975	Loren Schlipf	IL	1977
Louis Chesnut	WA	1975	Tom and Mary Shaw	ID	1977
George Chiga	OK	1975	Bob Sitz	MT	1977
Howard Collins	MO	1975	Bill Wolfe	OR	1977
Jack Cooper	MT	1975	James Volz	MN	1977

A. L. Grau		1978	Myron Aultfather	MN	1981
George Becker	ND	1978	Jack Fagsdale	KY	1981
Jack Delaney	MN	1978	W. B. Williams	IL	1982
L. C. Chestnut	WA	1978	Garold Parks	IA	1982
James D. Bennett	VA	1978	David A. Breiner	KS	1982
Healey Brothers	OK	1978	Joseph S. Bray	KY	1982
Frank Harpster	MO	1978	Clare Geddes	CAN	1982
Bill Womack, Jr.	AL	1978	Howard Krog	MN	1982
Larry Berg	IA	1978	Harlin Hecht	MN	1982
Buddy Cobb	MT	1978	Willard Kottwitz	MO	1982
Bill Wolfe	OR	1978	Larry Leonhardt	MT	1982
Roy Hunt	PA	1978	Frankie Flint	NM	1982
Del Krumwied	ND	1979	Gary & Gerald Carlson	ND	1982
Jim Wolf	NE	1979	Bob Thomas	OR	1982
Rex and Joann James	IA	1979	Orville Stangl	SD	1982
Leo Schuster Family	MN	1979	C. Ancel Armstrong	KS	1983
Bill Wolfe	OR	1979	Bill Borror	CA	1983
Jack Ragsdale	KY	1979	Charles E. Boyd	KY	1983
Floyd Mette	MO	1979	John Bruner	SD	1983
Glenn and David Gibb	IL	1979	Leness Hall	WA	1983
Peg Allen	MT	1979	Ric Hoyt	OR	1983
Frank and Jim Willson	SD	1979	E. A. Keithley	MO	1983
Donald Barton	UT	1980	J. Earl Kindig	VA	1983
Frank Felton	MO	1980	Jake Larson	ND	1983
Frank Hay	CAN	1980	Harvey Lemmon	GA	1983
Mark Keffeler	SD	1980	Frank Myatt	IA	1983
Bob Laflin	KS	1980	Stanley Nesemeier	IL	1983
Paul Mydland	MT	1980	Russ Pepper	MT	1983
Richard Tokach	ND	1980	Robert H. Schafer	MN	1983
Roy & Don Udelhoven	WI	1980	Alex Stauffer	WI	1983
Bill Wolfe	OR	1980	D. John & Lebert Shultz	MO	1983
John Masters	KY	1980	Philip A. Abrahamson	MN	1984
Floyd Dominy	VA	1980	Ron Bieber	SD	1984
James Bryan	MN	1980	Jerry Chappell	VA	1984
Blythe Gardner	UT	1980	Charles W. Druin	KY	1984
Richard McLaughlin	IL	1980	Jack Farmer	CA	1984
Charlie Richards	IA	1980	John B. Green	LA	1984
Bob Dickinson	KS	1981	Ric Hoyt	OR	1984
Clarence Burch	OK	1981	Fred H. Johnson	OH	1984
Lynn Frey	ND	1981	Earl Kindig	VA	1984
Harold Thompson	WA	1981	Glen Klippenstein	MO	1984
James Leachman	MT	1981	A. Harvey Lemmon	GA	1984
J. Morgan Donelson	MO	1981	Lawrence Meyer	IL	1984
Clayton Canning	CAN	1981	Donn & Sylvia Mitchell	CAN	1984
Russ Denowh	MT	1981	Lee Nichols	IA	1984
Dwight Houff	VA	1981	Clair K. Parcel	KS	1984
G. W. Cornwell	IA	1981	Joe C. Powell	NC	1984
Bob and Gloria Thomas	OR	1981	Floyd Richard	ND	1984
Roy Beeby	OK	1981	Robert L. Sitz	MT	1984
Herman Schaefer	IL	1981			

1985

Ric Hoyt	OR	1985	Fred Killam	IL	1985
J. Newbill Miller	VA	1985	Tom Perrier	KS	1985
George B. Halterman	WV	1985	Don W. Schoene	MO	1985
Davis McGehee	KY	1985	Everett & Ron Batho & Families	CAN	1985
Glenn L. Brinkman	TX	1985	Bernard F. Pedretti	WI	1985
Gordon Booth	WY	1985	Arnold Wienk	SD	1985
Earl Schafer	MN	1985	R. C. Price	AL	1985
Marvin Knowles	CA	1985			

Continuing Service Awards

Clarence Burch	Oklahoma	1972	Paul D. Miller	Am. Breeding Svc-Wisconsin	1978
F. R. Carpenter	Colorado	1973			
E. J. Warwick	ARS-USDA Wash.DC	1973	C. K. Allen	Am. Angus Assn.	1979
Robert De Baca	Iowa State Univ.	1973	Wm. Durfey	NAAB	1979
Frank H. Baker	Okla. State Univ.	1974	Glenn Butts	PRI	1980
D. D. Bennett	Oregon	1974	Jim Gosey	Univ. Neb.	1980
Richard Willham	Iowa Sate Univ.	1974	Mark Keffeler	South Dakota	1981
Larry V. Cundiff	RLHUSMARC	1975	J. D. Mankin	Idaho	1982
Dixon D. Hubbard	USDA-FES,Wash.DC	1975	Art Linton	Montana	1983
J. David Nichols	Iowa	1975	James Bennett	Virginia	1984
A. L. Eller, Jr.	VPI&SU	1976	M. K. Cook	Univ. of GA	1984
Ray Meyer	South Dakota	1976	Craig Ludwig	Am. Hereford Assoc.	1984
Don Vaniman	Montana	1977			
Lloyd Schmitt	Montana	1977	Jim Glenn	IBIA	1985
Martin Jorgensen	South Dakota	1978	Dick Spader	Am. Angus Assn.	1985
James S. Brinks	Col. State Univ	1978	Roy Wallace	Select Sires	1985

Commercial Producer of the Year

Chan Cooper	MT	1972	Mose Tucker	AL	1978
Pat Wilson	FL	1973	Bert Hawkins	OR	1979
Lloyd Nygard	ND	1974	Jess Kilgore	MT	1980
Gene Gates	KS	1975	Henry Gardiner	KS	1981
Ron Baker	OR	1976	Sam Hands	KS	1982
Steve and Mary Garst	IA	1977	Al Smith	VA	1983
			Bob & Sharon Beck	OR	1984

1985

Glenn Harvey	OR	1985

Seedstock Breeder of the Year

John Crowe	CA	1972	Glenn Burrows	NM	1977
Mrs. R. W. Jones	GA	1973	James D. Bennett	VA	1978
Carlton Corbin	OK	1974	Jim Wolf	NE	1979
Leslie J. Holden	MT	1975	Bill Wolfe	OR	1980
Jack Cooper	MT	1975	Bob Dickinson	KS	1981
Jorgensen Brothers	SD	1976	A. F. "Frankie" Flint	NM	1982
			Bill Borror	CA	1983
			Lee Nichols	IA	1984

1985

Ric Hoyt	OR	1985

Organizations of the Year

Beef Improvement Committee, Oregon Cattlemen's Assn.	1972
South Dakota Livestock Production Records Assn.	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 Assn. (BCIA)	1976
The American Angus Association (Breed)	1977
The Iowa Beef Improvement Association (BCIA)	1977
The American Hereford Association (Breed)	1978
Beef Performance Committee or Cattlemen's Assn.	1978
The Iowa Beef Improvement Association (BCIA)	1979

Pioneer Awards

Jay L. Lush	Iowa State Univ.	Research	1973
John H. Knox	New Mexico State Univ.	Research	1973
Ray Woodward	American Breeders Svc.	Research	1974
Fred Willson	Montana State Univ.	Research	1974
Charles E. Bell, Jr.	USDA-FES	Education	1974
Reuben Albaugh	Univ. of California	Education	1974
Paul Pattengale	Colorado State Univ.	Education	1974
Glenn Butts	Performance Registry Intl.	Service	1975
Keith Gregory	RHLUSMARC	Research	1975
Bradford Knapp, Jr.	USDA	Research	1975
Forrest Bassford	Western Livestock Journal	Journalism	1976
Doyle Chambers	Louisiana State Univ.	Research	1976
Mrs. Waldo Emerson Forbes	Wyoming Breeder	Breeder	1976
C. Curtis Mast	Virginia BCIA	Education	1976
Dr. H. H. Stonaker	Colorado State Univ.	Research	1977
Ralph Bogart	Oregon State Univ.	Research	1977
Henry Holszman	South Dakota State Univ.	Education	1977
Marvin Koger	Univ. of Florida	Research	1977
John Lasley	Univ. of Missouri	Research	1977
W. C. McCormick	Tifton, Georgia Test Stn.	Research	1977
Paul Orcutt	Montana Beef Perf. Assn.	Education	1977
J. P. Smith	Performance Registry Intl.	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	Univ. of Arizona	Research	1979
Joseph J. Urick	U.S. Range Livestock Experiment Station	Research	1979
Bryon L. Southwell	Georgia	Research	1980
Richard T. "Scotty" Clark	USDA	Research	1980
F. R. "Ferry" Carpenter	Colorado	Breeder	1980
Clyde Reed	Oklahoma State Univ.		1981
Milton England	Panhandle A&M College		1981
L. A. Maddox	Texas A&M Univ.		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	Univ. of Wyoming		1983
W. Dean Frischknecht	Oregon State Univ.		1983
Bill Graham	Georgia		1984
Max Hammond	Florida		1984
Thomas J. Marlowe	VPI&SU		1984
Mick Crandell	South Dakota State Univ.		1985
Mel Kirkiede	North Dakota State Univ.		1985

Glenn Harvey - Commerical Producer of the Year

Glenn Harvey, owner and operator of Harvey Ranch Inc., at Paisley, Oregon, was named Commerical Producer of the Year by the Beef Improvement Federation (BIF) during their annual convention at Madison, Wisconsin, on May 1-3, 1985. BIF is a federation of State Beef Cattle Improvement Associations, National Breed Associations, Artificial Insemination Organizations, and other groups involved with the genetic improvement of beef cattle. The Commercial Producer of the Year Award is the highest award bestowed upon a Commercial Cattlemem by BIF.

Glenn Harvey is a native of Oregon, having been educated in Animal and Ranch Science at Oregon State University.

Glenn Harvey has one of the top Commercial herds of cattle in the West, and gives credit for the development of such a herd to the use of superior performance tested bulls and using records in selection and culling. His is a cow-calf-yearling operation of some 400 cows, calved in the Spring. The steers and surplus heifers are sold as yearlings. Yearling steers averaged 720 lbs. in August 1963, the year Glenn started performance testing. Average steer weight for the three year period 1982, 1983, and 1984 was 980 lbs., when gathered off the range at the same time in August.

In addition to being a superb Commercial Cattleman, he is industry and public-minded as well. He serves on the five member executive group of the Oregon Cattlemens Association Beef Cattle Improvement Committee. He has served as president of the Lake County Stockgrowers Association, president of the Central Freemont Grazing Association, president of the Lake County Roundup, and is president of the Paisley District Grazing Association. In addition, he served two years on the Lake County Planning Commission.

Glenn Harvey is a strong advocate of performance testing, he has been influential in Oregon's program of individual cow identification, which now numbers over 500,000 Commercial cows identified by individual within herd numbers.

Glenn was nominated for this very special honor by the Oregon Cattlemens Association headquartered in Portland.

Ric Hoyt - BIF Seedstock Producer of the Year

Ric Hoyt of Burns, Oregon, has been named Seedstock Producer of the Year by the Beef Improvement Federation (BIF) during their annual convention at Madison, Wisconsin on May 1-3, 1985. BIF is a federation of State Beef Cattle Improvement Associations, National Breed Associations, Artificial Insemination Organizations, and other groups involved in the genetic improvement of beef cattle.

Ric Hoyt, a breeder of registered Shorthorn cattle, as well as Commercial cattle, is responsible for the cattle operation of Hoyt & Sons. With 1,400 registered cows, Hoyt runs the largest purebred Shorthorn herd in North America. In addition, 2,000 Commerical cows and a feedlot for feeding out their produce, and for getting progeny data on shorthorn bulls rounds out the cattle operation. Individual performance records are kept on all the cattle for the last 18 years. Hoyt utilizes his own computer at the ranch for these records, but has been instrumental in setting up a workable performance testing program for the Shorthorn breed through the American Shorthorn Association.

Ric Hoyt and his family have established one of the outstanding registered Shorthorn herds, marketing some 500 performance tested bulls annually.

The American Shorthorn Association has designated Ric Hoyt as a "builder of the breed". In 1983, he was elected president of the American Shorthorn Association, and in 1984, he was elected to a unprecedented second term. He is a major force in the improvement and the rebuilding of the Shorthorn breed of cattle.

Hoyt is on the Board of Directors of the National Cattlemens Association. He serves as vice-president of the Pacific International Livestock Exhibition, and serves on the Oregon 4-H Foundation Advisory Board. He judges more than 20 cattle shows each year, and is a nationally known speaker at livestock meetings and events.

The Portland, Oregon Chamber of Commerce honored him in 1984 with their first annual "Voice of the Cattle Industry" Award.

Ric Hoyt was nominated for this very special honor by the Oregon Cattlemens Association headquartered in Portland.

1985 BIF PIONEER AWARDS

Two 1985 BIF Pioneer Awards recipients were Mick Crandall, retired Extension Beef Specialist, South Dakota State University and retired Mel Kirkiede, Extension Beef Specialist, North Dakota State University.

Crandall, a native of South Dakota and a graduate of South Dakota State University retired in 1983 after 31 years of service in South Dakota Extension as a county agent and livestock specialist. During those years he served as secretary to the South Dakota Livestock Production Records Association for 18 years. The association was the BIF organization of the year in 1973.

Kirkiede, a native of North Dakota with a BS and MS degree from North Dakota State University retired in 1984 after 35 years of service in North Dakota Extension. Thirty-three years were spent as state specialist. He served over 17 years as secretary to the North Dakota Hereford Association. In 1963 he helped organize the North Dakota Beef Cattle Improvement Association and served as its secretary for 21 years; it was the BIF organization of the year in 1976.

1985 BIF CONTINUING SERVICE AWARDS

Jim Glenn, Iowa Beef Improvement Association, Richard L. Spader, American Angus Association, and Roy A. Wallace, Select Sires, are the 1985 BIF Continuing Service Award recipients. This award recognizes individuals who have served the performance movement and BIF on a continuing basis for many years.

Glenn, a native of Iowa with BS and MS from Iowa State University, has served as a staff member for the Iowa Beef Improvement Association for the past 14 years, which was the BIF organization of the year in 1975 and 1979 and hosted the BIF convention in 1975. He has been active in many BIF committees and a frequent speaker on performance concepts.

Spader, a native of South Dakota and graduate of South Dakota State University, joined the American Angus Association in 1969 serving as assistant director of public relations and director of performance programs and became executive vice-president in 1981. The association earned the BIF Breed Association of the Year in 1976 and 1977. He was active in many BIF committees and has served 6 years on the BIF board. He is also active in the National Society of Livestock Records Association and the Beef Industry Council of the National Livestock and Meat Board.

Wallace, after graduation from Ohio State University, joined Central Ohio Breeding Association as Beef field representative and joined Select Sires, Inc. in 1970 as chairman of beef programs. He is past president of the Buckeye Beef Improvement Association, a member of the Performance Committee of the American Simmental Association, and a member and past chairman of the Beef Development Committtee of NAAB. A member of the BIF board of directors and active on many committees, Wallace is a well-known spokesman for performance concepts. Wallace is the recipient of the Young Professionals Award of the Ohio State University Agricultural and Home Economics College.

1985 BIF Seedstock Producer of the Year Nominees
Mary Boothe,Gordon Boothe, R. C. Price, June Schaeffer, Earl Schaeffer, Carolyn Perrier, Tom Perrier, Judy Hoyt, Ric Hoyt, Marie McGhee, Bernard Pedretti, Davis McGhee, Vern Soon (Brinks, Mgr.)

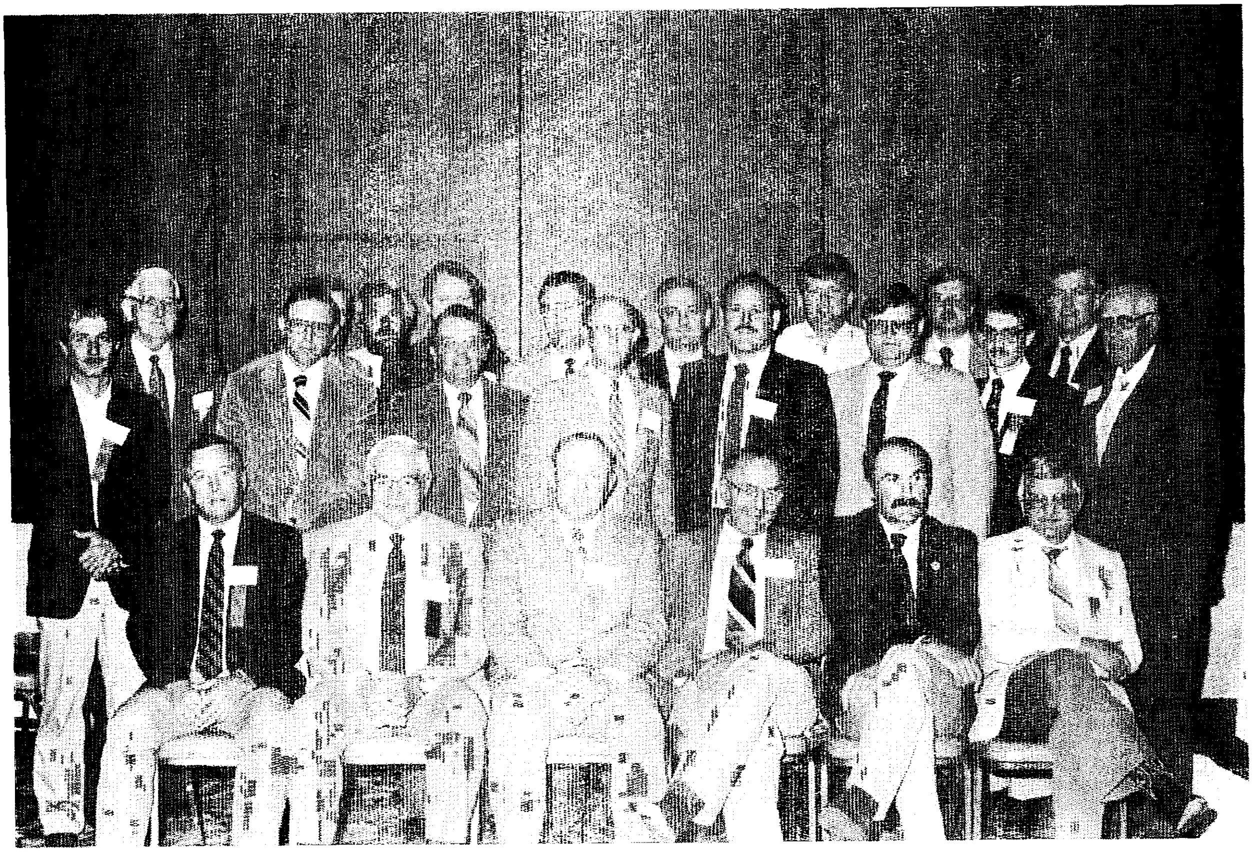
1985 BIF Commercial Producer of the Year Nominees
Mildred Harvey, Glenn Harvey, Sheri Schmidt, Susie Maino, John Maino, George Boucher

<u>1985 BIF Seedstock Producer of the Year Award</u>
Ric Hoyt and wife Judy flanked by President Gene Schroeder (L) and Director Frank Baker (R)

<u>1985 BIF Commercial Producer of the Year Award</u>
Glenn Harvey and wife Mildred flanked by President Gene Schroeder (L) and Director Frank Baker (R)

<u>1985 BIF Continuing Service Awardees</u>
Dick Spader, Roy Wallace and Jim Glenn flanked by President Gene Schroeder (L) and Director Frank Baker (R)

1985 BIF Pioneer Awardee Melvin Kirkeide with President Gene Schroeder (L) and Director Frank Baker (R)



BIF Board of Directors
Front Row (seated) - A. L. Eller, Jr., Executive Director; Gene Schroeder, Past President; Harvey Lemmon, Vice President; Henry Gardiner, President; Steve Radakovich; Dixon Hubbard, USDA.
Second Row - Darrell Wilkes, NCA; Bob Dickinson; Steve Wolfe; John Crouch; Daryl Strohbehn, Central Secretary; Roy Wallace; Roger McCraw, Eastern Secretary; Glenn Butts.
Third Row - Frank Baker; Jim Gibb; Bill Borror; Bruce Howard; Bill Warren; Larry Cundiff; Al Smith; Wayne Vanderwert; Richard Whitman.
Not Pictured - Keith VanderVelde and Ken Ellis, Western Secretary.

1985 BIF Convention Speaker James Leachman, Billings, Montana

1985 BIF Convention Speaker Hank Fitzhugh, Morrilton, Arkansas

1985 BIF Convention Speaker David Notter, Blacksburg, Virginia

1985 BIF Convention Speaker Doc Hatfield,
Brothers, Oregon

1985 BIF Convention Speaker James Innes,
Fairlie, New Zealand

1985 BIF Convention Speaker H. H. Dickenson, Kansas City, Missouri

BIF President Henry Gardiner and immediate Past President Gene Schroeder.

1985 BIF CONVENTION ATTENDANCE

DON ALBERT
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2081 HOLMAN WAY
SPARKS, NV 89431

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COLORADO STATE
DEPT. OF AN. SC.
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KNOLL CREST
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The Reduced Animal Mixed Model Equations for National Cattle Evaluation

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Abstract

The reduced animal mixed model equations for a maternally influenced trait such as weaning weight, are presented. The contribution of a performance record to the mixed model equations can be calculated when the following information is available on the animal: 1) status code (parent or nonparent record), 2) animal's known parents, 3) contemporary group in which the record was made and 4) performance record. The equations needed to compute back-solutions for nonparent animals are also presented.

Introduction

Most beef breed associations in the United States are using mixed model methodology developed by C. R. Henderson to predict expected progeny differences for the sires in their breeds. Historically, only progeny and pedigree information have been used in the genetic prediction procedures. Henderson and Quass (1976), Quass and Pollak (1980) and Pollak and Quass (1983) have described methodology for including individual performance information to predict breeding values for every animal in a population using all available information.

Quass and Pollak (1980) and Pollak and Quass (1983) have described the reduced animal model (RAM), which is an equivalent model to the animal model. The RAM describes all nonparent records in terms of animals that are parents, thus reducing the number of equations to solve in order to predict parent breeding values. Nonparent breeding values can be found by backsolving. The RAM has been applied to two breeds of beef cattle in the United States to predict direct genetic and maternal genetic breeding values for every animal in the breed (Benyshek, et al. 1985a,b).

The purpose of this paper is to present the reduced animal model equations for a maternally influenced trait and to present the contribution of parent and nonparent records to the mixed model equations.

The Reduced Animal Model

Pollak and Quass (1983) presented a full animal model and the mixed model equations for a maternally influenced trait. A RAM for the full animal model is:

$$\begin{bmatrix} Y_p \\ Y_n \end{bmatrix} = \begin{bmatrix} X_p \\ X_n \end{bmatrix} b + \begin{bmatrix} Z_p \\ \tfrac{1}{2}P \end{bmatrix} U_p + \begin{bmatrix} Z_{mp} \\ Z^*_{mp} \end{bmatrix} U_{mp} + \begin{bmatrix} Z_{pe} \\ Z^*_{pe} \end{bmatrix} U_{pe} + \begin{bmatrix} e_p \\ e_n + \delta_n \end{bmatrix} \quad (1)$$

where Y_p and Y_n are the performance records of parents and nonparents, respectively, b is the fixed effect vector; U_p and U_{mp} are the vectors of direct and maternal genetic breeding values, respectively, for all parents; U_{pe} is the permanent environmental random effect vector containing effects for only female parents. The matrices X_p, Z_p, Z_{mp} and Z_{pe} are incidence matrices relating the parent vector of records to the corresponding effects. The matrices X_n, $\frac{1}{2}P$, Z_{mp}^* and Z_{pe}^* are incidence matrices relating the nonparent vector of records to the corresponding effects. The matrix P contains ones in the columns corresponding to the animal's parents and zeros otherwise. The vectors e_p and e_n contain the random residual effects associated with parent and nonparent records, respectively. The vector δ_n contains the Mendelian sampling effects for the nonparent records when both parents are known. When one or both parents are unknown, the effect in δ_n also accounts for the sampling of the missing parent(s).

The mixed model equations for model (1) are presented in table 1. When both sides of the mixed model equations in table 1 are multiplied by σ_e^2, R^{11} becomes I (identity matrix) and R^{22} becomes $I^*(1/(1 + d_n\alpha^{-1}))$, where d_n = 1/2 when both parents are known, d_n = 3/4 when only one parent is known, d_n = 1 when neither parent is known and $\alpha = \sigma_e^2/\sigma_g^2$.

Forming the Equations

The original data set should contain records that include the animal's registration number, the contemporary group code, the animal's sire's registration number (if known), the animal's dam's registration number (if known) and the animal's performance record. A parent file containing the registration numbers of all parents and their known parents and a nonparent file containing the registration numbers of all nonparents and their known parents should be created. Using these files, it is possible to renumber the contemporary groups and parents to correspond to row and column identifiers and to restructure the original data. The restructured records should contain the following information on each record: 1) the status code (parent or nonparent) 2) the contemporary group number, 3) the animal's dam's number (if known) and 4) the performance record. The record on a nonparent should also include the animal's sire's number (if sire known). From this information, it is possible to compute the contribution of an animal's record to the normal equations (equations in table 1 before adding G^{-1}). The contribution of an animal's record is presented in table 2. G^{-1} can then be added to the equations and solved by Gauss Seidel iteration.

The backsolutions for a nonparent (n) can be computed by the following equations:

$$\hat{U}_n = (1/(1 + d_n^{-1}\alpha_{11}))(Y_n - \hat{C}g_\iota - \hat{U}_{md} - \hat{U}_{pe})$$
$$+ (\alpha_{11}d_n^{-1}/(1 + \alpha_{11}d_n^{-1}))(1/2\hat{U}_s + 1/2\hat{U}_d),$$

and

$$\hat{U}_{mn} = 1/2\hat{U}_{ms} + 1/2\hat{U}_{md} + \alpha_{11}\alpha_{12}^{-1}(\hat{U}_n - 1/2\hat{U}_s - 1/2\hat{U}_d),$$

where $\hat{C}g_\iota$ was the contemporary group estimate, s and d denote the animal's sire and dam, respectively, $\alpha_{11} = \sigma_e^2/\sigma_g^2$, $\alpha_{12} = \sigma_e^2/\sigma_{gm}$ and $d_n = 1/2$ if both parents are known and $d_n = 3/4$ if only one parent is known.

TABLE 1. THE REDUCED ANIMAL MIXED MODEL EQUATIONS.

$$
\begin{bmatrix}
X'_pR^{11}X_p + X'_nR^{22}X_n & X'_pR^{11}Z_p + \tfrac{1}{2}X'_nR^{22}P & X'_pR^{11}Z_{mp} + X'_nR^{22}Z^*_{mp} & X'_pR^{11}Z_{pe} + X'_nR^{22}Z^*_{pe} \\
Z'_pR^{11}X_p + \tfrac{1}{2}P'R^{22}X_n & \left[Z'_pR^{11}Z_p + \tfrac{1}{4}P'R^{22}P \right. & \left. Z'_pR^{11}Z_{mp} + \tfrac{1}{2}P'R^{22}Z^*_{mp} \right] & Z'_pR^{11}Z_{pe} + \tfrac{1}{2}P'R^{22}Z^*_{pe} \\
Z'_{mp}R^{11}X_p + Z'^*_{mp}R^{22}X_n & \left[Z'_{mp}R^{11}Z_p + \tfrac{1}{2}Z'^*_{mp}R^{22}P \right. & \left. Z'_{mp}R^{11}Z_{mp} + Z'^*_{mp}R^{22}Z'^*_{mp} \right] + G^{-1} & Z'_{mp}R^{11}Z_{pe} + Z'^*_{mp}R^{22}Z^*_{pe} \\
Z'_{pe}R^{11}X_p + Z'^*_{pe}R^{22}X_n & Z'_{pe}R^{11}Z_p + \tfrac{1}{2}Z'^*_{pe}R^{22}P & Z'_{pe}R^{11}Z_{mp} + Z'^*_{pe}R^{22}Z^*_{mp} & Z'_{pe}R^{11}Z_{pe} + Z'^*_{pe}R^{22}Z'^*_{pe} + \alpha_4
\end{bmatrix}^{a}
\begin{bmatrix} b \\ U_p \\ U_{mp} \\ U_{pe} \end{bmatrix}^{b}
$$

$$
= \begin{bmatrix}
X'_pR^{11}Y_p + X'_nR^{22}Y_n \\
Z'_pR^{11}Y_p + \tfrac{1}{2}P'R^{22}Y_n \\
Z'_{mp}R^{11}Y_p + Z'^*_{mp}R^{22}Y_n \\
Z'_{pe}R^{11}Y_p + Z'^*_{pe}R^{22}Y_n
\end{bmatrix}
\qquad
V\begin{bmatrix} U_p \\ U_{mp} \\ U_{pe} \end{bmatrix}
= \begin{bmatrix}
\begin{bmatrix} A_{p,p}\sigma^2_g & A_{p,p}\sigma_{gm} \\ A_{p,p}\sigma_{gm} & A_{p,p}\sigma^2_m \end{bmatrix} & \begin{matrix} \emptyset \\ \emptyset \end{matrix} \\
\begin{matrix} \emptyset & \emptyset \end{matrix} & \sigma^2_{pe}
\end{bmatrix} = G \quad ^{c}
$$

$$
V\begin{bmatrix} ep \\ e_p + \delta_n \end{bmatrix}
= \begin{bmatrix} I\sigma^2_e & \emptyset \\ \emptyset & I\sigma^2_e + D\sigma^2_g \end{bmatrix}^{d}
= \begin{bmatrix} R_{11} & \emptyset \\ \emptyset & R_{22} \end{bmatrix}
\quad
\begin{bmatrix} R^{11} & \emptyset \\ \emptyset & R^{22} \end{bmatrix}
= \begin{bmatrix} R_{11} & \emptyset \\ \emptyset & R_{22} \end{bmatrix}^{-1}
$$

a. $\alpha_4 = I^*1/\sigma^2_{pe}$.

b. The b effects in beef cattle evaluation usually correspond to fixed contemporary group effects.

c. $A_{p,p}$ = relationship matrix among the parents.

d. D = diagnonal matrix with 1/2 on diagonal when both parents are known, 3/4 when one parent is known and 1 when neither parent is known.

TABLE 2. THE CONTRIBUTION OF A RECORD TO THE REDUCED ANIMAL MIXED MODEL EQUATIONS PRESENTED IN TABLE 1.

Parent record		Nonparent record	
Submatrix[a,b,c,d]	Contribution[e]	Submatrix	Contribution
$(X_p'R^{11}X_p)\iota\iota$	1	$(X_n'R^{22}X_n)\iota\iota$	R_1 or R_2
$(X_p'R^{11}Z_p)\iota j$ and $(Z_p'R^{11}X_p)j\iota$	1	$(1/2X_n'R^{22}P)\iota\kappa$ and $(1/2P'R^{22}X_n)\kappa\iota$	$.5R_1$ or $.5R_2$
$(X_p'R^{11}Z_{mp})\iota\ell$ and $(Z_{mp}'\ R^{111}X_p)\ell\iota$	1	$(1/2X_n'R^{22}P)\iota\ell$ and $(1/2P'R^{22}X_n)\ell\iota$	$.5R_1$ or $.5R_2$
$(X_p'R^{11}Z_{pe})\iota\ell$ and $(Z_{pe}'R^{11}X_p)\ell\iota$	1	$(X_n'R^{22}Z_{mp}^*)\iota\ell$ and $(Z_{mp}'^*R^{22}X_n)\ell\iota$	R_1 or R_2
$(Z_p'R^{11}Z_p)jj$	1	$(X_n'R^{22}Z_{pe}^*)\iota\ell$ and $(Z_{pe}'^*R^{22}X_n)\ell\iota$	R_1 or R_2
$(Z_p'R^{11}Z_{mp})j\ell$ and $(Z_{mp}'R^{11}Z_p)\ell\iota$	1	$(1/4P'R^{22}P)\kappa\kappa$ and/or $(1/4P'R^{22}P)\ell\ell$	$.25R_1$ or $.25R_2$
$(Z_p'R^{11}Z_{pe})J\ell$ and $(Z_{pe}'R^{11}Z_p)\ell j$	1	$(1/4P'R^{22}P)\ \kappa\ell$ and $(1/4P'R^{22}P)\ell\kappa$	$.25R_1$
$(Z_{mp}'R^{11}Z_{mp})\ell\ell$ and $(Z_{pe}'R^{11}Z_{pe})\ell\ell$	1	$(1/2P'R^{22}Z_{mp}^*)\kappa\ell$ and $(1/2Z_{mp}'^*R^{22}P)\ell\kappa$	$.5R_1$
$(Z_{mp}'R^{11}Z_{pe})\ell\ell$ and $(Z_{pe}'R^{11}Z_{mp})\ell\ell$	1	$(1/2P'R^{22}Z_{mp}'^*)\ell\ell$ and $(1/2Z_{mp}'^*R^{22}P)\ell\ell$	$.5R_1$ or $.5R_2$
$(X_p'R^{11}Y_p)\iota$	Y_{pj}	$(1/2P'R^{22}Z_{pe}'^*)\kappa\ell$ and $(1/2Z_{pe}'^*R^{22}P)\ell\kappa$	$.5R_1$
$(Z_p'R^{11}Y_p)j$	Y_{pj}	$(1/2P'R^{22}Z_{pe}'^*)\ell\ell$ and $(1/2Z_{pe}'^*R^{22}P)\ell\ell$	R_1 or R_2
$(Z_{mp}'R^{11}Y_p)\ell$	Y_{pj}	$(Z_{mp}'^*R^{22}Z_{mp}^*)\ell\ell$ and $(Z_{pe}'^*R^{22}Z_{pe}^*)\ell\ell$	R_1 or R_2
$(Z_{pe}'R^{11}Y_p)\ell$	Y_{pj}	$(Z_{mp}'^*R^{22}Z_{pe}^*)\ell\ell$ and $(Z_{pe}'^*R^{22}Z_{mp}^*)\ell\ell$	R_1 or R_2
		$(X_n'R^{22}Y_n)\iota$	R_1Y_{nj} or R_2Y_{nj}
		$(1/2P'R^{22}Y_n)\kappa$ and/or $(1/2P'R^{22}Y_n)\ell$	$.5R_1Y_{nj}$ or $.5R_2Y_{nj}$
		$(Z_{mp}'^*R^{22}Y_n)\ell$ and $(Z_{pe}'^*R^{22}Y_n)\ell$	R_1Y_{nj} or R_2Y_{nj}

(table 2 continued)

a. ι = contemporary group, j = animal making the record, κ = sire of animal making the record and ℓ = dam of animal making record. $(X_p'R^{11}Z_{mp})\iota\ell$ for example, is the element of the submatrix belonging to the ι^{th} contemporary group and the ℓ^{th} female parent.

b. $R^{11} = I$ and $R^{22} = I + D\alpha^{-1}$ where D is a diagonal matrix and $\alpha = \sigma_e^2/\sigma_g^2$. If all nonparents have at least one parent known, $R_1 = 1/(1 + \alpha^{-1}/2)$ when both parents are known, and $R_2 = 1/(1 + 3\alpha^{-1}/4)$ when only one parent is known.

c. All submatrix elements not shown in the above table = 0. For example, $(Z_{mp}'Z_{mp})\kappa\kappa = (1/2P'R^{22}Z_{mp}^*) = 0$.

d. The elements of the submatrices involving parents of the individual making the record will be zero if the parent is unknown. For example: $(Z_p'R^{11}Z_{mp})j\ell = 0$ if the dam is unknown and $(1/4P'R^{22}P)\kappa\ell = 0$ if either sire or dam is unknown.

e. To form the complete normal equations, animal contributions must be collected by like row and column identifiers.

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Direct and Maternal Effect Variance Component Estimation From Field Data

For several years, mixed model methodology of Henderson (1972) has been used to quantify the differences among sires for their birth, weaning and yearling weight expected progeny differences (EPD's). Further development of these procedures by D. E. Wilson (1984) allowed for the partitioning of dam effects into maternal and genetic contributions to their progeny's. As a consequence, a sire's EPD for maternal effect can also be determined by analyzing the records of a sire's daughters' progeny.

In order to conduct this mixed model sire evaluation for maternal effects, appropriate variances and covariances of random effects are needed; values which do not currently exist in the literature for this type of evaluation. The objective of this technical note is to present a method and preliminary results of a study conducted to obtain these needed variance components (see Skaar, 1985).

Model

Expanded from a basic model describing the sire and dam contributions to the phenotype of a calf, the mixed model used for this investigation is given as

$$Y_{ijklp} = \mu + cg_{ij} + s_k + md_l + mm_l + e_{ijklp}$$

where

μ = overall mean of progeny records (fixed),

cg_{ij} = effect of the i^{th} group in the j^{th} herd (fixed),

s_k = the direct additive genetic contribution of sire k (random),

md_l = 1/2 of the direct additive genetic contribution of mgs l (random) through the dam of p,

mm_l = genetic maternal effect of mgs l as expressed in the maternal ability of the dam of p,

and

e_{ijkl} = remaining random error after fitting other effects associated with the record of the p^{th} calf.

In matrix notation, this model is stated as $\underline{y} = X\underline{b} + Z_1\underline{u}_1 + Z_2\underline{u}_2 + \underline{e}$,

where

$\underline{y}$ = a known N x 1 vector of adjusted birth weight or weaning weight records.

$\underline{b}$ = an unknown cg x 1 vector of fixed contemporary group effects, including the overall mean.

X = a known N x ng incidence matrix which relates the elements of $\underline{b}$ to $\underline{y}$.

$\underline{u}_1, \underline{u}_2$ = unknown ns x 1 vectors of random effects for sire direct and sire maternal effect, respectively.

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Z_1, Z_2 = unknown N x ns incidence matrices that relate elements of u_1 and
e = an N x 1 vector of residual random errors, assumed NID($0, \sigma^2$).

Note that elements of $\underline{u}_1$ represent direct effect evaluations for bulls represented as both sires and maternal grandsires (hence 1's and .5's compose Z_1).

The $E(\underline{y}) = X\underline{b}$ and $V(\underline{y}) = ZGZ'$

where

$$G = \begin{bmatrix} \sigma_s^2 & \sigma_{s \cdot mg} \\ \sigma_{s \cdot mg} & \sigma_{mg}^2 \end{bmatrix} * I$$

The mixed model equations solved for estimate of a sire's EPD for direct effect ($\underline{u}_1$) and his EPD for maternal effect ($\underline{u}_2$) are given as:

$$\left[\begin{bmatrix} Z'MZ & Z_1MZ_2 \\ Z_1MZ_1 & Z_1MZ_2 \end{bmatrix} + G^{-1}\sigma_e^2\right] \begin{bmatrix} \underline{u}_1 \\ \underline{u}_2 \end{bmatrix} = \begin{bmatrix} Z_1'M\underline{y} \\ Z_2'M\underline{y} \end{bmatrix}$$

where M is an idempotent matrix ($M'M = I$) and is defined as

$$M = (I - X(X'X)^{-1}X').$$

Variance Component Analysis

The method of variance component analysis selected is an adaptation of techniques discussed by Harville (1977) and Henderson (1984). The method has been referred to as, MINQUE-D, approximate MINQUE, and Henderson's New Method in various publications. It has the advantage over competing methods such as REML, MINQUE, and ML in that it is more computationally feasible for mixed models with large numbers of levels per random factor.

The method uses quadratic forms of approximate solutions to the mixed model equations; one form needed per component estimated. In this study, the quadratic forms $\underline{u}_1'\underline{u}_1$, $\underline{u}_2'\underline{u}_2$, $2(\underline{u}_1'\underline{u}_2)$, and $\underline{y}'M\underline{y}$ were considered (see Schaeffer, 1983).

Let the equations for $\hat{\underline{u}}_1$ and $\hat{\underline{u}}_2$ be approximated as

$$\begin{bmatrix} D_{11} & D_{12} \\ D_{12} & D_{22} \end{bmatrix} \begin{bmatrix} \tilde{\underline{u}}_1 \\ \tilde{\underline{u}}_2 \end{bmatrix} = (r)$$

where D_{11} = the diagonal elements of $Z_1'MZ_1 + (G^{-1})_{11} \cdot \sigma_e^2$,

D_{12} = the diagonal elements of $Z_1'MZ_2 + (G^{-1})_{12} \cdot \sigma_e^2$, etc.

and $r = \begin{bmatrix} Z_1'My \\ Z_2'My \end{bmatrix}$

These approximate solutions are thus computed by inverting the 2x2 matrix which includes the diagonal elements of a bull's direct and maternal equations and the corresponding off-diagonal elements from the coefficient matrix after absorption.

Unbiased solutions for each variance component are found by taking the expectation of each quadratic formed from these approximate solutions and equating them to their calculated value and solving this system simultaneously.

For example, the $E(u_1'u_1)$ is given as

$$E(u_1'u_1) = tr\ (Q_1V(r))$$

$$= tr\begin{bmatrix} (D^{11})^2 & D^{11}\cdot D^{12} \\ D^{11}\cdot D^{12} & (D^{12})^2 \end{bmatrix}$$

where

$$V(r) = V(Z'My) = K_1\sigma_1^2 + K_2\sigma_2^2 + K_3\sigma_{12}$$

$$= Z'MZ_1\ Z_1'MZ + Z'MZ_2Z_2'\ MZ + 2(Z'MZ_1Z_2'\ MZ)$$

The final set of equations appear as

$$\begin{bmatrix} tr(Q_1K_1) & tr(Q_1K_2) & tr(Q_1K_3) & tr(Q_1K_0) \\ tr(Q_2K_1) & tr(Q_2K_2) & tr(Q_2K_3) & tr(Q_2K_0) \\ tr(Q_3K_1 & tr(Q_3K_2) & tr(Q_3K_3) & tr(Q_3K_0) \\ tr(Z_1'MZ_1) & tr(Z_2'MZ_2) & 2tr(Z_1'MZ_2) & (N-r(x)) \end{bmatrix} \begin{bmatrix} \hat{\sigma}_1^2 \\ \hat{\sigma}_2^2 \\ \hat{\sigma}_{12} \\ \sigma_e^2 \end{bmatrix} = \begin{bmatrix} \underline{\tilde{u}}_1'\underline{\tilde{u}}_1 \\ \underline{\tilde{u}}_2'\underline{\tilde{u}}_2 \\ 2\underline{\tilde{u}}_1'\underline{\tilde{u}}_2 \\ \underline{y}'M\underline{y} \end{bmatrix}$$

Computation would be impossible for a large number of sires if one did not take advantage of the block diagonality of each Q_i. Hence only the block diagonal elements of each K_i need be computed as well.

Data and Results

Birth weight and weaning weight records collected by the American Angus and American Hereford Associations were used to determine sire direct and sire maternal effect variance components. Data from 20 Angus and 25 Hereford herds were selected for study. A total of 25,586 Angus birth weight records resulted from 718 sires and 1,319 maternal grandsires. For Angus weaning weight analysis, 34,190 records were used from 941 sires and 1,576 maternal grandsires. Hereford data contained 14,436 birth weight records from 566 sires and 1,134 maternal grandsires. For weaning weight analyses, 46,616 Hereford records resulted from 1,366 sires and 2,169 maternal grandsires.

First round estimates, although unbiased, were found to be sensitive to initial prior variance components used in their estimation. Nonetheless, final iterative solutions were found to converge quickly to the same approximate point despite a range in priors tested. Although the properties of iterative solutions procedures used in this analysis are not known, they produced consistent results.

Heritabilities and genetic correlations determined from these analyses are given in Table 1.

Table 1. Heritabilities and genetic correlations of direct (A) and maternal (M) birth weight and weaning weight.

Trait	Breed	$\hat{h}^2_A$	$\hat{h}^2_M$	$\hat{r}_{A \cdot M}$
Birth wt.				
	Angus	.57	.004	(0)[a]
	Hereford	(*)[b]	(*)[b]	(0)[a]
Weaning Wt.				
	Angus	.24	.18	.16
	Hereford	.18	.23	.25

[a]Genetic covariance restricted to equal zero due to negative estimates.

[b]Convergence criterion not met due to negative estimates.

For birth weight, iterative solutions for $\hat{h}^2_M$ tended toward zero, while $\hat{h}^2_A$ increased each round toward a value of .55. By restricting $\hat{r}_{A \cdot M}$ to zero, heritabilities were obtained for Angus but not Hereford data. As for weaning weight, the positive correlation estimated by this study is in agreement with reports of genetic correlations between sire proofs for milk production and growth rate. However, the correlation is in contrast to negative estimates reported from research that utilized covariances of dam and offspring or of maternal half sibs to determine its value.

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