PROCEEDINGS

BEEF IMPROVEMENT FEDERATION

RESEARCH SYMPOSIUM & ANNUAL MEETING

May 22-24, 1978
Donaldson Brown Center
for
Continuing Education
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia

PROCEEDINGS OF BEEF IMPROVEMENT FEDERATION
RESEARCH SYMPOSIUM AND ANNUAL MEETING

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MONDAY, May 22

7:45 a.m. to 9:00 a.m.	REGISTRATION.
7:00 a.m. to 9:00 a.m.	BIF Board Meeting - Board Room. Sub-Committee Meetings - Conference Rooms.
9:00 a.m. to 12:00 noon	SYMPOSIUM 1 - Auditorium - RECORD COLLECTION, ADJUSTMENT AND HANDLING - Dr. T. J. Marlowe, VPI&SU, Blackburg, VA Chairman. A. "RATIONALE AND NEED FOR DATA ADJUSTMENT" - Dr. T. J. Marlowe. B. "REVIEW AND UPDATE OF WEANING ADJUSTMENTS" - Dr. Larry Benyshek, University of GA, Athens. C. "REVIEW AND UPDATE OF YEARLING ADJUSTMENTS" - Dr. Larry Cundiff, U.S. MARC, Clay Center, NE. D. "ARE TESTING PROGRAMS AND ADJUSTMENTS PROPER IN LIGHT OF GROWTH, MATURITY RATE AND EFFICIENCY DIFFERENCES" - Dr. W. T. Butts, USDA-ARS, Knoxville, TN. (Paper not prepared for proceedings).
10:30 a.m.	Coffee Break. (Compliments of Select Sires)
12:00 noon	LUNCHEON - Dining Room. Martin Jorgensen, President, Presiding - Welcome by President; Roger Winn, Jr., VA BCIA President; and Dr. James R. Nichols, Dean, VPI&SU College of Agriculture and Life Sciences. - Charge to Standing Committees - Martin Jorgensen and Dixon Hubbard.
1:15 p.m. to 4:15 p.m.	STANDING COMMITTEE MEETINGS Conference Rooms: A. Reproduction - Bill Durfey, Chairman B. Growth and Efficiency of Gain - Dick Whaley, Chairman C. Seedstock Herds - Don Vaniman, Chairman D. Carcass Evaluation - Jim Wolf, Chairman E. Live Animal Evaluation - C. K. Allen, Chairman Committee Room - Commercial Herd - Mark Keffeler, Chairman
3:30 to 4:00 p.m.	Coffee and Coke Break. (Compliments of American Breeders Service).

4:30 p.m.	ELECTION OF DIRECTORS Regional Caucuses - Conference Rooms. General Meeting for Director Election - Auditorium.
6:15 p.m.	RECOGNITION DINNER - Dining Room. Dr. Art Linton, New BIF Executive Director, Ft. Collins, CO, Presiding. Award Committee Chairmen. Recognition of Award Nominees for Commercial Producer and Seedstock Producer of the Year. Recognition of Pioneer Award recipients.
8:30 p.m.	Finalize Committee Work - Conference Rooms. (Exchange of ideas among committees).
9:00 p.m.	"The West of Charles Russell" - Movie (IMC) - Auditorium.

TUESDAY, May 23

8:00 a.m. to 10:40 a.m.	SYMPOSIUM II - Auditorium - EXPECTED BREEDING VALUES - Dr. Joe Armstrong, University of GA, Calhoun, Chairman. A. "WHY AND HOW AMERICAN SIMMENTAL ASSOCIATION USES THE BREEDING VALUE PRINCIPLE" - Mr. Don Vaniman, American Simmental Association, Bozeman, MT. B. "WHAT ARE BREEDING VALUES - DIRECT AND MATERNAL" - Dr. Richard Willham, Iowa State University, Ames, IA. C. "WHY AND HOW AMERICAN ANGUS ASSOCIATION USES BREEDING VALUES" - Mr. Richard Spader, American Angus Association, St. Joseph, MO. D. "HOW TO USE BREEDING VALUES FROM A BREEDER's PERSPECTIVE" - Mr. Martin Jorgensen, Ideal, SD.
10:40 a.m.	Coffee Break. (Compliments of NOBA)
11:00 a.m. to 12:00 noon	BIF LISTENING CONFERENCE - Auditorium. Dr. Dixon Hubbard, Chairman - National Breed Associations, PRI and Eastern Region BCIA's
12:00 noon	LUNCH - Dining Room.
1:15 p.m. to 2:30 p.m.	BIF LISTENING CONFERENCE (Cont.) - Auditorium
2:30 p.m.	Coffee and Coke Break. (Compliments of Curtis Breeding Service)
3:00 p.m.	STANDING COMMITTEE REPORTS AND DISCUSSION - Auditorium. Martin Jorgensen in charge. - Reproduction - Growth and Efficiency of Gain - Carcass Evaluation - Live Animal Evaluation - Seedstock Herds - Central Test Station - Commercial Herd

6:00 p.m.	SOCIAL HOUR - University Club (next door). Compliments of Virginia Beef Associations.
7:00 p.m.	AWARDS BANQUET - Dining Room. Master of Ceremonies- Dr. M. B. Wise. - Entertainment - "The New Virginians" - National BIF Awards - Mr. Martin Jorgensen. *Beef Cattle Improvement Association of the Year. *Breed Association of the Year. *Commercial Producer of the Year. *Seedstock Breeder of the Year. *Continuing Service Awards. - "Observations" - Dr. Robert C. de Baca, Retiring Executive Director, BIF.

WEDNESDAY, May 24

8:00 a.m. to 3:00 p.m.	BIF Board of Directors Meeting - Board Room.

RATIONALE AND NEED FOR DATA ADJUSTMENT

Dr. T. J. Marlowe

The basic objective of any system of measurements is to evaluate differences between animals so that effective comparisons can be made. Differences among animals are due to two major causes - genetic and evironmental. Therefore, the observed performance of an animal is the result of the combined expression of the genes it received for its parents and the environment in which it is raised. In a favorable environment, these forces are usually complimentary.

The livestock breeder is primarily interested in the genetic differences between or among individual animals for one or several traits. Unfortunately, the whole animal is the smallest unit which the breeder can select or reject. This slows down progress that can be made through selection if the breeder is selecting for more than one trait at a time. Another complicating factor is that the environment may duplicate or hide the effects of some genes, causing the breeder to make mistakes, and thereby slowing progress by selection.

Most important production traits (1) are influenced by many pairs of genes; (2) there is a continuous distribution between the desirable and the undesirable; (3) the expression of these traits are greatly influenced by the environment; (4) estimates of the true genotypes can probably never be perfect for most of these traits; and (5) the heritability of many of these traits is relatively low. All of these factors tend to make genetic progress through selection to be relatively slow for most traits. Consequently, it becomes extremely important that ways be found to prevent the effects of the environment from obscuring the genetic differences between animals.

Fortunately, there are some remedies for overcoming these obstacles to progress through selection: (1) any procedure which will increase the phenotypic variation among animals will permit a larger selection differential; (2) any change in the environment that will cause the genetic difference to show their effects more clearly; (3) a higher percentage calf crop; and (4) less attention to traits of little or no economic importance, will all help to speed up progress through selection.

We know that we do not get all of the improvement that we reach for when we select a high performing young bull. The reason is simply because heritability is not perfect. If heritability of the trait is high we can predict the individual's breeding value from his own phenotype, but if heritability is low, we make mistakes when we select on phenotype alone because of: (1) innacurate records of performance; (2) confusing temporary and/or permanent environmental effects with gene effects (not properly adjusted for environmental effects), and confusing genotypes because of dominance or epistasis. These difficulties can be partially overcome by studying (1) repeated performance of the individuals, (2) phenotypes or performances of ancestors or collateral relatives, and (3) phenotypes or performance of offspring. To be meaningful, however, all of these performance records must have been made under similar environmental conditions or adequately adjusted for the environmental differences.

Among the more valuable uses of performance records are the comparisons of progeny performance of sire groups and/or individual cows within a breeder's herd. Because of the tremendous variation in environmental conditions and production programs, comparison should be on a within herd basis rather than between herds. The most accurate adjustment factors are those developed in the herd in which they are to be used, provided the herd is sufficiently large to give reliable estimates of all major environmental effects. This is not feasible for many herds, however; therefore, data must be obtained from many herds and used in a statistical model which will control the herd effects while estimating the magnitude of the effects under study.

The major non-genetic effects that influence preweaning growth rate and weaning weights of calves are age, sex and month of birth of calf, age of the cow, and preweaning management (creep feeding). An example of the variation in preweaning growth rates caused by these effects will illustrate my point. These values were taken from a study of the performance records of 14,157 Angus and 8,860 Hereford noncreep fed calves tested in the VA BCIA program from 1954 through 1964. The least squares estimates of these effects are shown on table 1. All of these effects had a highly significant influence of preweaning growth rate and weaning weight of Angus and Hereford calves.

In general, as calves increased in age from 3 to 10 months their average daily gains (ADG) decreased. This difference was greater for Angus (-.20) than for Herefords (-.12). Age effect was less for creep fed calves. When seasonal influences were removed, growth was essentially linear from five months to weaning.

Bull calves weighed 22 lbs. more than steer calves and steer calves weighed 27 lbs. more than heifer calves at 205 days of age. Steer calves grew approximately 6% faster than heifer calves regardless of whether they were creep fed or not. Noncreep fed bull calves grew 6.6% faster than noncreep fed steer calves, and creep fed bull calves grew 9.7% faster than creep fed steer calves.

Month of birth significantly influence the preweaning gain of both Angus and Hereford calves. Calves born during March and April had the fastest gains when other environmental factors were held constant. Calves born during August and September made the slowest gains. Differences between these extremes amounted to 0.25 lbs. per day (51 lbs. at 205 days) for the noncreep fed calves and 0.17 lbs. per day (35 lbs. at 205 days) for the creep fed calves. There was a gradual increase in ADG from August or September and March or April followed by a gradual decrease through June and a rapid decrease from June until August or September. Calves born during February through May gained about 4% faster than January and June calves, 12% faster than July through October calves and 6% faster than November and December calves. Creep feeding decreased the magnitude of these differences.

Age of cow had a significant effect on calf gain in both breeds. Calf gains increased with age of cow from 2 to 7 years and decreased with age of cow after 11 years. There was no significant difference in calf gains from 7-through 11-year-old cows.

Year effects were highly significant on both breeds. Creep feeding was considerably more advantageous during the poorer years.

These findings agree rather closely with results from other studies reported in the literature. They also illustrate clearly the need for proper adjustment factors if one is going to be able to make meaningful comparison of the performance records of individual calves of progeny groups, even within the same herd.

With this bit of rationale on the need for data adjustment as a background, I am going to call on the other members of this symposium to provide the "meat and potatoes" part needed to determine the specific adjustments necessary for a workable program for the beef cattle industry.

First, we wll hear from Dr. Larry Benyshek from the University of Georgia, who will give us a "review and update of preweaning adjustment factors". He will be followed by Dr. Larry Cundiff of the US Meat Animal Research Center at Clay Center, Nebraska, who will give us a "review and update on postweaning or yearling adjustment factors". Finally, Dr. Will Butts, USDA-ARS and the University of Tennessee, will discuss the question "Are testing programs and adjustments proper in light of growth, maturity rate and efficiency differences?"

Paper presented by Thomas J. Marlowe as part of a symposium on "Record Collection, Adjustment and Handling" during the 1978 Beef Improvement Federation Convention at Virginia Polytechnic Institute and State University, May 22, 1978.

TABLE 1. LEAST SQUARES ESTIMATE OF EFFECTS OF AGE, SEX AND MONTH OF BIRTH OF CALF, AGE OF COW AND WEANING ON PREWEANING GAIN OF ANGUS AND HEREFORD CALVES IN VIRGINIA

Effects studied	Angus calves		Hereford calves	
	No. head	ADG (lb)	No. head	ADG (lb)
Age of calf (days)				
90-119	616	0.16	371	0.07
120-149	1725	0.06	981	0.04
150-179	2783	0.04	1527	0.03
180-209	3214	0.01	1900	0.01
210-239*	3216	0.00*	2161	0.00*
240-269	1837	- .01	1258	- .02
270-299	766	- .04	662	- .05
Sex of calf				
Bulls	1788	0.11	1069	0.11
Steers*	7025	0.00*	4408	0.00*
Heifers	5344	- .11	3383	- .10
Month of birth				
January	2736	- .03	2148	- .05
February*	2617	0.00*	1589	0.00*
March	2713	0.07	1678	0.02
April	1584	0.02	978	0.04
May	697	0.00	407	0.02
June	169	- .03	102	- .01
July	275	- .16	32	- .14
August	138	- .23	22	- .23
September	275	- .26	64	- .17
October	332	- .18	79	- .10
November	802	- .12	378	- .08
December	1819	- .06	1383	- .05
Age of cow (yrs)				
2	1762	- .18	989	- .23
3	2115	- .10	1360	- .11
4	2138	- .06	1393	- .07
5	1840	- .03	1229	- .03
6	1759	- .02	1085	- .00
7*	1453	0.00*	889	0.00*
8	1210	0.00	676	0.00
9	963	- .01	498	0.01
10	738	- .01	387	- .01
11	520	- .01	212	0.00
12	380	- .05	138	- .05
13	266	- .02	72	- .07
14	166	- .01	47	- .05
15+	188	- .09	40	- .05
Period				
Preweaning*	13,882	0.00	8,715	0.00
Weaned	275	- .07	145	- .09
Totals & Unadj. Means	14,157	1.63	8,860	1.61

*Selected base.

WEANING ADJUSTMENTS - A REVIEW AND UPDATE

Larry Benyshek

University of Georgia

An animal's performance record is influenced by the genes he or she possesses and the environment in which the animal is placed. Genetic change resulting from selection in a population is concerned only with the effects of genes. Environment is important since it may mask the effects of genes thus reducing the accuracy of the selection decision. Some environmental factors affecting performance records are unknown such as subclinical health and parasite problems. However, several environmental factors affecting the weaning records of beef cattle are well documented such as the year the record was made, the season of birth, management (creep-fed or non-creep-fed), age of dam, age of calf and various interactions of these factors. Breed of dam certainly affects weaning records; however, this factor may be of a genetic nature as well as environmental.

If the effect of the above factors can be determined, then appropriate procedures can be utilized to minimize their effect, which will allow a more reliable selection decision. These procedures usually involve correction factors which adjust for known environmental influences. If suitable adjustment factors can not be computed, it becomes necessary to use some other statistical device to minimize environmental effects.

Year Effects. Almost every study which has included a year of record effect has found this effect to be statistically significant. Appropriate adjustments are difficult to derive for year effects. Thus, selection is usually practiced on a within year basis. Comparison of individuals born in different years on the basis of individual performance is difficult; however, ratios may reduce environmental differences between years provided year contemporary groups are large. It seems possible that mixed model techniques used in sire evaluation could be used to estimate year-herd means that would allow computation of ratios which could be used for direct comparisons (Willham, 1976).

Season of Birth. Marlowe et al., (1965) using Virginia BCIA Hereford and Angus performance records studied the effect of month of birth on preweaning average daily gain. The results of this study indicated that calves born during March and April made the fastest gains whereas calves dropped in August and September made the slowest gains. The difference between the two seasons was approximately .25 lb. per day for non-creep-fed calves and .17 lb. per day for creep-fed calves. The results reported by Brown (1960), Marlowe and Gaines (1958), Thrift (1964), Cundiff et al., (1966a) and Sellers et al., (1970) for weaning performance are in close agreement with the study of Marlowe et al., (1965).

Season of birth is of sufficient magnitude to be of concern in beef cattle improvement programs. However, since most herds calve in a single season or perhaps in two adjacent seasons, development of season correction factors are probably not warranted. The exception to this might be the need for season of birth correction in dam summaries. Cundiff et al., (1966b) indicates that additive correction factors would be more appropriate than multiplicative corrections for season of birth.

Management (Creep or Non-Creep Feeding). Almost all studies involving weaning performance field records have considered the effect of creep versus non-creep feeding to be significant. In many cases, the data have been analyzed on a within type of management basis. Estimates of the effect of creep feeding are difficult since creep feeding will usually be confounded with herd effects and sometimes season. Marlowe and Gaines (1958) indicated that creep feeding increased growth rate by approximately 0.1 lb. per day. Schaeffer and Wilton (1974) found the effect of creep feeding to be significant for preweaning ADG. Cundiff et al., (1966a) reported that creep-fed calves were 28 pounds heavier than non-creep-fed calves at weaning.

The importance of this factor may be its effect on other environmental factors; that is, the interactions of management with factors such as age-of-dam or sex-of-calf. Schaeffer and Wilton (1974a) found a significant management by sex-of-calf interaction in Canadian Record of Performance data for preweaning average daily gain of Hereford and Angus cattle. Cundiff et al., (1966a) also found a significant sex by management interaction for weaning weight. Both studies seemed to indicate that these interactions were of little biological significance.

A sound breeding program would probably either creep feed all the calves or not creep feed any calves so that adjustment would usually not be necessary on a within herd basis. The work of Cundiff et al., (1966b) indicates using an additive correction factor if adjustment is to be made. Schaeffer and Wilton (1974b) tried a number of additive and multiplicative correction procedures and found that two additive procedures (adjustment of management and sex, adjustment of sex within management) resulted in the removal of the sex by management (creep versus non-creep) interaction for preweaning average daily gain in Hereford and Angus cattle. However, complete removal of the main effects of sex and management was not accomplished in the Hereford data.

Breed-of-Dam. Several studies have shown breed-of-dam to have a significant effect on preweaning and weaning performance (Cundiff et al., 1966a; Lehmann et al., 1961, and Schaeffer and Wilton, 1974a). Minyard and Dinkel (1965) did not demonstrate a significant breed-of-dam effect for weaning weight in Angus and Hereford cattle. Breed-of-dam adjustments would be useful to commercial cattle operations where several breeds or breed crosses might be utilized or in herds upgrading new breeds of beef cattle, particularily in sire and dam summaries.

Sex-of-Calf. Many studies have found sex-of-calf to be a significant effect in preweaning and weaning performance (Vesely and Robison, 1971; Bailey and Koh, 1974; Schaeffer and Wilton, 1974a; Marlowe et al., 1965; Cundiff et al., 1966a; Tanner et al., 1970; Minyard and Dinkel, 1965; Cunningham and Henderson, 1965; Hamann et al., 1963; Lehmann et al., 1961; Swiger, 1961; Marlowe and Gaines, 1958, and Koch et al., 1959). Sex-of-calf adjustment may not be necessary if weaning performance rations are computed on a within sex group basis. However, if sex-of-calf adjustments are to be made, the question is whether to use an additive or multiplicative correction factor. Cundiff, Willham and Pratt (1966b) studied additive and multiplicative sex-of-calf adjustment factors for weaning weight in Hereford and Angus cattle. In their data, variance among bulls was significantly greater than among steers or heifers in both creep-fed and non-creep-fed calves. Multiplicative adjustments of .89, 1.02 and 1.00 were derived for bulls, heifers and steers, respectively. Their results for steers and heifers suggested that multiplicative adjustment tended to equalize the variance in these two groups and reduce the variance in bulls. The conclusion of the study concerning sex-of-calf adjustment was that multiplicative corrections are more appropriate than additive corrections when the calves are creep-fed and at least equally appropriate when they are not creep-fed. This same study found a sex by type of management interaction that was removed by the multiplicative adjustment for sex. Brinks et al., (1961) also reported that multiplicative adjustments would be more appropriate than additive correction for sex-of-calf.

Schaeffer and Wilton (1974b) studied 16 adjustment procedures for preweaning average daily gain in Angus and Hereford cattle. In their study, it was shown that a 10 percent sex-of-calf adjustment failed to remove sex-of-calf differences. Furthermore, it was shown that adjustment of other factors within sex did not remove a sex by type of management (creep versus non-creep) interaction in Herefords. Adjusting additively for sex-of-calf did remove this sex-of-calf by management interaction in Hereford and Angus; however, the sex-of-calf main effect was not completely eliminated in the Hereford data.

Age-of-Dam. The effect of the dam's age on weaning performance has probably been studied more than any other environmental factor affecting the performance of beef cattle. The question here is not whether to adjust for age-of-dam, but rather what is the best procedure to use. With respect to most of the other factors discussed, it is possible to find some method other than data adjustment to handle those effects.

Currently there are two types of adjustment factors being used for age-of-dam: additive and multiplicative corrections. The Beef Improvement Federation is currently recommending additive correction factors developed on a within breed basis. One of the first studies which compared additive versus multiplicative correction factors was conducted by Cundiff, Willham and Pratt (1966b). Additive and multiplicative correction factors were derived from data on Hereford and Angus calves recorded in the Oklahoma Beef Cattle Improvement Program. Estimates of the effects of the two types of adjustment factors were then obtained. The adjustment factors and the adjusted means are shown in Table 1.

Observation of Table 1 from Cundiff, Willham and Pratt (1966b) indicates that the means were equalized by both methods. The variance does not change when additive factors are used; however, when multiplicative corrections are used, the variance increases in proportion to the square of the correction factor. The expected standard deviation is equal to the observed standard deviation multiplied by the correction factor. Table 1 shows additively adjusted standard deviations with a range of 12.8 lb and a standard deviation of 3.3 lb. The multiplicatively adjusted standard deviations have a range of 23.5 lbs. and a standard deviation of 5.7 lb. This indicates that additive is more appropriate than multiplicative age-of-dam adjustment of weaning weights. The additive adjustments did not equalize the variances; however, they did not cause further divergence as did the multiplicative factors.

Schaeffer and Wilton (1974a) found an age-of-dam x sex-of-calf interaction and an age-of-dam x level of herd performance interaction in Hereford and Angus data from the Canadian Record of Performance Program. The first interaction is in contrast to results reported by Cundiff et al., (1966a) and Cardellino and Frahm (1971). The second interaction of age-of-dam with level of herd performance indicates that increases in cow age may result in smaller increases in calf gains at high levels of herd performance than at lower herd levels. A second study, Schaeffer and Wilton (1974b), looked at the effect of various adjustment procedures on these interactions as well as the main factor of age-of-dam in a data set independent of the data set used to obtain the correction factors. Of the sixteen adjustment procedures, three additive procedures appeared to do a better job of removing both main effects and interactions. These three procedures appeared to be superior to the multiplicative age-of-dam adjustments in use at that time. These additive correction procedures were age-of-dam and sex adjustment within management; age-of-dam within sex within management and simultaneous age-of-dam, management and sex adjustment (management refers to creep versus non-creep feeding). The Record of Performance multiplicative factors did not remove the age-of-dam effect. The Record of Performance multiplicative adjustments introduced an age-of-dam by level of herd performance interaction in the Angus data that was not in the unadjusted data. One procedure utilized a 10 percent sex adjustment in addition to the multiplicative age-of-dam correction. The 10 percent sex-of-calf adjustment did not remove the effect of calf sex. The three mentioned additive corrections all removed age-of-dam effects and did not introduce any interactions that were not in the original data. The two additive adjustments which adjusted for sex as well as age-of-dam did remove the effect of sex-of-calf in Angus but not in Herefords. In the Hereford data the interactions of age-of-dam with level-of-herd performance, age-of-dam with sex-of-calf and sex-of-calf with level of herd performance were not removed. However, these interactions appeared to have little biological significance. This study also indicated that there are probably significant breed differences for the effect of age-of-dam.

Bair, Wilson and Ziegler (1972) obtained age-of-dam correction factors from data on Angus x Holstein cows. Their findings indicated that the Beef Improvement Federation multiplicative adjustments would have over-corrected the weights of calves from two and three year old Angus-Holstein cows because the crossbred dairy background cows were heavier milking cows at these younger ages than straightbred beef cows. Marlowe and Whittle (1978, memeograph, VPI & SU) studied age-of-dam corrections for various types of straightbred and crossbred cows using preweaning average daily gain and weaning weight records from the Virginia BCIA program and the Virginia Agricultural Experiment Station. This work would indicate that the magnitude of the age-of-dam effect is essentially the same for young straightbred and crossbred cows. However, there appeared to be a slightly greater difference between young straightbred and mature straightbred cows raising crossbred calves. This difference did not show up in crossbred cows raising crossbred calves.

Age-of-Calf. Present adjustments for age-of-calf assume a linear growth pattern from birth to weaning. The literature tends to support this method of adjustment (Marlowe and Gaines, 1958; Marlowe, Mast and Schalles, 1965; and Minyard and Dinkel, 1965) for calves 160 to 250 days of age. Swiger et al., (1962) demonstrated a curvilinear effect for gain from 130 to 200 days of age indicating that some bias may be introduced using the present adjustment procedure for age of calf. If a bias is introduced by the present adjustment procedure, it is probably small and not of biological significance.

In summary, there are many environmental factors which affect the weaning performance of beef cattle. Adjustments are available for several of these environmental factors, however, it appears that age-of-dam and sex-of-calf corrections are of major concern to present day performance testing programs.

Research indicates that additive correction for age-of-dam within breed is superior to multiplicative adjustment. It should be noted that differences between the additive and multiplicative factors are small thus the previously used factors have served the industry well. It appears that 60 percent of the state BCIA programs are presently using the BIF recommended additive corrections with the remainder using the BIF multiplicative adjustments for age-of-dam. Several breed associations have either changed or are in the process of obtaining new additive age-of-dam correction factors to be applied in their programs.

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TABLE 1. CORRECTION FACTORS FOR AGE OF DAM AND EXPECTED MEANS AND STANDARD DEVIATIONS AFTER ADJUSTING FOR AGE OF DAM

Age of Dam	Additive			Multiplicative		
	Factor	Adjusted mean	Adjusted SD	Factor	Adjusted mean	Adjusted SD
	lb	lb	lb	lb	lb	lb
Months						
27	64.5	432.3	62.0	1.18	434.1	73.3
28 to 30	51.7	432.3	55.4	1.14	433.8	63.1
31 to 33	43.8	432.3	56.8	1.11	431.2	62.9
34 to 39	35.4	432.3	59.2	1.09	432.7	64.7
40 to 45	20.0	432.3	55.2	1.05	433.0	58.1
Years						
4	15.0	432.3	56.3	1.04	434.1	58.5
5	8.6	432.3	53.9	1.02	432.1	55.0
6	0.0	429.9	54.6	1.00	429.9	54.6
7	0.0	432.5	58.7	1.00	432.5	58.7
8	0.0	435.2	58.7	1.00	435.2	58.7
9	0.0	434.9	58.3	1.00	434.9	58.3
10	0.0	432.3	53.7	1.00	432.3	53.7
11	0.0	433.0	53.2	1.00	433.0	53.2
12	0.0	429.2	54.3	1.00	429.2	54.3
13	0.0	431.4	50.4	1.00	431.4	50.4
14	5.7	426.6	49.3	1.01	430.8	49.7
15	20.5	411.8	57.4	1.05	432.5	60.3
Average Adjusted SD	----	-----	55.7	----	-----	58.1
Range	----	-----	12.8	----	-----	23.5
SD	----	-----	3.3	----	-----	5.7

From Cundiff, Willham and Pratt, 1966. J. Anim. Sci. 25:983.

REVIEW AND UPDATE OF YEARLING ADJUSTMENTS[1]

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Records of performance provide for evaluation of differences between animals. Our objective is to obtain the most accurate estimates possible of breeding values or differences in genetic merit of animals. Environmental differences among animals reduce effectiveness of selection. Two basic methods of reducing environmental variance are available to the breeder. One is to physically control environment by standardizing feeding and management conditions. The second method is based on statistical adjustment of records to correct for known environmental differences among individuals.

Physical control of the environment is the most accurate and effective method for reducing environmental variation. This allows the proportion of observed variation caused by genetic differences among animals to be maximum. However, there are many factors over which breeders have very little or no managerial control. For some of these factors it is possible for the breeder to use appropriate adjustment factors.

Records of performance should be taken on all characteristics of economic value. Performance records should include measures of (1) fertility (2) calving difficulty (3) mothering ability (4) rate and efficiency of gain and (5) carcass characteristics. Nutritive environment and management significantly affect all of these characteristics. For example, components of reproduction such as age or weight at puberty and conception rate in cows are affected significantly by level of energy fed (Wiltbank _et al._, 1962; Wiltbank, Kassens and Ingalls, 1969; Kropp _et al._, 1973; Pinney Stephens and Pope, 1974; Holloway _et al._, 1975). It is important to standardize nutritive environment to the extent possible at levels which optimize performance in reproduction and other important economic characteristics.

Most research evaluating alternative selection criteria and measurement of performance was conducted in the 1950's and early 1960's. Attention focused on procedures for measuring growth to weaning and market ages and on estimation of adjustment factors to correct for sources of environmental variation such as age of dam, season of birth and age at weaning.

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[1] Presented at Symposium on "Record collection, adjustment and handling" at Beef Improvement Federation Annual Convention, Virginia Polytechnic Institute and State University. Blacksburg, Virginia, May 22-24, 1978.

Research emphasis on evaluation of alternative selection criteria needs to be renewed, especially to seek improved methods of selection for reproduction. Can reproduction be improved by selection for younger age at puberty in females, or for testicular size in bulls, or by selection for early conception rate? Are these characteristics influenced by age of the dam, age of the heifer or bull? Can heritability and accuracy of selection for reproduction be improved by more accurate procedures of measurement and adjustment for environmental factors? Questions such as these relating to reproduction and other traits such as calving ease need attention in our research. However, the remainder of my remarks will be devoted to adjustment of postweaning growth and yearling weight records because these are the areas that have been studied to date.

Growth rate is an important economic trait because of its relation to fixed costs such as veterinary, building, labor, interest, taxes and other expenses that are charged on a per-unit-of-time or on an per-head basis (Gregory, 1965). Growth rate is also important because of its high association with economy of gain and with weight of retail trimmed beef produced at desired slaughter weights.

Age of Dam

Effects of age of dam on postweaning growth were first reported by Koch and Clark (1955) on 2,303 Hereford heifers raised at the U.S. Range Livestock Experiment Station, Miles City, Montana, during the period of 1926 to 1951. Effects of age of dam on weaning weight (about 180 days), postweaning gain (about 360 days) and fall yearling weight (about 18 months) are presented in Figure 1. At that time females were managed to calve first as 3-year-olds at Miles City. Results for weaning weight in this study typify those which have followed. The largest difference for weaning weight was between the ages of 3 and 4 years. Adding 41, 18 and 6 pounds to the weaning weight of calves from 3, 4 and 5 year-old cows would adjust their weaning weights to that of peak production achieved at 6-years of age. Weaning weight dropped off at older ages.

The effects of age of dam on fall yearling weight had a pattern similar to that for weaning weight, except that the differences were smaller. Effects of age of dam on postweaning gain indicated partial compensation of age-of-dam effects at weaning in the postweaning period.

However, subsequent reports have found no age of dam effect on postweaning growth. In a study of 1,029 Hereford bulls raised at Miles City from 1939 through 1959, Brinks et al., (1962) found that age of dam significantly affected weaning weight and final weight but had no effect on 196-day postweaning gain (Figure 2).

A more recent study was conducted by Koch (unpublished) in connection with his studies on selection in Hereford cattle at the Fort Robinson Beef Cattle Research Station (Koch, Gregory and Cundiff, 1974 a,b). Results for 1,391 bulls and 1,181 heifers are summarized in Figure 3. Again, there is no effect of age of dam on postweaning growth of bulls and virtually no

FIGURE 1.

EFFECT OF AGE OF DAM ON WEANING WEIGHT, GAIN FROM WEANING TO 18 MONTHS AND 18 MONTH WEIGHT OF HEREFORD HEIFERS

(KOCH & CLARK, 1955; USDA & MONTANA)

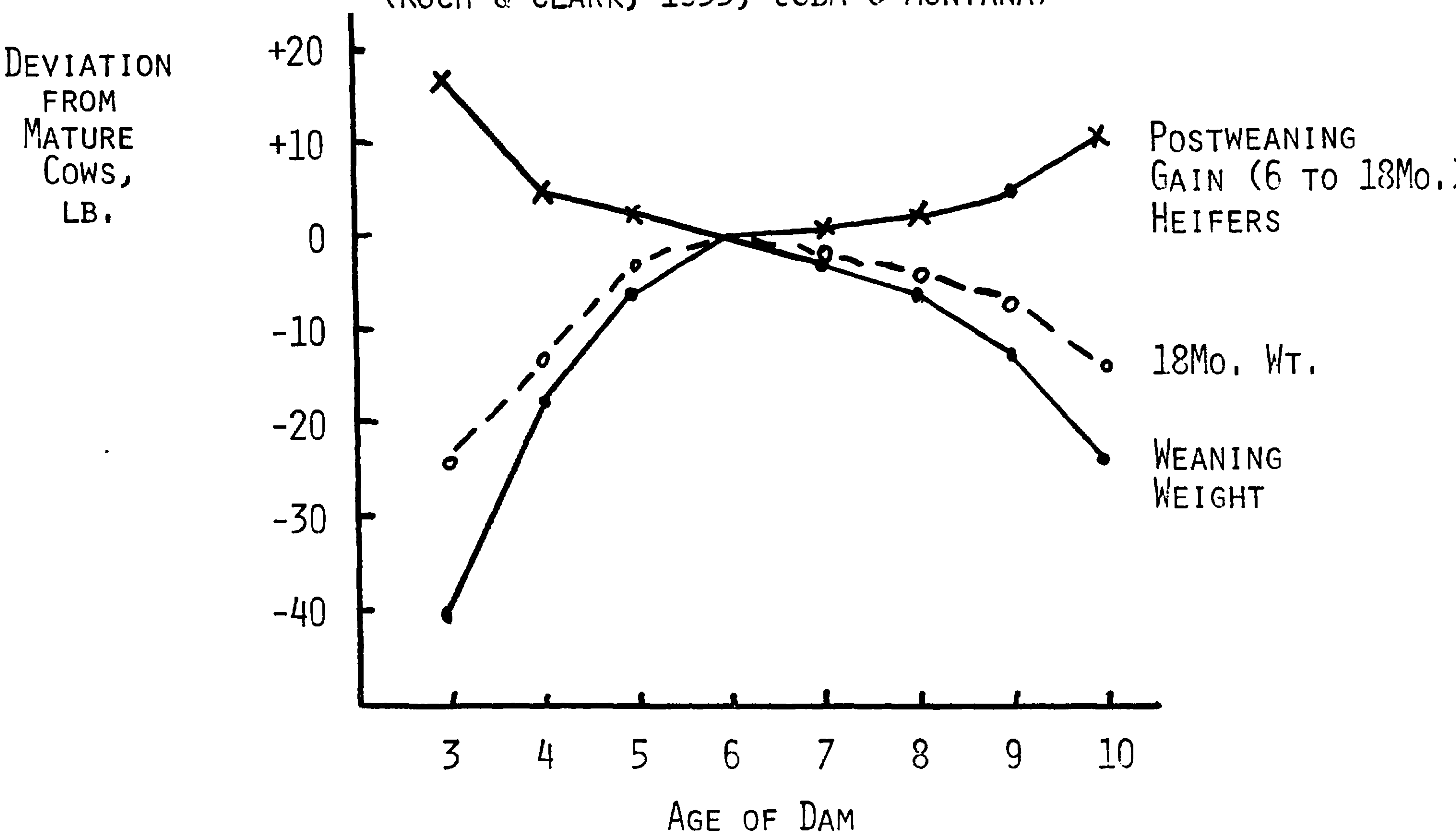


FIGURE 2.

EFFECTS OF AGE OF DAM IN HEREFORD BULLS

(BRINKS ET AL. 1962, USDA & MONTANA)

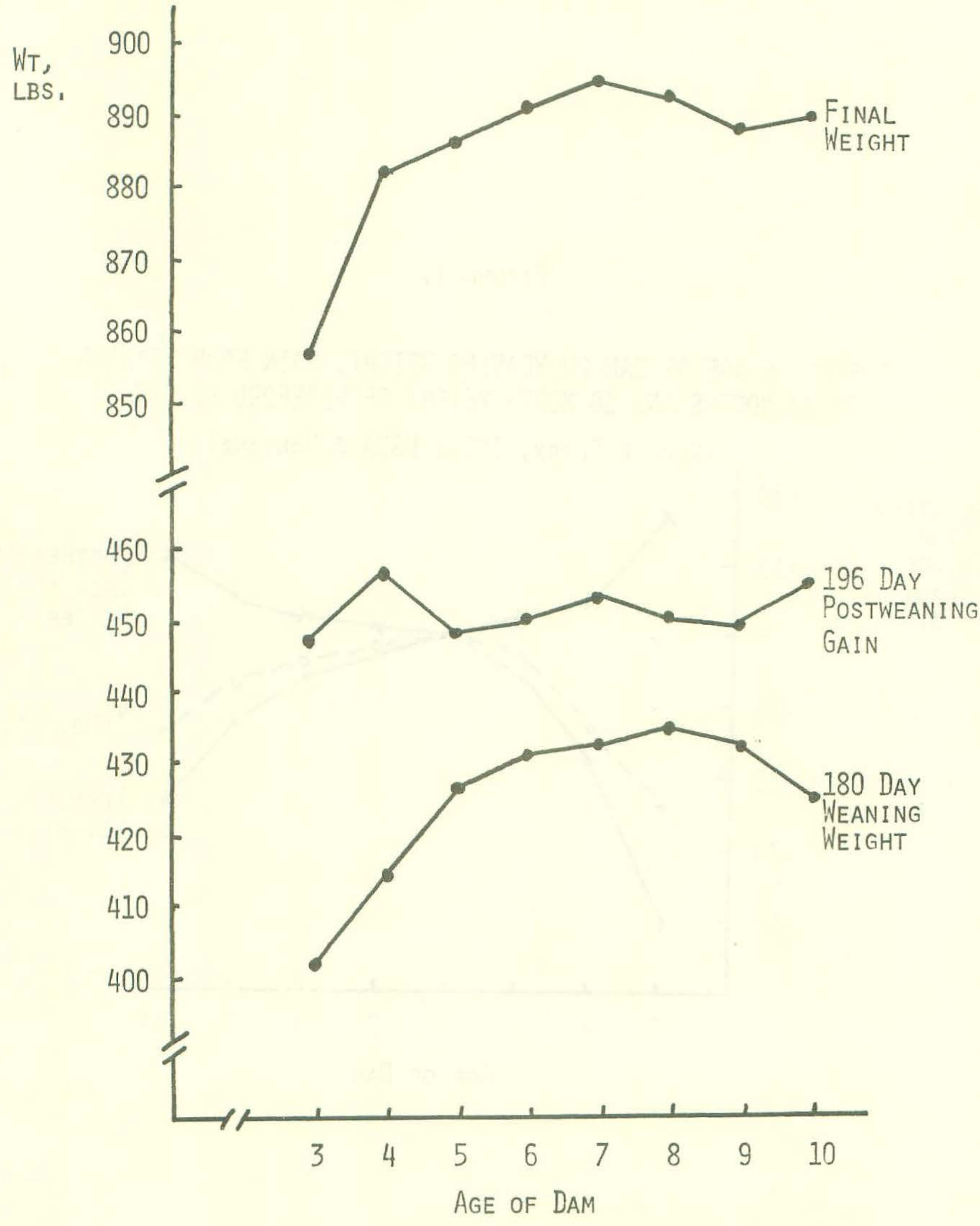
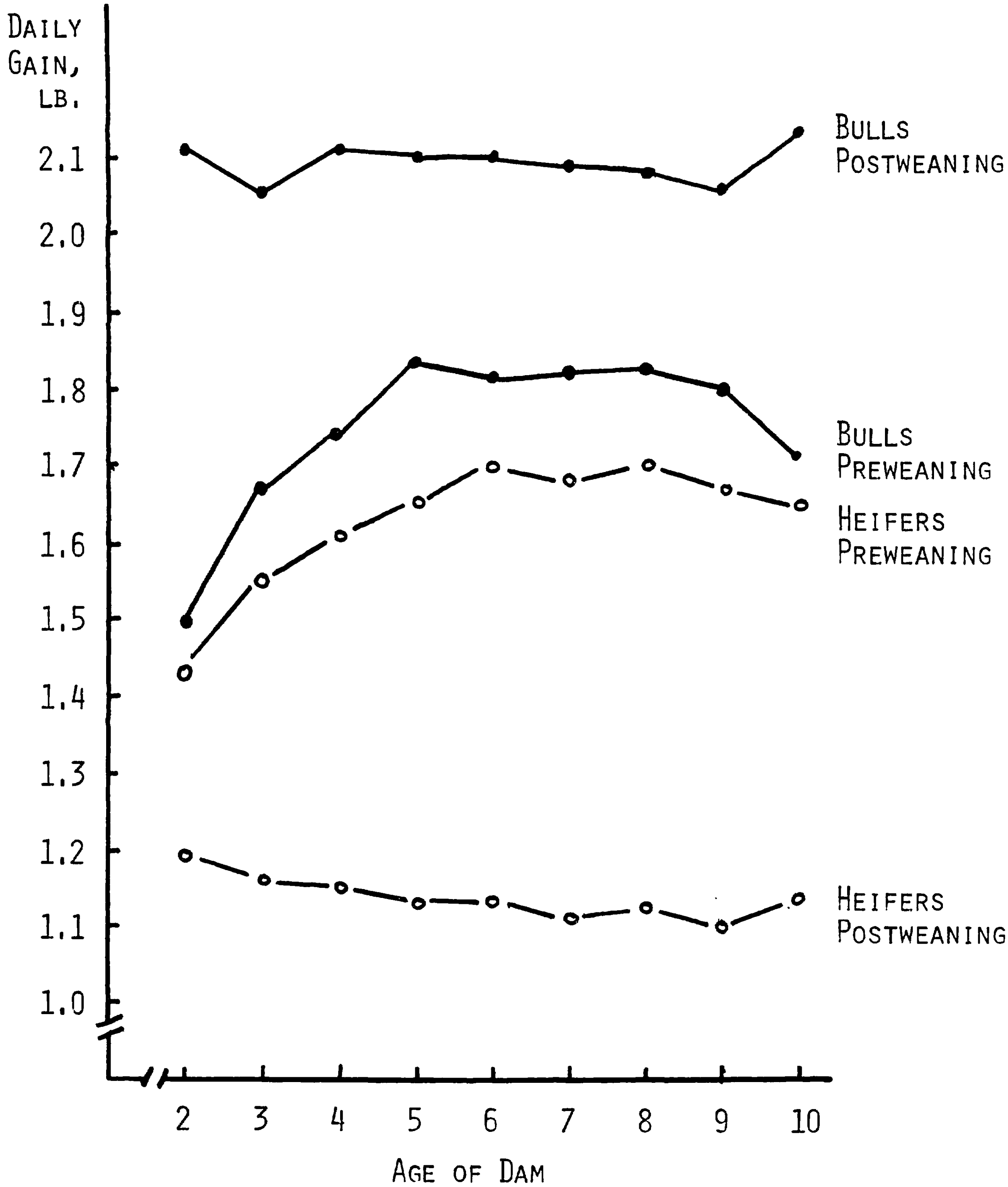


FIGURE 3.

EFFECTS OF AGE OF DAM ON PREWEANING AND POSTWEANING DAILY GAIN

(KOCH, NEBRASKA & USDA)



effect in heifers.

These results are in agreement with those of McCormick et al., (1956), Swiger et al., (1963), Schalles and Marlowe (1967), Dinkel et al., (1968) and Waugh and Marlowe (1969) also summarized in Table 1.

In a comprehensive review of evaluation of growth, Gregory (1965) pointed out that the lack of compensation for age of dam effects in the postweaning period is not consistent with results from feeding trials and with estimates of environmental correlations indicating that variations in gain caused by differences in previous environmental conditions tend to be compensated for with time. More recent studies have shown that inherited differences in maternal ability estimated from differences between reciprocal crosses of diverse biological types behave in the same manner as differences in maternal ability associated with age of dam (Gregory et al., 1966; Willham, 1974; Gregory et al., 1978).

Age of Calf

Effects of age of calf on postweaning gains have been studied by Brinks et al., (1962), Marlowe (1962) and Swiger et al., (1963). Results have shown that when variation in age of individuals does not range by more than 90 days, as would be the case with a restricted breeding and calving season, the effects of age differences on postweaning growth are negligible.

Final weight, standardized for age differences (eg. 365 day or 550 day weight) are often used to measure total growth to given ages. Final weight at 12 to 18 months is more highly heritable than any of its individual components (that is birth weight, preweaning gains and postweaning gains) because genetic correlations among measures of growth at different ages are high relative to corresponding phenotypic or environmental correlations.

Recently, several alternative methods of computing yearling weight have been proposed for use in central bull tests. Notter will discuss these methods in detail elsewhere in these proceedings. There are two points that should be considered when computing an age standardized final weight.

1) It is important that all periods of growth in the animals life be accounted for.
2) Every animal should be given an equal opportunity.

It is important to standardize the number of days for preweaning gain (eg. 205), and the number of days postweaning. Use of lifetime average daily gain is not appropriate if the mean average daily gain differs substantially in one period from another (eg. preweaning, interval from weaning to initiation of test and postweaning).

Adjusting Yearling Weight Ratios

Weight ratios are useful for visualizing the relative rankings of individuals in a group. Weight ratios are usually calculated as:

TABLE 1.

STUDIES OF EFFECTS OF AGE OF DAM ON WEANING WEIGHT (WW), POSTWEANING GAIN (G) AND FINAL WEIGHT (FW) OF BEEF CATTLE

WORKERS	BREED[A]	SEX[B]	NATURE OF EFFECT[C] WW	G	FW
KOCH & CLARK (1955)	H	F	++	-	+
BRINKS ET AL. (1962)	H	B	++	0	+
SWIGER ET AL. (1963)	A,H,S	B,S,H	++	0	++
SCHALLES AND MARLOWE (1967)	A,H,S	B		0	+
DINKEL ET AL. (1968)	H	B,H	++	0	++
WAUGH AND MARLOWE (1969)	A,H	B,H			++
KOCH (UNPUBLISHED)	H	B,H	++	0	++

[A] BREED: A = ANGUS, H = HEREFORD, S = SHORTHORN

[B] SEX: B = BULL, H = HEIFER, S = STEER

[C] ++ WEIGHT INCREASES SHARPLY AS AGE OF DAM INCREASES FROM YOUNG TO MATURE AGES
\+ WEIGHT INCREASES AS AGE OF DAM INCREASES FROM YOUNG TO MATURE AGES
0 NO EFFECT OF AGE OF DAM
\- GAIN DECREASES AS AGE OF DAM INCREASES FROM YOUNG TO MATURE AGES

$$\frac{\text{Individual record}}{\text{Average of Animals in group}} \times 100$$

Weight ratios should be computed separately for each sex-management group. Weight ratios are a useful criterion for removing average group (eg. year-sex-management) differences from the performance rankings. Thus, comparisons can be made between animals in different year-sex-management groups when ratios are used.

However, weight ratios for yearling weight can be biased downward if lighter calves are culled at weaning. Culling on the basis of weaning weight raises the mean for weaning weight and yearling weight of calves retained above that of an unselected group of calves. Comparisons between animals in different groups can be seriously biased by variation among groups in proportion of poorer calves culled at weaning. The magnitude of the bias was studied by Emsley et al., (1972). Figure 4 summarized their results and shows that with 25, 50 and 73 percent culling for low weaning weight, yearling weight ratios were underestimated by 3, 6 and 8 percent for each calf respectively.

Emsley et al., (1972) evaluated four alternative methods of adjusting for this bias. One of the four methods has subsequently been adopted by the Beef Improvement Federation:

$$\frac{W + P}{\overline{W}_u + \overline{P}_s} \times 100$$

where W = adjusted 205-day weight of the individual
P = the 160-day postweaning gain of the individual = 160 x postweaning average daily gain,
$\overline{W}$ = the average 205-day adjusted weight of all calves weaned contemporarily with the calf in question,
and $\overline{P}$ = the average 160-day postweaning gain of all calves tested in a contemporary sex-management group.

Data presented in Figure 4 show that this method rather accurately adjusted for the bias resulting from culling on weight at weaning time.

Alternative Selection Criteria for Yearling Growth

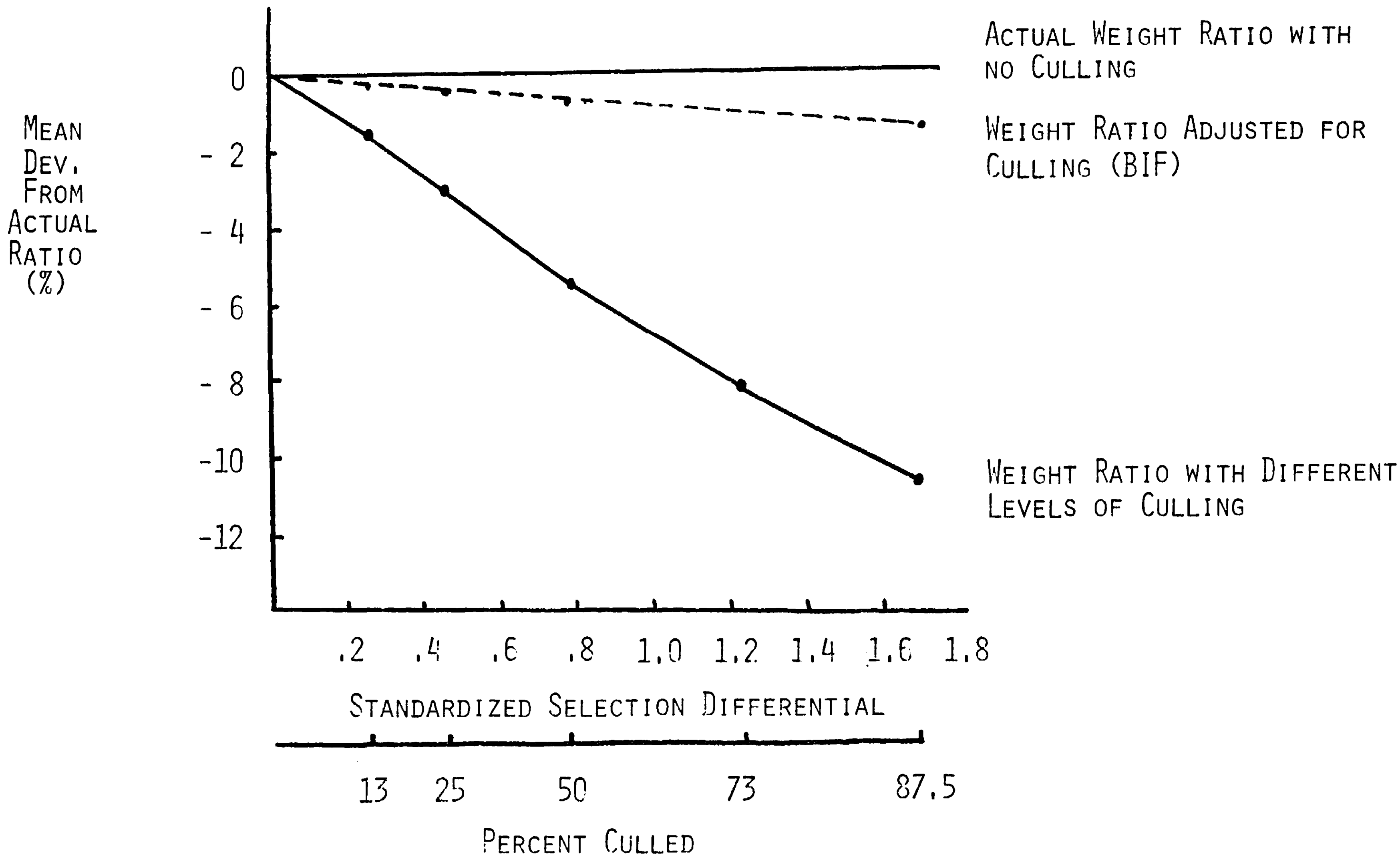
There are other consequences of the high heritability for yearling weight and high genetic correlations between yearling weight and weight at other ages that need to be recognized. Selection for 365 or 550 day weight leads to significant increases in birth weight and mature size. Increases in birth weight contribute to increased calving difficulty associated with reduced survival of calves and reduced rebreeding performance of dams (Laster et al., 1973; Laster and Gregory, 1973).

Hence, recent studies have been conducted to evaluate genetic variation in shape of growth curve to assess the feasibility of increasing weights at market ages while minimizing changes in weight at birth and maturity.

FIGURE 4.

DEVIATION OF ESTIMATED FROM ACTUAL YEARLING-WEIGHT RATIO

(EMSLEY ET AL., 1972)



Encouraging results were reported in a study of selection criteria for efficient bull production (Dickerson et al., 1974). Results indicated that selection for heavier yearling weight (Y) but lighter birth weight (B) with an index = Y- 3.2B would increase improvement in efficiency 6 to 7 percent more than selection for yearling weight alone. Adding this degree of selection against birth weight reduced expected increases by 55 percent in birth weight and by 25 percent in mature weight but only by 10 percent in yearling weight.

Other results have indicated that selection for postnatal relative growth rate would have a similarly favorable effect on shape of growth curve reducing response in birth weight and mature weight relatively more than weight at market ages (Fitzhugh, 1976; Smith and Cundiff, 1976).

More research is needed to determine the most appropriate selection criteria for optimizing the shape of the growth curve. Postnatal growth (eg. adjusted yearling weight - birth weight) should be emphasized rather than their respective final weights to eliminate direct selection for heavier birth weight. Results from one study indicate that although birth weight would still increase because of a positive genetic correlation with postnatal growth, the expected increase in birth weight would be reduced by 30 percent (Koch, Gregory and Cundiff, 1974 b) if all emphasis were directed to postnatal growth rate rather than weaning or yearling weight.

Conclusions

Age of dam affects weaning weight and yearling weight but does not affect postweaning gain.

When variation in weaning age does not vary by more than 90 days, age of calf at weaning does not significantly affect postweaning gain.

Yearling weight ratios should be adjusted for culling on weight at weaning time.

Selection should emphasize growth to market weights but lighter birth weights to reduce correlated response in calving difficulty and mature size.

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HOW AND WHY ASA USES THE BREEDING VALUE PRINCIPLE

Don Vaniman

You have caught us in a very awkward position--our ASA Performance Committee is scheduled to meet one month from now and the first agenda item is "Breeding Values". Therefore, today we are in a quandry and the outcome of whether or not ASA will embrace breeding values is unknown.

What are we doing today?

For all bulls, we are automatically producing what can be construed as breeding values in the National Simmental Sire Summary, but maybe not in the purest sense since only progeny records are considered. You realize that most of our bulls have been imported from Europe--most have breeding values-- but only for milk production. Most all of our performance records to date are from crossbreds--1/2, 3/4, 7/8 and 15/16 Simmental blood (we were just ten years old this year). The National Simmental Sire Summary measures not only direct progeny traits but also a sire's daughters' traits of calving ease, birth weights and weaning weights.

For all cows in the Herdbook, we automatically compute and print Most Probable Producing Abilities on Cow Cards and in our Sale Catalog Service. This is somewhat of a breeding value as it too measures progeny records.

So far we have only questions.

How many breeding values are there? I've heard or read about Direct Breeding Values, Estimated Breeding Values, Maternal Breeding Values, Breeding Value Ratios and Breeding Value Indexes. It is going to take some education--many cattlemen haven't conquered 205-day adjusted weights or ratios yet.

The only breeding values I have seen printed in the USA by beef breed associations are for weaning weights. What about all the other heritable, economic traits? Why limit breeding values to just one or two traits?

Where should breeding values be printed--on the Herd Handler forms (ASA's within-herd performance testing and registration system)? On Calf Crop Summaries? On Cow Cards? On Registration Certificates? On the Sale Catalog Lot Pages? Or just on within-herd breeding work sheets? Should breeding values replace or supplement within-herd individual performance trait ratios?

Will we confuse members by printing one in one place and the other in another? Or, should breeding values be calculated for new traits such as calving interval, fertility, postnatal gain or for a combination of traits? Can they be such that the breeder can indicate his own traits or importance so custom breeding values can be generated for every member? What does it cost to calculate breeding values? Will breeders use them? How often can we afford to calculate them? How often will the value change? Is updating the entire herdbook once a year enough?

Will Breeding Values work as well in small herds as in large herds? Will it work on twins and ovum transplant calves that are raised by foster dams? How will linebreeding affect breeding values?

Will breeding values help eliminate individual performance records with contemporaries of one and a ratio of 100?

Personally, I have some doubts--I have seen performance pedigree credit raise an animal above average on his within-herd test when in fact he was still below average in the herd. I can still go back to the statement that even though every set of parents are highly selected, not all of their progeny will be equal--but doesn't a breeding value say they will be?

BREEDING VALUE CONSIDERATIONS

R. L. Willham and E. A. Leighton

Iowa State University

A breeding value is the value of an individual as a parent. This is precisely what breeding stock herds sell. It is the value of the progeny from their breeding stock in the herd of the buyer that is the issue. As specification of product becomes more important in the beef industry, breeders can be merchandizing breeding value. Beef breeders are selling a product that must transmit a sample half of its germ plasm to progeny before the result is realized. Commercial producers sell pounds not breeding value, but they need to buy breeding value as well as combine breeds in logical combinations to obtain the crossbred advantages especially for the reproductive complex. Thus, both the commercial and breeding stock producer can benefit from understanding the concept of breeding value. The purpose of this paper is to define and describe the breeding value concept and to examine ways to use the concept in practice. Then we will study some possible ways more use can be made of breeding values that are estimated using procedures that eliminate several of the problems involved with current estimation. This leads to the future integration with national sire evaluation since national sire evaluation has as its goal the increase in the number of sires that can be fairly compared on breeding value differences obtained from all sources of information including herd performance data.

THEORY

The breeding value concept is a figment of man's fertile imagination. It was defined and developed to relate selection theory with the genetic reality that genes have their effects in pairs (one member of each pair ha ving come from the sire and the other the dam) yet the genes are transmitted singly from parent to offspring (one gene or the other of each pair possessed by a parent is transmitted to an offspring). The basis of selection is the resemblance between parent and offspring. Since each parent transmits a sample half of its genes to an offspring, the degree of resemblance is a measure of the importance of gene effects (not gene pair effects) on the variation for a trait. The heritability of a trait is evaluated using a measure of the degree of resemblance between relatives. The sum of the gene effects, produced by the sample half of the genes transmitted from a parent, as expressed in its progeny is a definition of one-half of the breeding value of the parent. Thus, we see that using measurable quantities obtained from performance data, it is possible to predict selection response. Heritability is the fraction of the variation in a trait that is produced by gene effects. Heritability times the superiority of the selected parents over the average is the average breeding value of the parents as well as being the response to selection expected. So the concepts tie together to give us a usable theory on which to design and conduct breeding programs that maximize genetic change. Selection or the choice of parents is the only direction tool available to the breeder to bring about genetic change. There is no other.

A breeding value can be defined as twice the difference between the average performance of a large number of progeny and the population average. This is the working definition of breeding value. The difference is doubled because only a sample half of the genes of an individual are transmitted to its progeny. Several clarifications need to be stated for the definition. The other sex to which the individual is mated to produce the progeny must be a random sample from the population. If they are not, the difference measures more than just the breeding value. The population average must include progeny from the other individuals whose breeding values are to be compared. It is obvious that we are defining the basics of progeny testing and in particular that an expected progeny difference in national sire evaluation is a measure of half the breeding value of the sire. True, a progeny test of a number of sires each with a large number of progeny is the most accurate measure of breeding value, but the progeny test is costly both in resources and in time. There are alternatives. The first is the individual's own performance if it can be measured and the second is the performance or average performance of related individuals or groups of related individuals. The progeny in the definition are a group of related individuals since they each have the same parent. Each progeny received a sample half of his genes from the same parent. A few progeny could have received the same half and a few might have received the other half, but on the average they have one-fourth of their genes in common (1/2 times 1/2). Only the parent-offspring relationship is exactly one-half. All the others are averages. However, since relatives have like genes, they have a fraction of their breeding values alike. Thus, relatives can be used to help estimate breeding values of individuals.

Consider the individual's own performance. If heritability (which as a fraction of the total variation goes from zero to one) is one, then knowing the performance of an individual as a difference from a contemporary average corresponds to its breeding value (1 times difference). If heritability is only .3 or 30% of the variation is due to breeding value differences, then a difference of 20 pounds would result in a breeding value of 6 pounds (.3 x 20 = 6). Now what is being done is using an average result on individuals. We say that on the average we expect only 30% of the 20 pound difference to be heritable when it is entirely possible for all or none of this difference to be heritable, but on the average 30% will be. However, if we find the average superiority of ten bulls is 20 pounds over their contemporaries, then we expect them to transmit 3 pounds (one-half their average breeding value) to their progeny on the nose.

This brings up the idea of accuracy. Accuracy is the correlation between the estimated breeding value of an individual and his true breeding value (using the definition). When using individual performance information, the accuracy is the square root of the heritability. For a trait with 50% heritability, using own performance differences has an accuracy of .71 where 1.00 is perfect accuracy. For 40% heritability, accuracy is .63. Incidentally, this is the same accuracy as evaluating six progeny which is not bad. The point is that for highly heritable traits (50% up) individual performance, if it can be measured, is an excellent criteria to use in selecting or buying parents. This is the reason that national sire evaluation is but a means to an end. Now it is the only way to fairly compare individuals outside of the same contemporary group. But as we learn more through sire evaluation, it will be possible to use own performance to make selection more effective.

Now consider relative information. Provided the average performance of groups of relatives that are unselected and do not lengthen the generation interval can be used, they will increase the accuracy of breeding value estimation a lot for traits of low heritability and a bit even for highly heritable traits. All good cattlemen in one way or another consider the other calves of the sire and especially the calves of the dam when selecing an individual. There is logic to doing this. Each member of the group of relatives has a fraction of his or her genes in common with the individual and consequently have the same fraction of their breeding values alike. Assuming that the environmental influences are random relative to the breeding values then some add to the value of some animals and subtract from others. If a large number are in the group these plus and minus effects tend to cancel out leaving the group average nearly an evaluation of the fraction of the breeding values in common. This benefit is most helpful for lowly heritable traits, but it also helps for moderately heritable traits. Use of relative information is practiced in current breeding value estimation, but the concept of breeding value is not tied directly to using relative data.

RELATIVE INFORMATION

When used in concert with individual performance, paternal and maternal half-sib (calves from the same sire or dam) add to the accuracy of breeding value estimation and do not lengthen the generation interval. When the individual is a parent, the progeny average is extremely useful. Table 1 presents the various sources of relation information available in most performance programs.

Table 1. Accuracy of Records on Relatives for Estimating Breeding Value of an Individual Animal.

Relatives'	Number	Genetic relationship	Heritability 20%	40%	60%
Parent	1	1/2	.22	.31	.39
Midparent	2	.71	.317	.45	.55
Paternal half-sibs	10	1/4	.30	.36	.40
	40	1/4	.41	.45	.47
Maternal half-sibs	2	1/4	.15	.22	.26
	4	1/4	.21	.28	.33
Individual	1	1	.45	.63	.77
Progeny	10	1/2	.59	.72	.80
	40	1/2	.82	.90	.94

To evaluate the sources, the table gives the accuracy or correlation between the true breeding value and the estimated breeding value, using the particular relative information. Three heritability values are used. The accuracy is higher, the more heritable the trait. As the genetic relationship to the individual animal increases, so does the accuracy. When the numbers in the relative groups increase, the accuracy goes up. The rate of increase is faster for high heritability than for low, but diminishing returns for increasing numbers set in more quickly for high than for low heritability. The accuracy of selection is influenced by heritability, relationship, and number of relatives in the average.

The primary relatives in beef records are the individual animal, his paternal and maternal half-sibs, and his progeny. If sibs are available, the parent records add little. The first three sources are avilable at or before reproductive maturity, while the progeny require an increased generation interval to obtain. The use of sib or progeny averages helps in breeding value estimation, since the groups are usually unselected and the averaging of several records tends to cancel out the plus and minus environmental differences, leaving more nearly a genetic value for the average.

These sources of information can be combined into a single estimate of breeding value for each animal that is the subject of selection. This is done by using the numbers in the averages, the heritability, and the relationships to develop a set of linear equations that, when solved, give proper weighting factors to the particular information available on the individual animal for the trait. Then, these weights times the records expressed as deviations will give an estimated breeding value. The value is for the particular trait, using the available information. This procedure has some desirable properties for the breeder using the values for selection. First, the correlation between true and estimated breeding value is maximum. Second, the estimate is regressed toward the average, depending on the amount of information. This latter feature makes it possible for the breeder to use these values to fairly rank individual animals that differ in the amount of information available. The computation of estimated breeding values is done easily by computer, but otherwise is extremely difficult.

Table 2 presents the percentage of attention that is paid to various combinations of information in the estimation of the breeding value of an individual. Note that 10 paternal half-sibs are about equal to the individual's own performance. When numbers of sibs are doubled in the second row, the importance of maternal sibs is doubled while paternal sibs goes up only slightly. This results because the dam side of the pedigree, from which comes half of the genes, is lacking as much information as exists on the paternal side. The last two rows indicate the importance of including progeny on the parents. When 20 progeny exist on a parent, over 70% of the attention goes to the progeny average as it should. Breeders have done something like this for a long time. The problem is that breeders are human and tend to over or under emphasize relative groups in their evaluation. The computer does what it is told and treats the special groups simply as groups.

Table 2. Relative Amount of Attention that Should Be Paid to Various Relative Groups in Estimating Breeding Value of an Individual Animal

Numbers				Percentage attention			
IND	PHS	MHS	PROG	IND	PHS	MHS	PROG
1	10	2	0	44	42	14	0
1	20	4	0	33	46	21	0
1	10	2	10	18	17	6	59
1	20	4	20	10	14	6	69

Currently several breed associations are calculating breeding values using available information on weaning and yearling weights. Because the maternal sibs are so few in number, both of these breeding values can be considered measures of growth. Growth differences pre-weaning are at least 30% heritable and post weaning growth differences are at least 40% heritable. Thus, inclusion of relative information will increase the accuracy of breeding value estimation a bit (around 15 to 20 percent) over using only own performance.

MATERNAL BREEDING VALUES

Recently maternal breeding values have become available. As they are now calculated, they estimate the breeding value of an individual for milk production as indicated in weaning weights. In this context, breeding value estimation really comes to life as an advantage. First, the heritability for milk production is from 20 to 30%, so inclusion of relative information is an advantage in increasing the accuracy. Second, maternal performance is a generation behind in being expressed relative to growth. Either performance of daughters must be measured which would lengthen the generation interval or pedigree evaluation becomes necessary which does not increase the generation interval. Evaluation of maternal breeding values depend on the ability of the program to collect ratios of performance from over herds where various relatives have produced daughters. Third, milk production is a sex-limited trait being expressed only in females. Thus, only females in production must be used. If the dairy approach is used, there would be a six year progeny testing program before calves of daughters of a sire could be used as the selection criterion of sires. This is the reason for developing maternal breeding values rather than adding on the daughter evaluation to national sire evaluation programs.

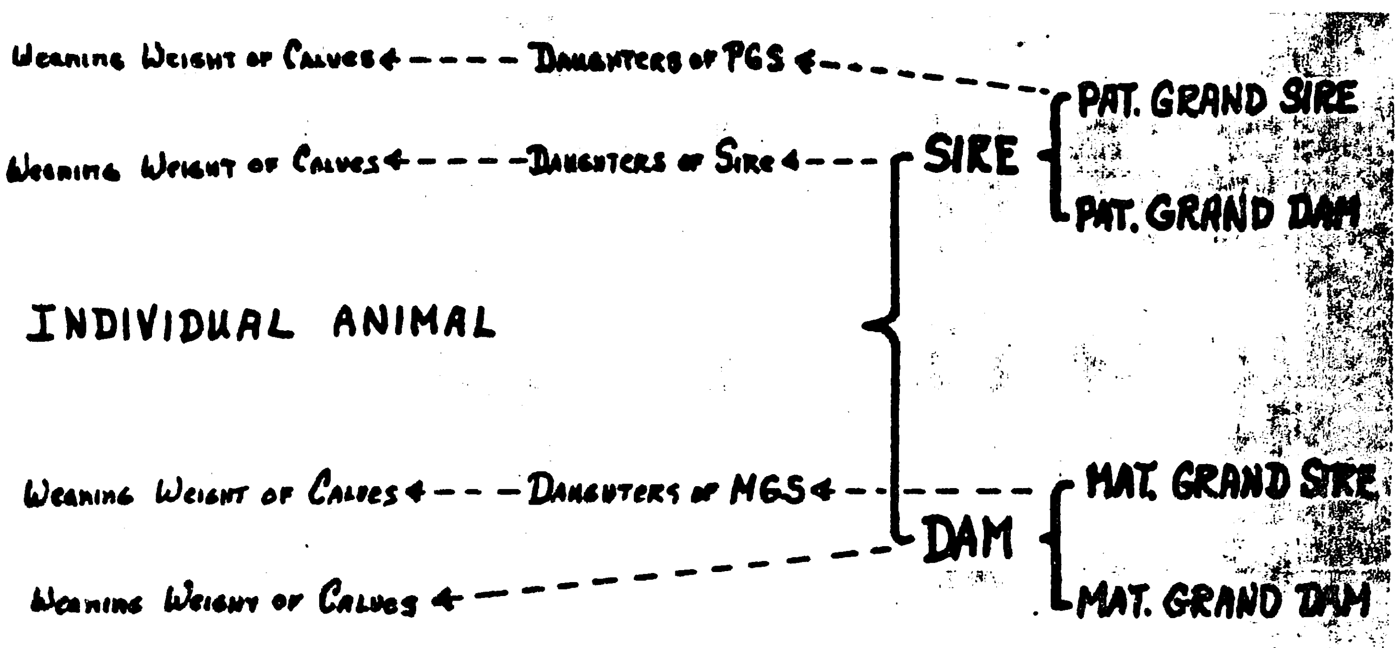
Table 3 gives the same listing of accuracy for maternal breeding values as Table 1 for growth breeding values. Heritability for milk was assumed to be .3 and repeatability .4. The accuracy values for paternal and maternal grandsires' daughters' calves are low even for a large number of progeny. Calves of the daughters of the sire have a higher accuracy, but if a breeder is turning generations there should be little information available. The accuracy figures are low in general, but when the four relatives groups are combined, the accuracy is roughly .65 which is nearly (.67) as good an estimate on calves for their daughters' milk as in their yearling breeding value for growth using own and paternal and maternal sib information.

Table 3. Accuracy of Records on Relatives for Estimating Maternal Breeding Value of an Individual When Heritability is .3 and Repeatability is .4.

Relative	No. Daughters	Calves per Daughter	Genetic Relationship	ACCURACY
Calves of the Dam		2	1/2	.33
		4	1/2	.37
Calves of the Daughters of Sire	50	1	1/4	.45
	100	2	1/4	.48
Calves of the Daughters of the Paternal grandsire	100	2	1/8	.22
	200	3	1/8	.24
Calves of the Daughters of the Maternal grandsire	100	2	1/8	.22
	200	3	1/8	.24
Calves of the Individual (if a Dam)		2	1	.66
		4	1	.74
Calves of the Daughters of the Individual (if a Sire)	50	1	1/2	.90
	100	2	1/2	.96

Now consider how maternal breeding values are calculated. The following is a pedigree diagram of an animal of interest.

-PEDIGREE-



Note that, with the exception of the calves by the dam, each set of weaning weights are from daughters of a sire, meaning that the maternal ability being measured is passed on a generation, so it is genetic. The maternal breeding value ratio uses four pieces of information when they are available. These are as follows:

1. The average weaning weight ratio of calves of daughters of the paternal grandsire. The diagonal value for this average is

$$\frac{1 + (m-1)R}{nmH} + \frac{n-1}{4n}$$

   where m = average number of calves per daughter, n = number of daughters, R = repeatability, and H = heritability.

2. The average weaning weight ratio of calves of daughters of the sire. The diagonal value for this average has the same structure.

3. The average weaning weight ratio of calves of daughters of the maternal grandsire. The diagonal value for this average has the same structure.

4. The average weaning weight ratio of calves of the dam. The diagonal for this average is

$$\frac{1 + (m-1)R}{mH}$$

   where m is the number of calves of the dam.

When the individual is a sire that could have daughters in production, then the average performance of his daughter's calves could replace the dam information. The diagonal element would be of the same structure as (1).

When the individual is a dam, then the performance of her own calves could be used in place of her dam's calves.

These averages are weighted heavily for maternal ability rather than growth rate. Any information that is available is combined into a single breeding value as was done with the regular breeding values for weaning and yearling weight. This procedure would have little information if it were not for the opportunity to look up the weaning ratios of all calves of the daughters of the paternal or maternal grandsire in the herds in which they were used.

Real problems exist in including fertility information. The values of m and n of the relatives with the value of the possible average number of calves (m') would give a good picture of fertility if one could assume that all calves were recorded, but they are not in most performance programs. Use of the calf crop percentage of the dam is probably all that is practical at this time. This is unfortunate because fertility is much more important that milk production. However, this will serve to get breeders thinking about measuring maternal traits.

Table 4 gives the percentage attention paid to relative groups used to calculate maternal breeding values. The results are only approximate since the off-diagonals were ignored. The calves of the daughters of the grand sires do provide useful information.

Table 4. Relative Amount of Attention that Should be Paid to Relative Groups in Estimating the Maternal Breeding Value for an Individual**

IND	IND*	SIRE	PGS	MGS	IND	SIRE	PGS	MGS
Calf	2	0/0	100/2	100/2	20		40	40
	4	50/1	200/3	200/3	13	39	24	24
Dam	2	50/1	200/3	200/3	20	36	22	22
	4	50/1	200/3	200/3	23	35	21	21
Sire	50/1	100/2	200/3	200/3	46	26	14	14

*For calf the IND is calves by the dam, for dam the IND is calves by the IND, and for sire the IND is calves of the daughters of the individual. **The values were obtained ignoring the off-diagonals.

Use of maternal breeding value ratios by breeders can help breeders maintain their superior maternal performance while still improving feedlot growth rate. Without these maternal performance indications, it would be possible to lose a maternal advantage by going all out for size and growth rate. This represents another opportunity for creative breeders to develop sound breeding programs. The breeds that survive the intense competition for the commercial man's germ plasm dollar will be those breeds having an association that provides them a sound performance program and breeders willing to adopt the new technology in practical breeding programs.

COMPUTATION PROCEDURES

Appendix A is included to show the computation procedures to estimate growth breeding values. This also appears in the latest BIF guidelines. Appendixes B, C, and D are included to show the computation procedures to estimate maternal breeding values for calves at weaning, for sires having daughters in production, and for dams with calves, respectively.

PROBLEMS

There are obviously a number of problems with the calculation of breeding values as it is now done. However, present procedures are a rather good first step in development. All of the procedures use ratios only. That is, deviations from contemporary group averages are used. All the genetic differences between groups are eliminated from consideration and the ratios are subject to the problem of comparing only genetic differences that happen to exist within the particular contemporary group. This problem of trying to eliminate environmental differences using contemporary groups will be with us a long time, but there are better ways to accomplish within group comparisons than using raw means of the contemporary groups.

The assumption made but never stated as such in the computation of breeding values is that random mating is assumed. Progeny averages when used to evaluate current parents assume that the sires or dams used as the other parent are drawn at random from the herd. That is, the same criteria that make for good national sire evaluation apply in the use of progeny averages. If a sire is mated only to superior cows, then his breeding value could be biased upwards. Also, if a dam gets poor sires for her three calves, her value is less than it should be. The use of these progeny averages as paternal and maternal sib groups in the breeding value estimation of calves need to have the random mating assumption. If a paternal half sib-group is from a sire that was used on superior cows, then this advantage may or may not really apply to a particular calf. The same is true on maternal sibs coming from a dam mated to poor sires. Thus, the failure of a herd to mate at random will affect the estimation of breeding values. This problem is probably not as important as others. With maternal breeding value estimation from data collected in many herds, one hopes that the biases will cancel. This assumption will simply need to be lived with even using better procedures.

No inbreeding is assumed in current estimation procedures. Note the off-diagonal coefficients that relate the averages to each other. They are standard relationships that are not correct if inbreeding has been practiced. However, they will not change drastically even when inbreeding is considered and it can be done using new procedures.

The last assumption has to do with selection. Currrent estimation assumes that there is no selection being practiced or that the contemporary group means from one year to the next are not changing. The individual sire and dam selection does not disrupt the estimation procedure, but calling a ten-year-old ratio of 105 the same as a current ratio of 105 is not correct if selection is practiced. Breeding values on calves are not drastically influenced, but dam values are hurt. Using dam values tends to bias the values in favor of the old cows. Sire values, unless they include many years of data, are not badly biased. This selection problem can be corrected using new procedures.

In general, there are definite problems with current breeding value estimation procedures, but if a breeder that uses them knows his herd well and studies the data, the values are not that biased.

TRAITS

Weaning weight, yearling weight, and milk production as indicated by weight at weaning are not all the traits on which breeding values would be useful. Fertility of daughters would be an important addition, but few data files contain complete data on each year of a cow's life. Computing breeding values on important traits to a breed might be one way of encouraging breeders to consider the trait in selection and in merchandizing their breeding stock.

PRESENTATION

There are two ways estimated breeding values can be presented for use by the breeder. The first is in the form of a selection worksheet, and the second is in the form of a performance pedigree. The first is useful in making selections in a breeding program; the second has as its purpose promotion of breeding stock.

The selection worksheet gives the animal identification, available data for that animal, and estimated breeding value, based on the records of a contemporary group of animals in a herd. The purpose is to use the selection worksheet in conjunction with common sense to select breeding stock. For example, each time a group of calves is weaned, the breeder receives selection worksheets that give the estimated breeding values of the male and female calves separately, along with the values for the dams and sires. These are current worksheets which give all relevant weaning data for each individual animal that is on record. From this, the breeder can make his first selection on the calves and cull his cows in conjunction with a pregancy test. When yearling selection worksheets are sent, the breeder can select his sire prospects, develop his sale bull offering, and make decisions about his herd bulls before he lots his sires for breeding. Use of the selection worksheet is a way to make effective use of records in a breeding program.

Performance pedigrees are primarily promotion, especially if the selection worksheets are being used. Using the information on a performance pedigree to estimate a breeding value for each trait of importance is a much safer procedure than trying to come up with a sound analysis of the pedigree mentally. Human nature is such that the good records get over-evaluated, and the poorer ones are sometimes forgotten. The individual performance of the ancestors when expressed relative to their contemporaries provides an excellent means of determining the selection practiced in the herd. As a promotional tool, the breeding value is an estimate of what that individual animal is expected to transmit to his or her offspring. The breeding value concept is precisely what a breeding stock breeder is selling. It is what the stock of a breeder does in the herd of the buyer that makes the performance reputation.

NEW PROCEDURE

Now let us consider a new approach to the estimation of breeding values within a breeding herd. The procedure sounds impossible, but some of the basic programs to do the analysis are already written. What we want to do is use sire evaluation procedures to estimate the breeding value of each current individual in a herd using all of the available information on all relatives that are or have been in the herd. Further, the contemporary groups will be evaluated simultaneously making the breeding values obtained much better than using ratios.

What is done is to fit a model for every animal in the herd that includes an effect for the average, the contemporary groups, the breeding value within groups, and a random error. Out of this analysis will come breeding value estimates for all current animals based on their own and all relative information available. The innovation is the use of an array of numbers that is the genetic relationship of every animal in the herd with every other animal in the herd. This array is considered in obtaining solutions for the breeding values as well as the heritability of the particular trait which serves to regress the values for incomplete heritability. Appexdix E gives a very concise account of what is actually done. The net result is a set of breeding values for a herd that are the best values that current theory and computing procedures can accomplish. It will also mean that beef performance programs will need at least modest computer facilities to stay current.

The logical extension of this proposal is to include more than one herd or all herds that are tied together by the use of current sires and maternal grandsires by A.I. Then one could estimate breeding values that could be ranked over herds and accomplish the goal of national sire evaluation--"National Sire Evaluation has as its goal the increase in the number of sires that can be fairly compared on breeding value differences obtained from all sources in information."

COMBINING BREEDING VALUES

Theory is available to combine information on several traits into a selection index, so that selection could be based on the index. The additional information necessary to comput such an index is the economic value of each trait, the genetic and phenotypic correlations between the traits, and a specification by the breeder of net merit. Which traits are used and how they relate economically are individual breeder problems in the determination of goal and cannot be set for him by his performance record program.

Two logical alternatives exist for the breeder that gets estimated breeding values on his herd for several traits. First, he can weigh the estimated breeding values by appropriate economic values and use this as his selection criterion. Second, he can use an independent culling level for each trait. When the values for the first trait are available, he can select a fraction P of the animals, and when the second trait values are available, he can selection a fraction Q of the remaining animals. The product P x Q must equal the number of replacements necessary.

SUMMARY

A breeding value is the value of an animal as a parent. Breeding values are what breeding stock herds sell and what commercial herds are buying. Performance data can be used to calculate breeding values for the beef industry so that specification of product at the genetic level can be enhanced. Weight breeding values offer breeders the opportunity to select and sell on all the performance information available in their program. Maternal breeding values offer breeders the opportunity to use pedigree performance data on weaning weight to select and sell animals on their potential for milk production. Letting the performance program find and weight properly the relative information allows the breeder the opportunity to devote his time to the conduct of more creative breeding programs. New procedures to better estimate breeding values are in the wings awaiting utilization. Ways exist to start integration of performance data such that breeders can make fair comparisons over herds as they now can do using national sire evaluation information. Implementation of new ideas and concepts for beef industry use is one of the most valuable purposes of the beef improvement federation.

APPENDIX A

GROWTH BREEDING VALUES

Following are the statistical and computational details of estimating breeding values. The information needed for each individual animal, if available, is as follows:

1. His own performance as a deviation or a ratio deviation from his contemporary group.

2. The average performance of his paternal half-sibs as the average of the individual deviations or ratio deviations and the number of sibs. The individual animal's own record should be excluded from the average.

3. The same as number 2, except for maternal half-sibs.

4. The average performance of his progeny as the average of the individual deviations or ratio deviations and the number of progeny.

After this information has been collected, the following set of linear equations must be solved for the B values for each individual:

$$
\begin{array}{lllllllll}
1/H\cdot B_1 & + & 1/4\cdot B_2 & + & 1/4\cdot B_3 & + & 1/2\cdot B_4 & = & 1 \\
1/4\cdot B_1 & + & \dfrac{4+(N_1-1)H}{4N_1H}\cdot B & + & 0\cdot B_3 & + & 1/8\cdot B_4 & = & 1/4 \\
1/4\cdot B_1 & + & 0\cdot B_2 & + & \dfrac{4+(N_2-1)H}{4N_2H}\cdot B & + & 1/8\cdot B_4 & = & 1/4 \\
1/2\cdot B_1 & + & 1/8\cdot B_2 & + & 1/8\cdot B_3 & + & \dfrac{4+(N_3-1)H}{4N_3H}\cdot B_4 & = & 1/2
\end{array}
$$

The values that change from one animal to the next are as follows:

N_1 = number of paternal half-sibs excluding the individual
N_2 = number of maternal half-sibs excluding the individual
N_3 = number of progeny

The symbol H is the heritability for the particular trait. Only the lead diagonal coefficients change; all other coefficients are genetic relationships. If an individual has only part of the information, the row and column where no data is available is eliminated. The solution to these equations can be obtained by matrix inversion as:

$$C\cdot B = R$$
$$B = C^{-1}\cdot R$$

where C^{-1} is the inverse of the matrix of coefficients C. After solution, a set of weights or regression coefficients is available. There are multiplied by their respective relative average and summed as:

$$\begin{aligned} & B_1 \cdot \text{Individual deviation} \\ + & B_2 \cdot \text{Paternal half-sib average deviation} \\ + & B_3 \cdot \text{Maternal half-sib average deviation} \\ + & B_4 \cdot \text{Progeny average deviation} \end{aligned}$$

This sum of products equals the estimated breeding value. The accuracy of the estimated breeding value is:

$$\text{Accuracy} = \sqrt{B_1 \cdot 1 + B_2 \cdot 1/4 + B_3 \cdot 1/4 + B_4 \cdot 1/2}$$

The accuracy is an indication of the confidence to be placed in the estimated breeding value, but the estimate has already been regressed; therefore, this value should not be considered again. An approximate standard error of the estimated breeding value is:

$$\text{Standard Error} = \sqrt{H \cdot \text{Variance} \cdot (1 - \text{Accuracy}^2)}$$

where Variance is the phenotypic variance of the particular trait. This information on each animal should be listed for use by the breeder and returned to him as soon as possible after the trait has been evaluated.

APPENDIX B

MATERNAL BREEDING VALUES FOR CALVES

$$\left.\begin{array}{l} \text{Sire} \quad \left\{\dfrac{1 + (M_{R1} - 1)R}{N_{R1}M_{R1}H} + \dfrac{N_{R1} - 1}{4N_{R1}}\right\} \cdot \beta_1 + \dfrac{1}{8}\beta_2 = \dfrac{1}{4} \\ \text{PGS} \quad \dfrac{1}{8}\beta_1 + \left\{\dfrac{1 + (M_{R2} - 1)R}{N_{R2}M_{R2}H} + \dfrac{N_{R2} - 1}{4N_{R2}}\right\}\beta_2 = \dfrac{1}{8} \end{array}\right\} \text{Solve Together}$$

$$\left.\begin{array}{l} \text{Dam} \quad \left\{\dfrac{1 + (M_{R3} - 1)R}{M_{R3}H}\right\} \cdot \beta_3 + \dfrac{1}{4}\beta_4 = \dfrac{1}{2} \\ \text{MGS} \quad \dfrac{1}{4}\beta_3 + \left\{\dfrac{1 + (M_{R4} - 1)R}{M_{R4}N_{R4}H} + \dfrac{N_{R4} - 1}{4N_{R4}}\right\}\beta_4 = \dfrac{1}{8} \end{array}\right\} \text{Solve Together}$$

M_{R1} = average number of calves per daughter of SIRE

M_{R2} = average number of calves per daughter of PGS

M_{R3} = number of calves of DAM

M_{R4} = average number of calves per daughter of MGS

N_{R1} = number of daughters of SIRE

N_{R2} = number of daughters of PGS

N_{R4} = number of daughters of MGS

Maternal Abiltiy Breeding Value = $1.00 + B_1V_1 + B_2V_2 + B_3V_3 + B_4V_4$

V_1 = average WW ratio of daughters of sire - 1.00

V_2 = average WW ratio of daughters of PGS - 1.00

V_3 = average WW ratio of daughters of dam - 1.00

V_4 = average WW ratio of daughters of MGS - 1.00

APPENDIX C

MATERNAL BREEDING VALUES FOR SIRES

Maternal breeding values for sires that have daughters in production includes the average weaning weight of daughters of the individual which will be in this case a sire. We will exclude the calves of the dam from the equation. The equations are as follows:

SIRE: $$\left\{\frac{1 + (M_{R1} - 1)R}{N_{R1}M_{R1}H} + \frac{N_{R1} - 1}{4N_{R1}}\right\} \cdot \beta_1 + \frac{1}{8} \cdot \beta_2 + \frac{1}{8} \cdot \beta_3 + 0 \cdot \quad = \frac{1}{4}$$

PGS: $$\frac{1}{8} \cdot \beta_1 + \left\{\frac{1 + (M_{R2} - 1)R}{N_{R2}M_{R2}H} + \frac{N_{R2} - 1}{4N_{R2}}\right\} \cdot \beta_2 + \frac{1}{16} \cdot \beta_3 + 0 \cdot \beta_4 = \frac{1}{8}$$

INDIVIDUAL: (Sire) $$\frac{1}{8} \cdot \beta_1 + \frac{1}{16} \cdot \beta_2 + \left\{\frac{1 + (M_{R3} - 1)R}{N_{R3}M_{R3}H} + \frac{N_{R3} - 1}{4N_{R3}}\right\} \cdot \beta_3 + \frac{1}{16} \cdot \beta_4 = \frac{1}{2}$$

MGS: $$0 \cdot \beta_1 + 0 \cdot \beta_2 + \frac{1}{16} \cdot \beta_3 + \left\{\frac{1 + (M_{R4} - 1)R}{N_{R4}M_{R4}H} + \frac{N_{R4} - 1}{4N_{R4}}\right\} \cdot \beta_4 = \frac{1}{8}$$

M_{R1} = average number of calves per daughter of SIRE

M_{R2} = " PGS

M_{R3} = " INDIVIDUAL

M_{R4} = " MGS

N_{R1} = number of daughters of SIRE

N_{R2} = " PGS

N_{R3} = " INDIVIDUAL

N_{R4} = " MGS

Maternal Breeding value = $1.00 + \beta_1 \cdot V_1 + \beta_2 \cdot V_2 + \beta_3 \cdot V_3 + \beta_4 \cdot V_4$

V_1 = average weaning weight ratio of daughters of SIRE - 1.00

V_2 = " PGS - 1.00

V_3 = " INDIVIDUAL - 1.00

V_4 = " MGS - 1.00

R = REPEATABILITY = .40 H = HERITABILITY = .30

The equations will need to be solved together. If one or more averages are missing, move the equations up and solve with available averages. The equations in matrix algebra are as follows:

$$\begin{bmatrix} X_1 & \frac{1}{8} & \frac{1}{8} & 0 \\ \frac{1}{8} & X_2 & \frac{1}{16} & 0 \\ \frac{1}{8} & \frac{1}{16} & X_3 & \frac{1}{16} \\ 0 & 0 & \frac{1}{16} & X_4 \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{bmatrix} = \begin{bmatrix} \frac{1}{4} \\ \frac{1}{8} \\ \frac{1}{2} \\ \frac{1}{8} \end{bmatrix}$$

where $X_i = \left\{ \frac{1 + (M_i - 1)R}{N_i M_i H} + \frac{N_i - 1}{4N_i} \right\}$

i goes from 1 to 4 and

M_i = average number of calves per daughter

N_i = number of daughters

Use this set of equations only when the individual is a male, such as when you calculate the maternal breeding values for the Sire Evaluation bulls.

APPENDIX D

MATERNAL BREEDING VALUES FOR DAMS

Now to calculate maternal breeding values on cows that have calves with weaning weights, solve the following equations:

SIRE: $X_1 \cdot \beta_1 + \frac{1}{8} \cdot \beta_2 + \frac{1}{4} \cdot \beta_3 + 0 \cdot \beta_4 = \frac{1}{4}$

PGS: $\frac{1}{8} \cdot \beta_1 + X_2 \cdot \beta_2 + \frac{1}{8} \cdot \beta_3 + 0 \cdot \beta_4 = \frac{1}{8}$

INDIVIDUAL: (Dam) $\frac{1}{4} \cdot \beta_1 + \frac{1}{8} \cdot \beta_2 + \left\{\frac{1 + (M_{R3} - 1)R}{M_{R3}H}\right\} \cdot \beta_3 + \frac{1}{8} \cdot \beta_4 = 1$

MGS: $0 \cdot \beta_1 + 0 \cdot \beta_2 + \frac{1}{8} \cdot \beta_3 + X_4 \cdot \beta_4 = \frac{1}{8}$

Matrix wise we have

$$\begin{bmatrix} X_1 & \frac{1}{8} & \frac{1}{4} & 0 \\ \frac{1}{8} & X_2 & \frac{1}{8} & 0 \\ \frac{1}{4} & \frac{1}{8} & "X_3" & \frac{1}{8} \\ 0 & 0 & \frac{1}{8} & X_4 \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{bmatrix} = \begin{bmatrix} \frac{1}{4} \\ \frac{1}{8} \\ 1 \\ \frac{1}{8} \end{bmatrix} \qquad "X_3" = \left\{\frac{1 + (M_{R3} - 1)R}{M_{R3}H}\right\}$$

Thus, calves of the dam are replaced by calves of the individual or dam.

A WITHIN HERD SELECTION MODEL

Consider the model

(1) $Y_{ij} = \mu + g_i + b_{ij} + e_{ij}$

where μ = the population mean

g_i = the i^{th} contemporary group

b_{ij} = the breeding value of the j^{th} animal in the i^{th} group

e_{ij} = random error

and y_{ij} = the observed value for a particular trait (weaning weight) on the j^{th} animal in i^{th} group.

Written in matrix notation, the model is

(2) $Y = X\beta + Zu + e$

Where X = a known matrix relating elements of β to Y

β = an unknown vector of fixed effects

Z = a known matrix relating elements of u to Y

u = a nonobservable random vector of breeding values

e = random error

Y = vector of observed values for a particular trait

also var (u) = G and var (e) = R

$$\text{var}(Y) = \text{var}(X\beta) + \text{var}(Zu) + \text{var}(e) \text{ if } \beta, u, e \text{ are uncorrelated}$$

$$= Z\,\text{var}(u)\,Z' + \text{var}(e)$$

$$= ZGZ' + R$$

The normal equations to produce Best Linear Unbiased Estimates (BLUE) of β and Best Linear Unbiased Predictors (BLUP) of u, are given by Henderson (1963, 1973) as

(3) $$\begin{bmatrix} X'R^{-1}X & X'R^{-1}Z \\ Z'R^{-1}X & Z'R^{-1}Z + G^{-1} \end{bmatrix} \begin{bmatrix} \beta \\ u \end{bmatrix} = \begin{bmatrix} X'R^{-1}Y \\ Z'R^{-1}Y \end{bmatrix}$$

Now if $R = I\sigma_e^2$, (3) can be rewritten as

$$(4)\quad \begin{bmatrix} X'X & X'Z \\ Z'X & Z'Z + G^{-1}\sigma_e^2 \end{bmatrix} \begin{bmatrix} \beta \\ u \end{bmatrix} = \begin{bmatrix} X'Y \\ Z'Y \end{bmatrix}$$

Henderson (1963) has shown that G (the variance-covariance matrix among the u_i's) is

$$G = A_{ij}\sigma_G^2$$

where A_{ij} is Wright's (1922) numerator relationship matrix and σ_G^2 is the variance of a single breeding value (in this case the population additive genetic variance). The numerator relationship matrix, used in this way, relates genetically every individual being considered in u with every other individual and itself. Inbreeding is taken into consideration because the relationship of an individual to itself is 1.0 + (the individual's inbreeding). All the information from all relatives (no matter how remote) is considered in producing the BLUP of u.

Now let us assume, in a simple case, that an individual herd has been performance testing for the past 20 years. Clearly animals alive 20 years ago are generally not available for selection today, but their individual performance and subsequently the performance of their progeny has been responsible for the animals currently in the breeding herd. All of this past information can be used to obtain the predictor of u (breeding value of the individual) by a simple partition of model (2). Rewrite (2) as

$$(5)\quad Y = X\beta + Z_1u_1 + Z_2u_2 + e$$

where Y, X, β, and e are are previously defined

Z_1 = a known matrix relating elements of u_1 to Y

u_1 = a vector of nonobservable random variables (breeding values) for animals no longer available for selection

Z_2 = a known matrix relating elements of u_2 to Y

u_2 = a vector of nonobservable random variables (breeding values) for animals now available for selection

The vector u_2, in reality, could contain one element for each calf in this year's calf crop plus one element for each bull and cow that produced the current calf crop.

The normal equations necessary to yield BLUE estimates of β and BLUP estimates of u are:

$$(6)\quad \begin{bmatrix} X'X & X'Z_1 & X'Z_2 \\ Z_1'X & Z_1'Z_1 + G^{11}\sigma_e^2 & Z_1'Z_2 + G^{12}\sigma_e^2 \\ Z_2'X & Z_2'Z_1 + G^{21}\sigma_e^2 & Z_2'Z_2 + G^{22}\sigma_e^2 \end{bmatrix} \begin{bmatrix} \beta \\ u_1 \\ u_2 \end{bmatrix} = \begin{bmatrix} X'Y \\ Z_1'u_1 \\ Z_2'u_2 \end{bmatrix}$$

Look more closely at the partition of $G = A_{ij}\sigma_e^2$.

$$(7)\quad G = \sigma_e^2 \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} = \begin{bmatrix} G_{11} & G_{12} \\ G_{21} & G_{22} \end{bmatrix}$$

A_{11} is the relationship among animals no longer available for selection. $A_{12} = A'_{21}$ is the matrix relating animals no longer available for selection with those animals which are available for selection. A_{22} is the relationship among all animals now available for selection. Because G^{-1} is needed in both (5) and (6) define:

$$(8)\quad G^{-1} = \frac{1}{\sigma_G^2} A_{ij}^{-1} = \frac{1}{\sigma_G^2} \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}^{-1} = \frac{1}{\sigma_G^2} = \begin{bmatrix} A^{11} & A^{12} \\ A^{21} & A^{22} \end{bmatrix} = \begin{bmatrix} G^{11} & G^{12} \\ G^{21} & G^{22} \end{bmatrix}$$

Now equations (6) can be rewritten in terms of A_{ij}^{-1} as

$$(9)\quad \begin{bmatrix} X'X & X'Z_1 & X'Z_2 \\ Z_1'X & Z_1'Z_1 + Z^{11}k & Z_1'Z_2 + A^{12}k \\ Z_2'X & Z_2'Z_1 + A^{21}k & Z_2'Z_2 + A^{22}k \end{bmatrix} \begin{bmatrix} \beta \\ u_1 \\ u_2 \end{bmatrix} = \begin{bmatrix} X'Y \\ Z_1'Y \\ Z_2'Y \end{bmatrix}$$

where $k = \sigma_e^2/\sigma_G^2$

The constant k can be estimated from the heritability for a particular trait because we know:

$$h^2 = \frac{\sigma_G^2}{\sigma_G^2 + \sigma_e^2}$$

Then $$\frac{1}{h^2} = \frac{\sigma_G^2 + \sigma_e^2}{\sigma_G^2} = 1 + \frac{\sigma_e^2}{\sigma_G^2}$$

and $$k = \frac{\sigma_e^2}{\sigma_G^2} = \frac{1}{h^2} - 1$$

For a trait such as weaning weight with $h^2 = 0.28$, one finds that $k = 2.57$.

Since the goal for this model is to obtain BLUP estimates for u_2, the computational effort can be considerably reduced by absorbing the equations for β and u_1 into the equations for u_2. This is easily seen by rewriting the equations in (9) and then doing some algebra.

$$(10)\quad X'X\beta + X'Z_1u_1 + X'Z_2u_2 = X'Y$$

$$(11)\quad Z_1'X\beta + (Z_1'Z_1 + A^{11}k)u_1 + (Z_1'Z_2 + A^{12}k)u_2 = Z_1'Y$$

$$(12)\quad Z_2'X\beta + (Z_2'Z_1 + A^{21}k)u_1 + (Z_2'Z_2 + A^{22}k)u_2 = Z_2'Y$$

First equation (10) can be solved for β in terms of u_1 and u_2 as

$$(13)\quad \beta = (X'X)^{-1}(X'Y - X'Z_1u_1 - X'Z_2u_2)$$

Equation (13) is then substituted into (14) and (15) to give

$$(16)\quad (Z_1'TZ_1 + A^{11}k)u_1 + (Z_1'TZ_2 + A^{12}k)u_2 = Z_1'TY$$

$$(17)\quad (Z_2'TZ_1 + A^{21}k)u_1 + (Z_2'TZ_2 + A^{22}k)u_2 = Z_2'TY$$

where $T = I - X(X'X)^{-1}X'$

Now because u_1 is the vector of breeding values for animals no longer available for selection, u_1 is absorbed into the u_2 equations by solving (16) for u_1 in terms of u_2, substituting the result in (17) and simplifying the expression. This second absorption is easier to see if we define:

$$B = (Z_1'TZ_1 + A^{11}k)$$

$$D = (Z_1'TZ_2 + A^{12}k)$$

$$E = (Z_2'TZ_2 + A^{22}k)$$

$$S_1 = Z_1'TY$$

$$S_2 = Z_2'TY$$

and write (16) and (17) as

$$(18)\quad B\,u_1 + D\,u_2 = S_1$$

$$(19)\quad D'u_1 + E\,u_2 = S_2$$

Solving (18) for u_1 in terms of u_2 gives

$$(20)\quad u_1 = B^{-1}(S_1 - D\,u_2) = B^{-1}S_1 - B^{-1}D\,u_2$$

Substituting (20) in (19) gives

$$(21)\quad D'B^{-1}S_1 - D'B^{-1}D\,u_2 + E\,u_2 = S_2$$

$$(E - D'B^{-1}D)u_2 = S_2 - D'B^{-1}S_1$$

Finally, BLUP estimates for u_2 using all the available information from all animals in the herd are obtained as

$$(22)\quad \hat{u}_2 = (E-D'B^{-1}D)^{-1}\,(S_2 - D'B^{-1}S_1)$$

Henderson (1963) has shown that equations (9) have selection index properties which correctly weight the breeding value estimates in $\hat{u}_2$ for differences in the amount of information available in each class of relatives (paternal half-sibs, maternal half-sibs, full-sibs, progeny, first cousins, second cousins, nephews, etc.). Further, Henderson (1963) demonstrated that breeding values predicted in $\hat{u}_2$ (equation 21) are predicted with minimum error variance among the class of all unbiased predictors.

From a practical viewpoint, this model has three advantages over the now recommended method of predicting breeding values. These advantages are:

(a) All information available on all relatives of the individual is utilized in predicting the individual's breeding value.

(b) The effects of any inbreeding in the herd are taken into consideration.

(c) Because one is able to include other fixed effects besides contemporary groups (say generation coefficient), the effect of any genetic trend over time can be accounted for.

As one must expect, this model is computationally more difficult to fit than the method now being used by the beef breed associations.

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WHY AND HOW THE AMERICAN ANGUS ASSOCIATION USES BREEDING VALUES

Mr. Richard Spader

The use of breeding values in the Angus Association A.H.I.R. program started in 1972. Prior to 1972 breeders involved in A.H.I.R. received Sire Summaries at weaning and yearling listing adjusted weights and weight ratios as their primary selection information.

As reviewed by the Association's board and staff six years ago, Breeding Values appeared as another useful source of information for the constructive breeding programs of Angus seedstock producers. It was also felt that any effort the Association could take to supply valuable information for within-herd improvement for its members would eventually improve the acceptability of the breed in nationwide commercial production.

To review just a moment, Breeding Values are a cattleman's worth or his breeding program potential to his commercial customers. What other reason is there for producing seedstock if not to improve commercial production? It's a big challenge for seedstock producers and a challenge that must constantly be dealt with in a competitive business like beef production.

A Breeding Value is what a commercial breeder can expect from the seedstock producers product. It's sort of his guarantee for superior workmanship and design. Every time a sizable investment is made in a product, over half of the purchase decision is based on the guarantee. So why is it any different in cattle production? Seedstock producers guarantee pedigree, breed purity, freedom from genetic recessives and in most cases fertility. Along with that in today's business, producers involved in a systematic performance measure program can also guarantee predictability of performance --- and that's through the Breeding Value concept.

The more records, the more meaningful the Breeding Values. This statement is true. In the AHIR program Breeding Values are calculated for a wide diversity of herds; some as small as 10 head and some in excess of 2,000 head. With this in mind the Breeding Values are based in some cases on a limited amount of within-herd performance and progeny information and in other situations on a vast storehouse of herd information. At the same time a performance program like A.H.I.R. works with the new breeders with one year of records and others with 20-30 years of performance experience. Therefore, Breeding Values in one herd cannot necessarily be compared to Breeding Values in another. But then what source of performance data can be realistically compared from one management to another? It boils down to Breeding Values being an important addition to any performance program. The extent that breeders use Breeding Values in making decisions for within-herd improvement and how they merchandise the information is an individual's decision.

In the A.H.I.R. program Breeding Values are offered primarily at weaning and yearling. Up-to-date values are also included for sires and dams with each report. It must be pointed out that Breeding Values at weaning and yearling are predicted on within-herd performance. Breeding Values using all A.H.I.R. information will be reviewed later in this report.

The first acquaintance a cattleman has with Breeding Values is at weaning and with the Weaning Selection Work Sheet (Example 1). Forms returned to the breeder are the Weaning Sire Summary and a Selection Work Sheet. Each weaning work sheet based on within-herd information lists the individual's adjusted weight and weight ratio; the average weight ratios of paternal and maternal half sibs; and a current Breeding Value for the animal at weaning. It must be pointed out that additional breedwide information is, in many cases, available on the sire but the Breeding Values at weaning are based on with-herd information only. Along with the work sheet is an up-to-date Breeding Value for all sires represented with progeny in the weaning group and an up-to-date Breeding Value for each dam of calves weighed.

At yearling time breeders receive a Selection Work Sheet similar to the weaning work sheet with the addition of weights at either 12, 15 or 18 months of age. Again the Breeding Value is based on within-herd information. The information on both weaning and yearling Breeding Values becomes more meaningful as performance of generations of cattle have been recorded on A.H.I.R. The predictability of an animal's genetic potential becomes more accurate with more available performance information in the breed.

The Maternal Weaning Selection Work Sheet was adopted and included in A.H.I.R. records in the fall of 1976. The work sheet (Example 2) sent to breeders with the Weaning Summary ranks bull calves and heifer calves on their ability to pass growth and milking traits along to their offspring. It takes into consideration the weaning weight ratios of the progeny of the dam -- plus the weaning weight ratios of the offspring of the daughters of the sire and both grandsires. This report includes all available A.H.I.R. information in the breed.

An effort is also being made with the maternal work sheet to monitor fertility. Starting in 1977, each work sheet records the number of years on record for the dam of a calf, the number of calves reported and the percentage calf crop. At present this information is not included in the Maternal Breeding Value, but will be reviewed for future use.

Current Breeding Values are also reported for dams when a current Produce of Dam Summary is sent to a breeder. The Produce of Dam Summary is a complete review of all calves on record for cows currently in a breeder's herd. It is based on within-herd records only. Breeding Values are also reported on Angus Performance Pedigrees. Performance Pedigrees are a cumulative report of all available information on an animal in the breed. At present breeders can request a Performance Pedigree on any animal in the breed either as owner or non-owner. Once again Breeding Values on Performance Pedigrees are only as accurate as the information they're based on. For the herds actively involved in A.H.I.R., generations of performance information have a higher predictability of future performance than herds with little performance information. This situation should encourage more herd owners to maintain permanent records of performance. From a breed standpoint, the use of Performance Pedigrees has increased tremendously in the past two years. Breeders can use the pedigrees not only for selection decisions, but also as a strong sales tool in marketing sons or daughters of superior sires or dams. It is the one form in the A.H.I.R. program that offers complete information on the individual, the sire, dam and grandparents.

In general Breeding Values have been well accepted by the 1,300 Angus members who are involved in A.H.I.R. Like any program there is a continual need for education when Breeding Values are first adopted. It means more paperwork returned to the cooperating member which requires a breed organization to give guidance in filing and using the records once returned to the herd owner. As an example, an effort has been made in the past year to offer Angus breeders a complete and comprehensive three-ring binder and dividers to answer many of the questions about A.H.I.R. and the breeding value concept.

Most difficult is the simple fact that herd owners cannot calculate a Breeding Value as simply as adjusted weights and ratios. In other words, some faith has to be given to the program and the basis of computing Breeding Values.

From a breed standpoint, members must also be aware that their individual within-herd records will be used in calculating Breeding Values. In the past few years the Angus Association received a release of record information from all members on A.H.I.R. and today all new members sign a release when enrolling in the program.

In summary, the Breeding Value concept has been utilized by A.H.I.R. for six years. Breeder reaction has been very favorable and Breeding Values have become an accepted and useful tool in herd performance programs.

EXAMPLE 1

The Weaning Selection Work Sheet lists available within-herd information on the weaned calf, the paternal and maternal half sibs in addition to his up-to-date Breeding Value. Also listed is a current Breeding Value for the sires and dams represented in the weaning group.

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

WEANING

ANIMAL INFORMATION									AVAILABLE INFORMATION								RANK
SEX	TATTOO		BIRTH DATE			SIRE REGISTRATION NUMBER	DAM CHAIN NO.	DAM REGISTRATION NUMBER	ADJ. WEIGHT	WEIGHT RATIO	PAT. HALF SIBS		MAT. HALF SIBS		PROGENY		BREEDING VALUE RATIO
	LEFT EAR	RIGHT EAR	MO.	DAY	YR.						NO.	AVERAGE RATIO	NO.	AVERAGE RATIO	NO.	AVERAGE RATIO	
B	2285	2285	10	23	75	7770258	228	7993657	608	125	20	100					107
B	2185	2185	9	10	75	7770258	218	7926748	524	115	20	101					104
B	0535	0535	9	14	75	7770258	53	5268023	460	101	20	102	6	111			104
B	2075	2075	9	27	75	7926754	207	7542540	524	115	3	96	1	99			104
B	1075	1075	10	4	75	7027404	107	6191862	480	105	93	100	4	112			103
B	2115	2115	10	24	75	7027404	211	7656704	540	111	93	100	1	103			103
	UP TO DATE BREEDING VALUE FOR EACH SIRE OF CALVES WEIGHED																
B	403	403	5	10	73	7027404	53	5268023	505	120	93	100	6	108	4	101	106
B															21	102	103
B															94	100	100
B	523	523	5	25	73	7086528	187	7197627	423	101	70	98	2	100	2	96	98
B															71	98	97
	UP TO DATE BREEDING VALUE FOR EACH DAM OF CALVES WEIGHED																
C	351	351	4	12	71	6078729	12YL	6292074	552	128	4	106	4	109	2	123	114
C	572	572	5	27	72	6708829	62	5503143	480	118	33	103	5	118	2	107	110
C			3	24	69										5	113	107
C	243	243	4	27	73	6708829	111	6281096	429	113	33	103	4	108	1	115	107
C	160	160	3	8	70	4688839	62	5503143	495	125	135	100	5	116	3	96	107

EXAMPLE 2

The Maternal Weaning Selection Work Sheet includes all A.H.I.R. information in estimating the Breeding Value Ratio. An effort is also made with the Maternal Work Sheet to record fertility information.

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

MATERNAL WEANING WEIGHTS

ANIMAL INFORMATION						AVAILABLE INFORMATION								RANK	DAM FERTILITY		
BIRTHDATE			SIRE	DAM	DAM	DAM PROGENY		PAT. GRAND SIRE		MAT. GRAND SIRE		SIRE		BREEDING	YEARS	NUMBER	%
MO.	DAY	YR.	REGISTRATION NUMBER	CHAIN NUMBER	REGISTRATION NUMBER	NO.	AVERAGE RATIO	NO.	AVERAGE RATIO	NO.	AVERAGE RATIO	NO.	AVERAGE RATIO	VALUE RATIO	ON RECORD	OF CALVES	CALF CROP
7	30	PGS 76	6000000 6822101	MGS 162	5129577 7676676	2	109	50 115	100	5 10	106	7 9	96	101	3	2	67
6	24	PGS 76	6000000 6822101	MGS 164	5129577 7676678	2	103	50 115	100	5 10	106	7 9	96	100	3	2	67
6	20	PGS 76	6000000 6822101	MGS 56	4441273 5848186	4	106	50 115	100	19 61	99	7 9	96	100	5	4	80
6	16	PGS 76	6000000 6822101	MGS 69	3766303 4947006	5	102	50 115	100			7 9	96	99	5	5	100
6	20	PGS 76	6000000 6822101	MGS 19	5406909 6604290	4	102	50 115	100			7 9	96	99	5	4	80
5	24	PGS 76	5382680 6217010	MGS 158	6225783 7737780	2	101	20 29	99	1 2	101	5 7	97	99	2	2	100
6	16	PGS 76	5382680 6217010	MGS 179	6822101 7769260	2	99	20 29	99	7 9	96	5 7	97	98	2	2	100
6	1	PGS 76	6000000 6822101	MGS 77	3114215 4632378	4	97	50 115	100			7 9	96	98	5	5	100
6	20	PGS 76	6000000 6822101	MGS 2	5406909 6745954	4	92	50 115	100			7 9	96	97	5	4	80

HOW TO USE BREEDING VALUES

FROM A BREEDER'S PROSPECTIVE."

By: Martin Jorgensen

My first exposure to Breeding Values in an identified form was 1972 and in thinking back I soon realized sophistication of seed stock selection cannot become common place without thoroughly implementing this selection concept. It is safe to say that most breeding estiblishments have yet to experience the thrill of relying on Breeding Value selections and several years later have the decision documented to be correct with superior within progeny.

I don't want to leave the impression that because producers now have a system of ranking breeding stock with a Breeding Value Ratio that future mistakes will not be made. The failure to maintain complete accuracy in all reported data could easily distort the results to the point that your records are worthless to you. For example; the breeder that sorted off several favorite bull or heifer prospects and treated them with a special environment from the rest of the group.

Another possibility of distorting the real value of a sire can be accomplished by mating him to selected superior cows in your herd and comparing him on the same basis as the remainder of the herd. These are only several of many ways that records can be manipulated to the extent they have little or no value for replacement selection if you expect to rely on Breeding Value Estimates.

An ongoing program of providing equal management treatment for all contemporaries is a must for accuracy of records, therefore in our on program we attempt to keep the calving season short with all cows utilizing similar grazing conditions. Calves are not creep fed while nursing and all calves are weighed and weaned the same day and approximately the same day in October each year. All calves are immediately separated by sex and the next phase of performance comparison is set in motion for post weaning gain data.

We consider the following measurements necessary to record in order to properly evaluate the genetic variables within our herd that relate to objective selection for economic values:

1. Birth weights
2. Complete reproduction and production tabulation on all females.
3. Weaning weights adjusted to 205 days.
4. Yearling weights adjusted to 365 days.
5. Testicle measurements and semen test on all bulls.
6. Eighteen month weights adjusted to 550 days on all replacement females.

An organized management procedure incorporating like treatment for all contemporaries within sex must be established while comparisons are taken before you can expect accuracy from Breeding Value Estimates.

The example in Exhibit A shows our method of identifying each cow unit in the herd.

I will briefly relate the usefullness of this herd tabulation as we use them for selection purposes. This is our only record that contains performance and breeding history on one sheet. We find it quite helpful for the purpose of sire selection and the culling of cows.

It is quite possible to find a superior set of ratios on an individual that also has excellent breeding value estimates, that has a disappointing pattern on calving. We are careful not to select a sire from a dam that for an unknown reason shows the lack of regularity in her calving history. This is the advantage of posting all pertinent information in one condensed form because it brings all ratios, breeding values, and reproduction performance in one handy reference.

We random breed with a number of young sires involved each year and as one would expect the variable between sire groups is significant. The possibility always exists that some cows get several below herd average sires simultaniously, which is sure to reflect on her own production record. We attempt to take this into consideration when making selection or culling decisions.

Health problems will distort a ratio on individuals and again the importance of accurate records comes into play. A good example is shown in Exhibit B with sire number 83. This bull had the top breeding value estimate at weaning when compared against 110 contemporaries. The next record that rated above all contemporaries was the breeding value estimate of his dam on our weaning report. The superior record of bull # 83 was interrupted due to a siege of pneumonia which effectively reduced his own yearling ratio to 104 and consequently ranked him number eleven against his 110 contemporaries for breeding value estimate. Since we have no means of compensating a record for such a situation, the only recourse was to rely on the accumulated data up to the time of the health problem and give the bull a chance to further prove himself as a sire. This proved to be a wise decision when his first group of calves performed with an average four percent superior both at 205 and 365 days. His own breeding value now stands at 108 which was second high against twelve sire groups. The monetary value of breeding value estimates was certainly exemplified to me since we now own progeny from this sire rather than the probability of some from a less qualified sire. You will notice in Exhibit C that number 83 had the lowest yearling ratio on the entire sheet, yet he ranked near the middle of the group with his breeding value ratio. This factor certainly was the decision maker for us, since we were aware of what caused the reduction from a weaning ratio of 116 to a yearling ratio of 104.

Breeding value estimates can not serve you well if your records are lacking in continuity or time span. Also the accuracy of them increases as you incorporate more numbers to each progeny group. Many of our sires are selected from first calf heifers which demands that you have depth of performance established in your records in order to increase the accuracy of using an unsampled product. We incorporate approximately five young unsampled sires each year into our breeding program. Exhibit C is a good example of what comes to the top of the breeding value ranking more often than not where generations are moved at quite a rapid pace. You will notice the top three ranking sires are from dams with very little proof of progeny performance and this is where the breeding value estimate becomes the selection criteria. Frankly we do not hesitate to have confidence in an estimate that is established from a history of superior input. Most of these young females have superior growth ratios as well as their dams and grand dams which brings us back to the value of having a base of records that can take you through their four generation pedigree.

I would like to show some examples in Exhibit D that demonstrate the accuracy of the records that ranked the cows for weaning breeding value estimates. I would like to bring to your attention the average 205 day weight on the high group on their own performance is 507 pounds compared to 450 pounds on the low group of cows. Now, take note of their production performance and you will discover the average difference is about the same on the two groups of calves as you see on the two groups of cows. Performance selection is the most efficient way in the world to get an extra calf out of each cow in your herd in terms of salable pounds. We are simply replacing low ratio or low breeding value females with superior breeding value females and consistently mating them to bulls with top breeding values.

Let's take a look at three groups of cows in Exhibit E and see the correlation of the average yearling weight difference between each group and see how the average ratio of their progeny compare from one group to another. The Group 1 represents cows with superior breeding values, Group 2 represents cows from the average of our herd, and the Group 3 represents the lowest breeding values. It's interesting to me that the average weight of Group 2 is the same as ½ of the combined weight of Groups 1 and 3. It's even more interesting to see the yearling ratios of the progeny from Group 2 take the same pattern when you look at the group average. I converted the ratio difference on the progeny of Group 1 and Group 3 to pounds by working from our herd averages and it comes out to 70 pounds per yearling or 5,000 total pounds difference between groups.

In summary I want to re-emphasize that seedstock herds of the future without the implementation of a computerized herd measurement system will be of little value to the beef industry.

I will admit it takes extra effort to accumulate the necessary data and one cannot stop with just going through the motion. The figures cannot change your cow herd unless the breeder is willing to put the system in action by using the figures for the purpose of selection and culling. Most importantly, the value of Breeding Value Estimates increases from year to year.

COW NO. 3166

REGISTRATION CERTIFICATE

AMERICAN ANGUS ASSOCIATION
Certifies That

REGISTRY NUMBER 7892406

NAME OF ANIMAL	SEX	TATTOO LEFT EAR	TATTOO RIGHT EAR	DATE CALVED
RITO 149 OF IDEAL 033	COW	3166	3166	4/01/73

BREEDER
JORGENSEN BROS IDEAL SD — MEMBER CODE 294437

FIRST OWNER
JORGENSEN BROS IDEAL SD — MEMBER CODE 294437

SIRE
RITO 707 OF IDEAL 533 70 — 6810901
- R R RITO 707 — 5770651
  - RITO N BAR — 3175139
  - ERISKAY OF ROLLIN ROCK 3 — 4219419
- SKYMERE OF IDEAL 312 — 4889506
  - SKYLANDMERE 2058 — 2710761
  - EILEEN BARDOLIER 159 — 4222837

DAM
RITO 707 OF IDEAL 815 70 — 6810896
- R R RITO 707 — 5770651
  - RITO N BAR — 3175139
  - ERISKAY OF ROLLIN ROCK 3 — 4219419
- BAR OF IDEAL 313 68 — 6105800
  - RITO N BAR — 3175139
  - ROSEBUD BARDOLIER 32 — 4222838

NAME AND ADDRESS OF RECORDED OWNER — MEMBER CODE — DATE OF SALE

DATE ISSUED 11/06/73 G94382

Lloyd D. Miller
SECRETARY

INDIVIDUAL PERFORMANCE

WEANING

BIRTH WT.	ACTUAL WEANING WT.	ADJ. 205 WT.	RATIO	NO. CONTEMP.
	Age 195		BV 109	
86	490	561	122	220

YEARLING

ACTUAL 365 WT.	ADJ. 365 WT.	RATIO	NO. CONTEMP.	RATE OF GAIN
Age 382				BV 104
772	803	108	108	1.96

550

ACTUAL 550 WT.	ADJ. 550 WT.	RATIO	NO. CONTEMP.
980	1060	113	70

LIFETIME BREEDING RECORD

Year	'74	'75	'76	'77								
First Breeding Date	5/20	6/21	6/17	6/23 7/13								
No. Services	1	1	1									
Sire No.	234	72	116	86 204								

Breeding Value W / Y	/	110 / 107	111 / 107	110 / [illegible]								

COW NO. 3166

LIFETIME PRODUCTION

MALE CALVES

CALVING				WEANING					YEARLING						REMARKS
I.D.	BIRTH DATE	SIRE	BIRTH WT.	ACT. WT.	ADJ. 205	INDEX	NO. CONTEMP	Breeding Value	ACTUAL WT.	ADJ. 365	INDEX	NO. CONTEMP.	Breeding Value	DAILY GAIN	
119	3/28/76	72	100	Age 198 600	681	117	221	107	Age 383 1106	1097	110	118	106	2.74	[illegible]
152	3/23/77	116	91	Age 202 550	576	104	201	103	Age 383 1088	960	~~98~~ [illegible]	104	[illegible]	2.38	[illegible]
[illegible]	4-21-78	204	95												

FEMALE CALVES

CALVING				WEANING					YEARLING						550			REMARKS
I.D.	BIRTH DATE	SIRE	BIRTH WT.	ACT. WT.	ADJ. 205	INDEX	NO. CONTEMP.	Breeding Value	ACT. WT.	ADJ. 365	INDEX	NO. CONTEMP.	Breeding Value	DAILY GAIN	ACT. WT.	ADJ. WT.	NO. CONTEMP.	INDEX
5106	2/22/75	234	70	Age 229 550	576	112	207	102 ~~103~~	Age 418 925	893	114	102	107	2.35	1065	1081	62	111

PM 7

DATE: 12/18/75
CODE: 294437
JORGENSEN BROS IDEAL SD

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

WEANING

ANIMAL INFORMATION										AVAILABLE INFORMATION								RANK	REMARKS
CALF IDENTIFICATION NUMBER	SEX	TATTOO LEFT EAR	TATTOO RIGHT EAR	BIRTH DATE MO	BIRTH DATE DAY	BIRTH DATE YR	SIRE REGISTRATION NUMBER	DAM CHAIN NO.	DAM REGISTRATION NUMBER	ADJ. WEIGHT	WEIGHT RATIO	PAT. HALF SIBS NO	PAT. HALF SIBS AVERAGE RATIO	MAT. HALF SIBS NO	MAT. HALF SIBS AVERAGE RATIO	PROGENY NO.	PROGENY AVERAGE RATIO	BREEDING VALUE RATIO	SELECTION DECISIONS
✗ 83	B	583	583	3	20	75	7187001	033	6810896	660	116	77	103	2	121			108	
144	B	5144	5144	4	12	75	7530738	602	5188384	649	114	78	99	6	117			107	
193	B	5193	5193	4	24	75	7530832	281	7530840	648	114	73	104	1	111			107	
90	B	590	590	4	3	75	7187001	736	5729723	642	113	77	103	6	105			106	
188	B	5188	5188	4	17	75	7530832	814	6105799	614	108	73	104	5	107			106	
62	B	562	562	3	21	75	7795918	919	6475494	627	110	15	102	4	112			106	
85	B	585	585	3	25	75	7187001	866	6105701	592	104	77	103	5	109			105	
51	B	551	551	3	4	75	7851645	946	6495319	647	114	6	99	3	109			105	
197	B	5197	5197	4	26	75	7530832	1202	7187074	601	106	73	104	1	112			105	
140	B	5120	5120	4	6	75	7530738	520	4881359	619	109	78	99	8	110			104	
24	B	524	524	4	13	75	7892418	857	6363352	627	110	13	101	4	107			104	
116	B	5116	5116	3	4	75	7530738	3191	7892394	674	119	78	99					104	
15	B	515	515	3	23	75	7892418	1101	7337939	654	115	13	100					104	
189	B	5189	5189	4	18	75	7530832	927	6495218	584	103	73	104	3	105			104	
186	B	5186	5186	4	13	75	7530832	443	4613995	587	103	73	104	9	102			104	
70	B	570	570	3	29	75	7795918	042	6810869	602	106	15	102	3	111			104	
179	B	5179	5179	3	25	75	7530832	914	6495226	576	101	73	104	2	108			104	
81	B	581	581	3	16	75	7187001	257	7607718	605	106	77	103	1	102			104	

The SELECTION WORK SHEET is a CURRENT RANKING of calves, their sires and dams. The ranking is based on BREEDING VALUE RATIOS for either WEANING or YEARLING weight. These breeding value ratios are estimates of how these animals should TRANSMIT their superiority or inferiority to their offspring. A ratio of 100 is average. The breeding value ratio of an individual is computed using its own record, those of its paternal half sibs, maternal half sibs, and progeny. The breeding value ratio of any two animals can be fairly compared, since the ratios are adjusted for differing numbers of records. The SELECTION WORK SHEET is to be USED in making SELECTION DECISIONS.

PAGE 1

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DATE: 05/24/76
CODE: 294437
JORGENSEN BROS IDEAL SD

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

YEARLING

PM 7

ANIMAL INFORMATION										AVAILABLE INFORMATION								RANK	REMARKS
CALF IDENTIFICATION NUMBER	SEX	TATTOO		BIRTH DATE			SIRE REGISTRATION NUMBER	DAM CHAIN NO.	DAM REGISTRATION NUMBER	ADJ. WEIGHT	WEIGHT RATIO	PAT. HALF SIBS		MAT. HALF SIBS		PROGENY		BREEDING VALUE RATIO	SELECTION DECISIONS
		LEFT EAR	RIGHT EAR	MO.	DAY	YR						NO.	AVERAGE RATIO	NO.	AVERAGE RATIO	NO.	AVERAGE RATIO		
1321 X 156	B	5156	5156	5	6	75	7530738	2118	7530802	1159	117	76	101	1	110			108	
X 116	B	5116	5116	3	4	75	7530738	3191	7892394	1148	116	76	101					107	
X 105	B	5105	5105	2	22	75	7530738	3163	7892403	1109	112	76	101					106	
148	B	5148	5148	4	16	75	7530738	835	6105770	1051	106	76	101	4	112			106	
90	B	590	590	4	3	75	7187001	736	5729723	1082	109	77	103	6	101			105	
113	B	5113	5113	2	28	75	7530738	3197	7892399	1102	111	76	101					105	
85	B	585	585	3	25	75	7187001	866	6105701	1050	106	77	103	5	105			105	
140	B	5120	5120	4	6	75	7530738	520	4881359	1077	108	76	101	7	105			105	
51	B	551	551	3	4	75	7851645	946	6495319	1105	111	6	97	3	105			105	
24	B	524	524	4	13	75	7892418	857	6363352	1072	108	13	99	4	108			105	
1320 X 83	B	583	583	3	20	75	7187001	033	6810896	1028	104	77	103	2	111			105	
87	B	587	587	3	26	75	7187001	05	6810800	1071	108	77	103	2	98			105	
81	B	581	581	3	16	75	7187001	257	7607718	1063	107	77	103	1	101			105	
X 36	B	536	536	3	30	75	7892369	2218	7530764	1130	114	18	94	1	112			105	
111	B	5111	5111	2	27	75	7530738	3212	7892375	1078	109	76	101					104	
117	B	5117	5117	3	5	75	7530738	3204	7892367	1080	109	76	101					104	
231	B	5231	5231	3	20	75	7892377	020	6810768	1101	111	10	97	3	103			104	
107	B	5107	5107	2	24	75	7530738	379	7892488	1071	108	76	101					104	

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PM 7

DATE: 11/17/77

CODE: 294437

JORGENSEN BROS IDEAL SD

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

WEANING

ANIMAL INFORMATION: CALF IDENTIFICATION NUMBER	SEX	TATTOO: LEFT EAR	TATTOO: RIGHT EAR	BIRTH DATE: MO.	BIRTH DATE: DAY	BIRTH DATE: YR.	SIRE REGISTRATION NUMBER	DAM CHAIN NO.	DAM REGISTRATION NUMBER	AVAILABLE INFORMATION: ADJ. WEIGHT	WEIGHT RATIO	PAT HALF SIBS: NO	PAT HALF SIBS: AVERAGE RATIO	MAT HALF SIBS: NO	MAT HALF SIBS: AVERAGE RATIO	PROGENY: NO.	PROGENY: AVERAGE RATIO	RANK: BREEDING VALUE RATIO	REMARKS: SELECTION DECISIONS
SIRES: UP TO DATE BREEDING VALUE FOR EACH SIRE OF CALVES WEIGHED																			
8219382	B	430	430	4	23	74	7238066	087	6818100	692	134	26	96	3	120	18	106	111	Em Extra #30
8505240	B	583	583	3	20	75	7187001	033	6810896	660	117	105	103	4	113	6	104	108	Rito 83
7187001	B	172	172	4	9	71	5770651	836	6105771	581	111	89	105	6	109	106	103	106	#72
8505304	B	5116	5116	3	4	75	7530738	3191	7892394	646	115	100	99	2	109	26	103	105	Band 116
8505264	B	5156	5156	5	6	75	7530738	2118	7530802	609	108	100	99	3	115	10	100	102	Band 156
8505275	B	536	536	3	30	75	7892369	2218	7530764	597	106	44	96	1	97	27	102	102	Rito 36
8260628	B															21	101	101	Nebr bull
8219439	B	4104	4104	3	28	74	7530832	443	4613995	586	113	82	104	10	100	16	97	101	Rito 104
8219482	B	4157	4157	3	15	74	6810901	2216	7530762	591	114	2 99	TW 103	2	105	37	98	100	Rito 157
8505294	B	5105	5105	2	22	75	7530738	3163	7892403	579	103	100	99	2	98	25	99	99	Band 105
8455325	B															7	97	98	Both Rito 570
8325838	B															16	98	98	Marshall S C 5
8219471	B	4139	4139	4	28	74	7530832	533	4889506	418	81	82	104	8	108	20	94	95	Rito 139
COWS: UP TO DATE BREEDING VALUE FOR EACH DAM OF CALVES WEIGHED																			
087 6818100	C	670	670	8	29	70	5770651		5729712		-	90	105	5	107	4	124	114	
033 6810896	C	290	290	3	6	70	5770651	815	6105800	513	116	89	105	7	104	5	114	112	
928 6495214	C	979	979	4	29	69	3617840	520	4881359	532	117	48	101	8	109	7	111	111	
5198 8505249	C	5198	5198	5	4	75	7530832	087	6818100	602	118	82	104	3	126	1	100	110	
037 6810881	C	410	410	4	3	70	5770651	525	4881367	506	115	89	105	9	110	4	106	110	
3166 7892406	C	3166	3166	4	1	73	6810901	033	6810896	546	119	2 99	TW 103	4	113	3	109	110	
4100 8219435	C	4100	4100	3	23	74	7530832	709	5729710	559	120	82	104	7	110	2	102	110	
042 6810869	C	550	550	4	13	70	5770651	768	5729774	515	117	89	105	7	102	6	108	110	

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DATE: 11/17/77

CODE: 294437

JORGENSEN BROS IDEAL SD

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

WEANING

PM 7

ANIMAL INFORMATION									AVAILABLE INFORMATION								RANK	REMARKS
CALF IDENTIFICATION NUMBER	SEX	TATTOO LEFT EAR	TATTOO RIGHT EAR	BIRTH DATE MO.	DAY	YR.	SIRE REGISTRATION NUMBER	DAM CHAIN NO.	DAM REGISTRATION NUMBER	ADJ. WEIGHT	WEIGHT RATIO	PAT HALF SIBS NO	PAT HALF SIBS AVERAGE RATIO	MAT. HALF SIBS NO.	MAT. HALF SIBS AVERAGE RATIO	PROGENY NO.	PROGENY AVERAGE RATIO	BREEDING VALUE RATIO	SELECTION DECISIONS
2118 7530802	C	2118	2118	4	9	72	6810901	808	6105826	566	114	2 99	TW 103	7	104	4	113	109	
3191 7892394	C	3191	3191	3	26	73	7187001	606	5184613	533	117	105	103	9	103	3	111	109	
378 7892487	C	378	378	5	19	73	6495213	087	6818100	587	128	82	99	3	122	2	98	108	
3156 7892435	C	3156	3156	3	16	73	6810901	039	6810876	514	113	2 99	TW 103	5	106	3	110	108	
1101 7337939	C	1101	1101	8	13	71	5770651	162	3617843	399	98	89	105	6	105	3	118	108	
4171 8219493	C	4171	4171	3	30	74	6810901	565	4738518	580	124	2 99	TW 103	7	109	2	90	108	X
5183 8505201	C	5183	5183	4	7	75	7530832	565	4738518	534	105	82	104	7	112	1	105	107	
029 6810771	C	1640	1640	4	14	70	6386014	736	5729723	517	117	14	103	7	105	6	104	107	
919 6475494	C	1209	1209	3	10	69	3617840	715	5729714	511	113	48	101	5	105	7	107	107	
925 6495212	C	999	999	4	12	69	3617840	526	4881369	550	121	48	101			5	105	107	
174 7187003	C	174	174	4	10	71	5770651	826	6105750	529	112	89	105	5	105	5	102	107	
3115 7892469	C	3115	3115	3	27	73	7117436	525	4881367	490	107	31	101	9	111	2	107	106	
808 6105826	C	198	198	3	30	68	3175139	558	4977697	462	108	244	102	9	106	8	105	106	
902 6475461	C	479	479	3	20	69	3175139	558	4977697	534	118	244	102	9	105	7	102	106	
584 8505195	C	584	584	3	24	75	7187001	525	4881367	544	107	105	103	9	111	1	92	106	
4113 8219447	C	4113	4113	4	3	74	7530832	042	6810869	535	114	82	104	5	106	2	97	106	
2213 7530759	C	2213	2213	3	16	72	6495213	033	6810896	573	116	82	100	4	114	3	102	106	
3188 7892391	C	3188	3188	3	23	73	7187001	919	6475494	510	112	105	103	6	107	3	101	106	
955 6495293	C	1509	1509	8	27	69	5729682	617	5343374	536	125	35	97	1	102	2 6	TW 105	106	[illegible]
563 8505203	C	563	563	3	23	75	7795918	606	5184613	588	115	2 40	TW 103	9	104	1	96	106	
3203 7892366	C	3203	3203	4	4	73	7187001	860	6105682	523	114	105	103	7	105	1	93	106	
5176 8505213	C	5176	5176	3	15	75	7530832	777	5729779	588	115	82	104	7	101	1	96	106	
028 6810770	C	1630	1630	4	12	70	6386014	301	4083984	477	108	14	104	8	99	5	108	106	
924 6495215	C	959	959	4	7	69	3617840	444	4613999	487	107	48	101	3	103	5	109	106	

Ave - 507 Ave 103

The SELECTION WORK SHEET is a CURRENT RANKING of calves, their sires and dams. The ranking is based on BREEDING VALUE RATIOS for either WEANING or YEARLING weight. These breeding value ratios are estimates of how these animals should TRANSMIT their superiority or inferiority to their offspring. A ratio of 100 is average. The breeding value ratio of an individual is computed using its own record, those of its paternal half sibs, maternal half sibs, and progeny. The breeding value ratio of any two animals can be fairly compared, since the ratios are adjusted for differing numbers of records. The SELECTION WORK SHEET is to be USED in making SELECTION DECISIONS.

PM 7

DATE: 11/17/77

CODE: 294437

JORGENSEN BROS IDEAL SD

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

WEANING

ANIMAL INFORMATION										AVAILABLE INFORMATION								RANK	REMARKS
CALF IDENTIFICATION NUMBER	SEX	TATTOO LEFT EAR	TATTOO RIGHT EAR	BIRTH DATE MO.	BIRTH DATE DAY	BIRTH DATE YR.	SIRE REGISTRATION NUMBER	DAM CHAIN NO.	DAM REGISTRATION NUMBER	ADJ. WEIGHT	WEIGHT RATIO	PAT. HALF SIBS NO.	PAT. HALF SIBS AVERAGE RATIO	MAT. HALF SIBS NO.	MAT. HALF SIBS AVERAGE RATIO	PROGENY NO.	PROGENY AVERAGE RATIO	BREEDING VALUE RATIO	SELECTION DECISIONS
456 8219400	C	456	456	2	25	74	7530738	2101	7530824	470	101	100	99	2	103	2	86	98	x
4259 8219556	C	4259	4259	3	22	74	7564658	2225	7530731	462	99	11	94	2	102	2	97	98	x
5153 8505274	C	5153	5153	4	24	75	7530738	2217	7530763	487	96	100	99	3	96	1	95	97	x
315 7892545	C	315	315	3	26	73	6810908	170	7186999	436	95	76	95			3	105	97	
257 7607718	C	257	257	3	27	72	6810908	902	6475461	486	98	76	95	6	103	4	99	97	x
5131 8505189	C	5131	5131	3	22	75	7530738	378	7892487	461	90	100	99	1	105	1	93	97	
545 8505199	C	545	545	4	6	75	7892369	544	4943225	478	94	44	96	8	103	1	85	96	x
471 8219414	C	471	471	4	4	74	7530738	12	3978466	422	90	100	99	8	99	2	93	96	x
340 7892527	C	340	340	3	2	73	6495213	1127	7187036	378	83	82	100	3	102	2	95	96	x
43 8219362	C	43	43	2	21	74	7530753	2181	7530780	459	98	10	92	3	103	2	90	96	x
324 7892551	C	324	324	4	9	73	6810908	111	7173838	424	93	76	95	1	92	3	101	95	
533 8505211	C	533	533	3	29	75	7892369	770	5729775	466	91	44	96	5	104	1	88	95	x
272 7607726	C	272	272	4	11	72	6810908	769	5729772	492	100	76	95	3	94	4	96	95	x
5306 8627620	C	53	53	2	28	75	7530753	331	7892522	437	86	10	93			1	100	94	
312 7892542	C	312	312	3	17	73	6810908	177	7187007	393	86	76	95	1	85	3	101	94	x
										↑					Ave	=	95		
TOTAL CALVES:				191					Avc	450									

Total difference between two groups with an average of 3 calves per cow 5112 pounds.

The SELECTION WORK SHEET is a CURRENT RANKING of calves, their sires and dams. The ranking is based on BREEDING VALUE RATIOS for either WEANING or YEARLING weight. These breeding value ratios are estimates of how these animals should TRANSMIT their superiority or inferiority to their offspring. A ratio of 100 is average. The breeding value ratio of an individual is computed using its own record, those of its paternal half sibs, maternal half sibs, and progeny. The breeding value ratio of any two animals can be fairly compared, since the ratios are adjusted for differing numbers of records. The SELECTION WORK SHEET is to be USED in making SELECTION DECISIONS.

Exibit E

DATE: 06/20/77

CODE: 294437

JORGENSEN BROS IDEAL SD

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

YEARLING

ANIMAL INFORMATION										AVAILABLE INFORMATION								RANK	REMARKS
CALF IDENTIFICATION NUMBER	SEX	TATTOO		BIRTH DATE			SIRE REGISTRATION NUMBER	DAM CHAIN NO.	DAM REGISTRATION NUMBER	ADJ. WEIGHT	WEIGHT RATIO	PAT. HALF SIBS		MAT. HALF SIBS		PROGENY		BREEDING VALUE RATIO	SELECTION DECISIONS
		LEFT EAR	RIGHT EAR	MO.	DAY	YR.						NO	AVERAGE RATIO	NO	AVERAGE RATIO	NO.	AVERAGE RATIO		
3191 7892394	C	3191	3191	3	26	73	7187001	606	5184613	851	115	104	102	7	106	2	108	110	
902 6475461	C	479	479	3	20	69	3175139	558	4977697	857	118	168	101	9	101	6	106	109	
3212 7892375	C	3212	3212	4	11	73	7187001	709	5729710	865	117	104	102	6	106	2	101	109	
525 4881367	C	44	44	4	19	65	2719761	105	3916519	992	118	167	99	4	97	9	107	109	
029 6810771	C	1640	1640	4	14	70	6386014	736	5729723	815	114	14	104	7	103	5	105	109	
033 6810896	C	290	290	3	6	70	5770651	815	6105800	831	116	81	102	6	99	4	107	108	
037 6810881	C	410	410	4	3	70	5770651	525	4881367	820	115	81	102	8	106	3	102	108	
3156 7892435	C	3156	3156	3	16	73	6810901	039	6810876	828	112	2 95	TW 103	4	101	2	109	108	
4186 8219507	C	4186	4186	4	15	74	6810901	046	6810909	840	113	2 95	TW 103	4	106	1	100	108	
3115 7892469	C	3115	3115	3	27	73	7117436	525	4881367	804	109	31	102	8	107	1	111	108	
119 7173874	C	119	119	3	28	71	4701597	914	6495226	860	115	42	99	3	97	4	108	107	
1101 7337939	C	1101	1101	8	13	71	5770651	162	3617843			82	103	3	104	2	112	107	
3166 7892406	C	3166	3166	4	1	73	6810901	033	6810896	788	106	2 95	TW 103	3	108	2	111	107	
3179 7892419	C	3179	3179	4	8	73	6810901	857	6363352	824	111	2 95	TW 103	5	104	2	104	107	
174 7187003	C	174	174	4	10	71	5770651	826	6105750	831	111	81	103	4	104	4	104	107	
3188 7892391	C	3188	3188	3	23	73	7187001	919	6475494	824	111	104	102	5	103	2	107	107	
955 6495293	C	1509	1509	8	27	69	5729682	617	5343374	752	115	34	98			2 5	TW 105	107	
042 6810869	C	550	550	4	13	70	5770651	768	5729774	816	114	81	103	7	95	5	105	107	
3168 7892408	C	3168	3168	4	1	73	6810901	615	5343295	836	113	2 95	TW 103	7	103	1	92	106	
4138 8219470	C	4138	4138	4	27	74	7530832	730	5729719	834	112	81	102	6	107	1	90	106	
537 4889512	C	67	67	4	26	65	2719761	31	2571127	910	108	167	99	6	106	9	105	106	
4111 8219445	C	4111	4111	4	1	74	7530832	756	5729750	803	108	81	102	6	104	1	110	106	
908 6495238	C	329	329	4	7	69	3175139	533	4889506	858	118	168	101	8	104	6	99	106	
185 7187013	C	185	185	4	17	71	5770651	845	6105745	861	115	81	102	6	100	3	100	106	
										837							*104.5* *104.9*		

The SELECTION WORK SHEET is a CURRENT RANKING of calves, their sires and dams. The ranking is based on BREEDING VALUE RATIOS for either WEANING or YEARLING weight. These breeding value ratios are estimates of how these animals should TRANSMIT their superiority or inferiority to their offspring. A ratio of 100 is average. The breeding value ratio of an individual is computed using its own record, those of its paternal half sibs, maternal half sibs, and progeny. The breeding value ratio of any two animals can be fairly compared, since the ratios are adjusted for differing numbers of records. The SELECTION WORK SHEET is to be USED in making SELECTION DECISIONS.

— 24 cows from top 1/3 of herd

Average 365 day weight ------------------------- 839

Average 365 day weight ratio of progeny ----------- 105

Exibit E

4

PM 7

DATE: 06/20/77 Group 2

CODE: 294437

JORGENSEN BROS IDEAL SD

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

YEARLING

ANIMAL INFORMATION										AVAILABLE INFORMATION								RANK	REMARKS
CALF IDENTIFICATION NUMBER	SEX	TATTOO LEFT EAR	TATTOO RIGHT EAR	BIRTH DATE MO	BIRTH DATE DAY	BIRTH DATE YR	SIRE REGISTRATION NUMBER	DAM CHAIN NO	DAM REGISTRATION NUMBER	ADJ WEIGHT	WEIGHT RATIO	PAT HALF SIBS NO	PAT HALF SIBS AVERAGE RATIO	MAT HALF SIBS NO	MAT HALF SIBS AVERAGE RATIO	PROGENY NO	PROGENY AVERAGE RATIO	BREEDING VALUE RATIO	SELECTION DECISIONS
4180 8219501	C	4180	4180	4	3	74	6810901	043	6810865	736	99	2 95	TW 103	2	92	1	112	102	
817 6105808	C	468	468	4	27	68	3175139	503	4827384	916	104	168	101	5	94	6	102	101	
3159 7892438	C	3159	3159	3	25	73	6810901	373	4222872	730	99	2 95	TW 103	8	103	2	97	101	
465 8219408	C	465	465	3	23	74	7530738	736	5729723	763	102	103	100	7	105	1	93	101	
1128 7187037	C	1128	1128	4	21	71	6396067	929	6495208	774	103	39	97	5	101	3	105	101	
4156 8219481	C	4156	4156	3	13	74	6810901	193	7187020	770	103	2 95	TW 103			1	89	101	
2216 7530762	C	2216	2216	3	26	72	6495213	037	6810881	769	103	74	99	2	101	3	102	101	
010 6810805	C	1330	1330	4	14	70	5729682	760	5729755	755	106	34	98	4	98	5	101	101	
252 7607714	C	252	252	3	20	72	6810908	108	3047539	766	102	72	97	8	97	3	110	101	
3171 7892411	C	3171	3171	4	2	73	6810901	943	6495315	750	101	2 95	TW 103	5	100	2	97	101	
3140 7892456	C	3140	3140	3	30	73	7173865	026	6810779	793	107	2 20	TW 97	4	93	2	105	101	
281 7530840	C	281	281	4	16	72	6810908	931	6475506	721	99	72	97	5	107	3	105	101	
739 5729802	C	1207	1207	4	8	67	2719761	412	4582024	868	98	167	99	7	101	6	104	101	
3205 7892368	C	3205	3205	4	4	73	7187001	931	6475506	737	100	104	102	5	107	2	93	101	
334 7892524	C	334	334	5	7	73	6810908	932	6495324	774	105	72	97	4	105	2	99	101	
2218 7530764	C	2218	2218	3	30	72	6495213	052	6810906	740	99	74	99			3	106	101	
4118 8219452	C	4118	4118	4	6	74	7530832	761	5729757	763	102	81	102	4	96	1	101	101	
211 7600135	C	211	211	3	30	72	7036491	53	2984415	729	97	18	103	7	104	3	100	101	
920 6475487	C	969	969	3	23	69	3617840	516	4827403	753	103	34	102	6	101	5	98	101	
4165 8219489	C	4165	4165	3	26	74	6810901	158	7173859	724	97	2 95	TW 103	1	107	1	102	101	
814 6105799	C	368	368	4	12	68	3175139	522	4881364	911	104	168	101	5	94	6.	101	101	
497 8219432	C	497	497	3	22	74	7530832	919	6475494	741	99	81	102	5	105	1	92	101	
4159 8219484	C	4159	4159	3	17	74	6810901	826	6105750	705	95	2 95	TW 103	4	108	1	97	101	
504 4827385	C	7	7	3	28	65	2719761	19	2924995	810	97	167	99	4	97	8	104	101	
										771							100.6		

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Ave of group 1 and 2 = 769 101.

24 cows from average of herd

Average 365 day weight ---------------------------- 771

Average 365 day weight ratio of progeny ----------- 100.6

Exhibit E

4

PM 7

DATE: 06/20/77 Group 3

CODE: 294437

JORGENSEN BROS IDEAL SD

ANGUS HERD IMPROVEMENT RECORD

PRODUCTION MEASURE

SELECTION WORK SHEET

YEARLING

ANIMAL INFORMATION										AVAILABLE INFORMATION								RANK	REMARKS
CALF IDENTIFICATION NUMBER	SEX	TATTOO LEFT EAR	TATTOO RIGHT EAR	BIRTH DATE MO	BIRTH DATE DAY	BIRTH DATE YR.	SIRE REGISTRATION NUMBER	DAM CHAIN NO	DAM REGISTRATION NUMBER	ADJ. WEIGHT	WEIGHT RATIO	PAT HALF SIBS NO	PAT HALF SIBS AVERAGE RATIO	MAT HALF SIBS NO	MAT HALF SIBS AVERAGE RATIO	PROGENY NO	PROGENY AVERAGE RATIO	BREEDING VALUE RATIO	SELECTION DECISIONS
2217 7530763	C	2217	2217	3	28	72	6495213	443	4613995	694	93	74	99	8	104	3	100	98	
419 8219374	C	419	419	4	9	74	7238066	071	6810848	725	97	25	97	3	101	1	105	98	
315 7892545	C	315	315	3	26	73	6810908	170	7186999	727	98	72	97	1	106	2	100	98	
021 6810767	C	1700	1700	4	12	70	5729736	443	4613995	704	98	2	98	8	103	4	96	98	
477 8219419	C	477	477	4	19	74	7530738	822	6120374	711	95	103	100	5	102	1	95	98	
316 7892546	C	316	316	3	26	73	6810908	185	7187013	706	95	72	97	2	103	2	104	98	
822 6120374	C	598	598	3	24	68	3641469	12	3978466	858	98	11	95	6	96	6	101	98	
256 7607717	C	256	256	3	27	72	6810908	803	6105812	721	96	72	97	6	105	3	97	98	
078 6810844	C	820	820	4	11	70	5729769	822	6120374	699	98	31	100	5	102	5	95	97	
1150 7187049	C	1150	1150	4	1	71	6083683	816	6105803	697	93	43	100	5	97	4	101	97	
2222 7530768	C	2222	2222	4	7	72	6495213	771	5729776	714	98	74	99	5	101	3	94	97	
379 7892488	C	379	379	5	20	73	6495213	845	6105745	642	87	74	99	6	104	2	105	97	
3150 7892428	C	3150	3150	4	7	73	7173865	819	6105777	683	92	2 20	TW 97	4	97	2	107	97	
916 6495221	C	809	809	4	7	69	2719761	613	5343281	671	92	167	99	1	104	5	99	97	
768 5729774	C	1857	1857	6	8	67	4228207	26	2571132			6	99	3	99	8	97	97	
240 7697801	C	240	240	4	9	72	6396067	05	6810800	680	93	39	98	2	106	2	97	97	
272 7607726	C	272	272	4	11	72	6810908	769	5729772	718	98	72	97	3	89	3	100	96	
290 7530820	C	290	290	4	28	72	6810908	706	5729707	700	95	72	97	2	101	3	97	96	
212 6475479	C	869	869	3	26	69	2719761	761	5729757	694	95	167	99	4	98	5	96	96	
322 7892549	C	322	322	4	4	73	6810908	114	7173841	704	95	72	97			2	95	96	
3187 7892390	C	3187	3187	3	21	73	7187001	634	5343380	692	94	104	102	5	98	2	86	96	
07 6810804	C	1310	1310	4	12	70	5729682	373	4222872	647	90	34	99	8	104	4	94	95	
2198 7530848	C	2198	2198	5	29	72	6396067	075	6810853			40	98	3	94	2	94	95	
471 8219414	C	471	471	4	4	74	7530738	12	3978466	585	78	103	100	6	99	1	100	92	
										699							98		

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97.8

24 Cows from bottom 1/3 of herd

Average 365 day **weight** ---------------------------- 699

Average 365 day **weight** ratio of progeny ----------- 97.81

OBSERVATIONS

Robert C. de Baca
Executive Director, BIF (1975-1978)

It's a real treat for me to get to sing my swan song as Art Linton takes over the reins as Executive Director. These words will merely be my observations. I want to convey three messages as I see them. The three messages relate to the past, to the now and to the future. The message will not be as long as it might sound like because I subscribe to the practice of "stand up, speak up and shut up".

Reflect back to Denver in January of 1967. The mood in performance evaluation was literally war. It was them versus us or us versus them and that was irrespective of who was them or was us. There were moves under foot to try to create new beef improvement registries to the exclusion and destruction of the breed associations. Most of the breed associations at that time did not have performance programs and several of them didn't even believe in performance - - JUST A SHORT DECADE AGO.

Ferry Carpenter rallied people from many organizations or vested interest groups within the beef industry to a meeting in Denver. Egos were at stake. Each BCIA was its own empire with its own system. The BCI's were arms of the Universities and were educational entities. They were strong. And even though they weren't unified as to method, they had "non-performance""on the run. The first listening conference of what is now Beef Improvement Federation was not all happiness and conformity. But out of all this BIF was born. I'd class it as a hard pull - - as a matter of fact it might have been a C-Section. But BIF weaned out well and during postweanin has grown desirably on rather low energy rations. I think its time for BIF to produce its next generation.

Yes, its interesting to reflect on the past at least from my vantage point. I've had the opportunity to see lots of change and to try to cause some of it. I had the rare opportunity of being on one of professor Phil Neale's livestock judging teams. Phil Neale and John Knox of New Mexico State were performance men - - but they understood people. Knox has been recognized for his research which gave the performance movement many answers. Neale changed New Mexico's sheep and wool industry - - and he did it genetically. He weighed sheep, measured and weighed wool and classified sheep for many years. And he did selective matings by the hundreds. And the resulting animals were gorgeous as well as productive. Neale taught us how to win contests and we did well by him. Our key words were short, blocky, low set, dumpy and the like. Any animal that had the feel of bone on tail head, rear rib or point of shoulder was thin and to be deplored. Yet, Neale emphasized that what we were doing was wrong. He told us that those were non-functional animals and that we should judge them to win contests but breed productive ones to live on. Today the pendulum is on the other end of the swing. When people talk of animals being good - - the adjectives relate to height, to length and to bigness. We now talk of size as though synonymous with functional efficiency. Yes, we've gone from watch fob to soup bone, we're breeding cows for deep mud. As a matter of fact, on page 113 of the May 1978 Angus Journal there is reference to an Angus bull weighing 1690 at 353 days and standing 54 inches high. Steve Blumenthal might suggest someone has painted a Charolais black again.

Well, a big part of the reason for BIF was for us to help each other not to differentiate the irrelevant from the immaterial - - but indeed to assemble the relevant into efficient and utilizable packages. This BIF has done. And the thing that gives it strength is that it has all been done through volunteered talents. Each year since 1971, BIF has sponsored one or more research symposia to take a direct look at research and its potential impact. Over this period of time there have been some excellent lectures - - all printed and available to the public. When a topic problem or a need arose that was very relevant it was often answered through a set of lectures at conference time to present all sides. We say thank you again to all the speakers who have made EVERY symposium a good one.

Throughout the ten years, BIF has operated through committees made up of breeders, teachers and researchers. The committees studied their lessons then reported to the National Directors who coordinated and pronounced final action on the matters under consideration. Until recently our committees included Farm and Ranch, Central Test, Carcass, Reproduction, Merchandizing and Sire Evaluation. We've had lots of people active in these committees and we've had strong chairmen heading them up. For this again we say thank you.

Across the country the guidelines of BIF committees are affecting the livelihood of cattlemen. The impact of the recommendations are evident in breeding season lengths, in adjustment factors, in testing station methods, in carcass evaluations, etc. and certainly in the magnificent sire evaluation programs developed by the breeds and by one or more states. Lots of people have been involved in the sire evaluation programs but none more thoroughly involved than Dr. Richard Willham. Again to all of you — THANK YOU.

Recently we've reorganized the committee structure completely. Your program shows that the committee structure combined some committee responsibilities and created some new ones. Hopefully we're in for "NEW GENERATION" ideas - - and based soundly on data. We say thank you to those who accepted the new committee assignments - - all 160 of you. And like all the rest of us you'll do your work at your own expense.

To date BIF has formally said thank you to 15 persons for Continuing Service to the performance movement and to BIF in particular. BIF has said thank you and congratulations to 82 Seedstock Breeders across the land for a job well done at home. BIF said thanks and congratulations to 60 Commercial Producers for a terrific job of performance production.

There are others to whom gratitude must be extended for getting BIF to this 10th anniversary - - to this 10th year of accomplishment.

To the Breed Association executives and directors who have allowed their personnel to be BIF active and who have adopted BIF programs.

To the Department Heads at Universities who have funded travel and time for BIF activities and for incorporating the recommendations that have gone forth.

To PRI, NAAB, NCA, USDA and the AI organizations for their participation and financial support.

To the Breeders who time after time have paid their own way to be active in BIF.

To the Beef Improvement Associations for their loyalty and coordination.

To people like Don Vaniman, Ike Eller, Craig Ludwig and others who have chaired the conference committees and done the big job of putting on the annual meeting. They are work and they don't get done without lots of organization.

Yes, there's lots of places to say thank you. And there's lots of places to say HELP.

So concerning the future I say help! Not for myself personally but for the concept -. - and for the organization and for the directors and for Art Linton who just took a non-paying job - - a non-paying task - - that he should not be expected to do alone.

To paraphrase Glenn Butts, BIF is a movement and movements mature slowly. BIF is not a police organization and persuasion is its only muscle. It is based on 50 years of research that we have paid for yet Glenn says that there are four stages of public evaluation of Beef Improvement. These four stages are amUSE, enthUSE, abUSE and finally USE. He said that there are many cattlemen geared to each of the first three stages but there are never crowds in the final and logical stage - - USE.

Glenn further stated that there is one thing common to all "master" breeders: They continually compete with themselves rather than with their peers. The performance movement will approach its potential when breeds and breeders embrace that cardinal principle.

Glenn, there are mighty few breeders really involved in your fourth stage. Indeed the real sound genetically planned programs are to be counted on few hands. This is a pity considering the amount of research and the man years of teaching we've paid for.

How many times have you heard some cowman say about a county agent or a college professor, "he's not practical - - He hasn't a lick of sense?" You've heard it over and over. Thank God for the impractical who can dream the impossible and eventually make it common place. Visualize the new fangled labor saving devices on your farm and reflect on how impractical they may have once been.

Nevertheless, I submit to you that one of our problems is performance breeding is not practical. It's too idealistic. It's inflexible. It's colorless. Anyone knows your records are a pack of lies. How old do you think the 1690 pound bull was when he was born? All of us have seen the lights in the farrowing house in January, farrowing March pigs. Besides that someone will find an indicator trait, and sidestepping the real issue, breed for it like crazy and set up an alternative and all of a sudden the alternative becomes the goal. Yes, performance breeding is idealistic. Idealists don't make money - - but they do get old. And after they get old they sell out and someone else makes the money. There's more money made everyday out in the industry on "modern" cattle than there are on performance-proved cattle. Cattle traders make more money than idealistic cattle architects. I was arguing a point of idealism versus practicality with a dutch geneticist recently. He said, " If you do it "this way" it will pay off eventually because it is right - - my answer was, "who pays the bills in the interim?"

Performance breeding has been unable to stand alone. It needs help. Sale barn people live on commission. Volume is their livelihood. A good animal is a sold animal. Feeders want performance cattle but when the chips are down they can make more money from cheapies out of the south east. The breeding programs of this continent are not planned by the people in this room and they should be more so. The breeding programs of this continent are influenced auctioneers, sale managers, ad salesmen and fast promoting salesmen much more than by genetic logic. Feeders hire nutritionists but everybody is a breeder. Now what are we going to do about this besides gripe?

My plea is this. I'm issuing a call for courage from our teachers, researchers and breed people to give more direction to breeding programs. Our outcrossing practices often border on atrocious and our commercial crossbreeding programs are chaotic. It is time for those who are paid to lead to do so - - from the front. Too much of the leading has been from behind - - trying to "rub off some philosophy" and being apologetic for being right. Do nice guys finish last or just finish? They are sidetracked and by passed. We know the principles - - we know they work. You know your audiences and I submit that if you exert your leadership with greater courage and conviction that you can bring commercial or purebred breeders around to sounder planning and use of better programs. You are indeed paid to be change makers. Change is made first by making people think. Sometimes you have to shock people to make them think. Would it shock you if I told you that someone has to have $500,000 at interest at 6% to pay your salary. Are you earning it or are you part of the Federal bureaucracy-caused paper shuffling? Today's paper shuffling society prevents initiative. Administrators can't stand controversial employees - - they cause ripples.

It does not cease to amaze me for example that a few trained geneticists some sitting in this audience who understand selection index theory and understand breeding values still justify being out on the tanbark judging cattle as a gesture of public relations. Most of them don't. I did so in a big way until about 15 years ago when I found myself talking out of both sides of my mouth - - so I quit. The price of being a nice guy wasn't worth the price of principle. Todays "modern" cattle are the result of form following function, then observers picking up the form and trying to make function follow it. Performance brought on the form but modified form will not guarantee performance. I'm amused to recall a father telling me of his son, who is a noted judge, placing the long tall steers up at the fair and picking fat ones for his own slaughter. My feeling is that if a practice is wrong, an honest professional - - honest with himself - - should not condone it — JUST BECAUSE PEOPLE ARE DOING IT.

With the number of trained people that we have in the breeds, in the AI studs, in the universities, our BIF-idealistic programs of breeding better cattle should be even farther along. Yes, we've done a lot, but the job ain't done yet. One of the reasons is the big turn over of monied men in the seedstock business. They are brought in by sale managers, they pay big, they have a big influence, they popularize unknown-quantity bulls, then they disperse - - but they influence. Are theirs breeding programs? Perhaps and perhaps not - - but they influence, and generally they are not performance minded. They enjoy their cattle on weekends. That the job ain't done is evident from page 47 of the May 1978 Angus Journal, where about a popular bull it says "one would expect matings of a carrier such as "this bull", to individuals that are absent of the mulefoot trait, to produce calves that are normal in every case. One-half of these progeny would be carriers of this recessive trait, so a complete outcross breeding program should be incorporated to avoid occurrence of mulefoot when using a carrier." How does that grab you? Every professional here should face these problems with courage and determination.

So I've asked for an evaluation of your courage quotient. Do you feel a burning urge to make a mark or to be a contented follower. Now that I have your courage up let's look at you and BIF.

BIF is not Art Linton and Dixon Hubbard.

BIF is you. The Executive group - of the various BIF committee - - the cat is on your back. Committee responsibility can't rest on Art and Dixon's shoulders. They're swamped. They're free - - they need for you to carry your load. And you must not slant data to suit your fancies or BIF will die.

Most Breeds and states are supporting BIF. But if you're not, isn't beef improvement worth $100 to your state. One state responded, "we don't want to belong to YOUR organization." Another said that for $50 they'd join but not for $100. So we solicited the $50 and did't get it.

Can you imagine running an organization like BIF on $4,000. You know, if you take your family out to dinner you'll have trouble staying under the BIF dues rate. I know of cattle people in this audience whose daily operating expense equals the BIF annual budget. So I ask you, could you help us get your neighbor state or breed to support BIF if you knew who's not helping?

Have you responed to requests for news items for BIF UPDATE? Don't more than three or four answer yes.

Have you made an effort to recruit new members or associate members? We particularly want more Canadian participation.

Have you responded to a request for feature articles. There's people who haven't gotten to it after 5 years of my nagging. Respond to your Regional Director if he asks you for articles.

Have you participated in BIF awards. If not you're denying someone in your state a deserved recognition. About 40 states and 20 breeds are guilty.

I'm asking you to help Art before he needs it. BIF is a cause, you benefit from its direction. Nurture it. Feed it ideas.

You know what we really need is more of the old time performance zealots like Glenn Burrows, Glenn Butts when he was at Ogeechee, John Crowe, George Ellis, like Cooper and Holden and Dale Davis and Martin Jorgensen and Sally Forbes and R. W. Jones and Jim Hemmingsen and Jim Lingle - - people who believe in performance cattle and understand the genetic principles and who wouldn't get converted back when their cattle becamemodern and popular. I'd be one of them if I could afford it.

We need people who are performance Zealots to join together to breed and merchandise together and to be able to face the non-proof competition head on.

The principles of performance breeding have been proved. They work. They are what BIF serves to foster. Now BIF has been proved. It will work - - but it needs YOU. It needs a new you dedicated to help it become stronger in its communications and in its coordination and in the adoption of its recommendations. Dr. Linton, I wish you lots of progress and lots of help and I pledge you mine.

MINUTES OF THE BOARD OF DIRECTORS - BIF
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Blacksburg, Virginia
May 22, 1978

Present were Directors Jorgensen, Butts, Vaniman, Warwick, Berg, Ludwig, Bennett, Linton, Hubbard, Durfey, Cundiff, de Baca, Keffeler, Spader, Cooper, Lilley, Eschelman, Allen, Wolf, Whaley and Eller.

Minutes

The Directors meeting was at breakfast with President Jorgensen presiding The secretary was asked to read the minutes of the fall (midyear) conference held at Kansas City. Vaniman moved that the minutes be accepted as read. Butts seconded the motion which carried.

Financial Report

de Baca then read the financial report (which is attached). Note the asterisks relative to accounts receivable. The 1977 financial report showed receivables of $6,350.35 of which $2500 was uncollectable dues. The 1978 shows receivables of $6500 of which $2500 are carried forward from last years uncollectables. Also $1250 of those indicated as accounts receivable this year are probably not collectable. Since accounts receivable are almost entirely projections of potential member contributions as dues, this is a rather nebulous item. After discussion Wolf moved and Vaniman seconded that noncollectable accounts receivable be written off as bad debts so as not to carry them in the assets portion of the accounting.

Denver Listening Conference

Hubbard reported on the Listening Conference at Denver. He indicated that most of the individuals reporting were quite favorable in their analysis of Beef Improvement Federation and its accomplishments. There is still a great deal of concern about the Beef Improvement Associations at the state levels. There is further concern that administrators seem rather cool to the need of reviving the Beef Improvement Associations. After lengthy discussion the meeting was recessed until 8:00 a.m. May 24.

Respectfully submitted,

Robert C. de Baca

Robert C. de Baca
Executive Director

RdeB
jc

Financial Status
Beef Improvement Federation

	May 1, 1977 -	May 10, 1978
Savings Account	9,190.68	8,589.13
Cash on Deposit	1,079.51	1,936.35
Accounts Receivable	3,800.35*	2,700.00*
Accounts Payable	0.00	0.00
Total Assets	$14,070.54	$13,225.48

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* 1977 showed receivable $6,350.35 of which $2500 was uncollectable dues. 1978 shows receivables of $6500 of which $2500 is last year's uncollectables and $1250 is probably not collectable this year.

Itemized Income

	May 1, 1977 -	May 10, 1978
Membership	3,250.00	7,575.00
Conference	5,674.87	3,357.00
Proceedings	172.00	43.36
Carcass Data	242.80	130.40
Brochures	0.00	45.05
Interest	443.50	398.45
Removed from Savings	0.00	6,000.00
Total Income	$ 9,783.17	$17,150.81

Itemized Expenses

	May 1, 1977 -	May 10, 1978
Conference, Meetings	7,117.20	3,784.45
Telephone	528.89	485.61
Clerical	1,168.30	1,442.03
Printing	1,915.69	3,522.55
Postage	795.28	700.14
Executive Director Expenses	1,105.31	1,377.10
Carcass Data	179.40	137.80
Savings Account	0.00	5,398.45
IRS, Job Service	0.00	319.93
Legal	0.00	30.00
Total Expenses	$12,810.07	$17,198.06

Executive Director Expenses

	May 1, 1977 -	May 10, 1978
Travel	245.60	976.27
Copy Machine	310.86	334.15
Printing	179.97	0.00
Postage	29.59	0.00
Secretarial	278.78	0.00
Phone	38.12	0.00
Supplies	22.38	66.68
Total Executive Director Expenses	1,105.31	1,377.10

MINUTES OF BOARD OF DIRECTORS

BEEF IMPROVEMENT FEDERATION

Donaldson Brown Center
Virginia Polytechnic Institute
and State University

Blacksburg, Virginia

May 24, 1978

The meeting was called to order by President Jorgensen on May 24 at 8:05 a.m.. Those present included directors Butts, Eschelman, Martin, Cooper, Baker, Wolf, Allen, Hubbard, Farmer, Spader, Bennett, Keffeler, Eller, Ellis, Ludwig, Berg, Whaley, Warwick, Lilley, de Baca, Jorgensen and Linton. Also present was Mr. A. G. Lewis representing the National Cattleman's Association.

Comments from Retiring Directors

Jack Cooper - Recommended that we keep the rules (or BIF recommendations) as simple as possible so a broad segment of the industry can understand them.

Jim Wolf - Stated that BIF can do a better job of public relations, both from the organization and for the concept of performance testing. He suggested that the committee reports be digested and made available to the popular press in release form.

To maintain the continuity of the Board, Jim suggested that new directors be provided with copies of past minutes.

C. K. Allen - Suggested that a study be made of the breed association-BCIA relationship to see how that can be improved.

Bob de Baca - Urged BIF to keep in mind the goals of the industry in producing productive cattle. BIF should lead the industry and not necessarily be swayed by the masses.

Bob said BIF needed broader input from the Board and the membership. He proposed that breed associations might wish to hold board meetings in conjunction with BIF functions.

Martin Jorgensen - BIF should take pride in accomplishments, since 35% of the seedstock are now performance tested.

1978 BIF Convention

It was moved by Jorgensen and seconded by Allen that BIF Board extend its appreciation to Ike Eller, Milt Wise and the Virginia Polytechnic Institute and State University staff for hosting the 1978 BIF Annual Convention. Motion carried.

Election of Officers

Dick Spader presented the report of the nominating committee. The committee made the following recommendations:

for president: James Bennett
for vice-president: Mark Keffeler

Glenn Butts moved and Ray Lilley seconded that the report of the nominating committee be accepted and that a unanimous ballot be cast for these individuals. Motion carried.

Jim Bennett replaced Martin Jorgensen as the presiding officer at the Board meeting.

Mid-Year Board Meeting

The mid-year Board of Directors meeting will be held on October 9 and 10, 1978 in Denver, Colorado, at the Smith Road Ramada Inn. The meeting will commence at 1:00 p.m. on the ninth and conclude at 12:00 p.m. on the tenth.

1979 Annual Convention

The dates chosen for the 1979 Annual BIF Convention were, first choice, May 17, 18 and 19, and second choice, May 21, 22 and 23. In each case the general meeting will occupy the first two days and the Board will meet on the last day. The meeting will be located in Lincoln, Nebraska, at the Hilton Inn. Regional Director Jim Gosey is in charge of arrangements.

The structure of the 1979 meeting was discussed. Several board members suggested that more free time be built into the program schedule for informal visiting. Possible topics suggested for the research symposia were:

1. feed efficiency
2. systems approach to performance records
3. calving ease and difficulty
4. an update on current beef breeding research.

Committee Reports

The Board shall take action on the committee reports at the mid-year Board meeting. Dixon Hubbard will follow up on these committee reports and present them at this meeting.

Listening Conference

The reports presented at the listening conferences will be compiled and circulated to the Board in July or August by Dixon Hubbard. Topics and ideas that were mentioned during the listening conference were:

1. need more actual breeders at BIF activities.
2. need closer cooperation of breed associations and BCIA's.
3. BIF needs to look to new challenges -- avoid rehash of same subjects.
4. need for centralization of computing services for BCIA's.
5. study educational role of BCIA's, working with youth programs and new breeders.
6. conduct seedstock breeder short courses.
7. continuation of listening conferences.

Awards Review

President Bennett appointed Greg Martin (Chairman), Wayne Eschelman and Art Linton as a committee to review the awards selection process. Many Board members were complementary of the breed association displays and suggested that they be continued.

Recruitment

The matter of inactive organizations was discussed. The financial difficulties of many BCIA was mentioned as a probable cause for this inactivity. President Bennett instructed the Executive Director to review the BIF fiscal year. Many Board members felt it would be advantageous if the fiscal year were the same as the calendar year.

President Bennett appointed a committee to study the dues structure of BIF. That committee is: Ike Eller, Chairman, Craig Ludwig and Frank Baker.

Office Transfer

Art Linton reported that the transfer of all Executive Directors' materials and responsibilities should be complete by the end of June, 1978. He was instructed by the President to review BIF services. BIF materials should be sent to the member organizations so they will receive greater use. A complete library of past proceedings and other pertinent documents should be maintained by the Executive Director.

New Business

BIF Guidelines

Dixon Hubbard reported that he expects to have a supplement to the BIF Guidelines printed after the mid-year Board meeting. Plans are to have 1,000 copies of this publication produced.

Research Needs

The question was raised as to how best to get action on those areas where additional research is needed as identified by BIF. Frank Baker stated that he expected the greatest response would be achieved by communicating this information through state organizations to their respective land grant colleges.

The meeting was adjourned at 12:10 p.m..

Respectfully submitted by,

Art Linton

Art Linton
Executive Director

COMMITTEE REPORTS

1978

BEEF IMPROVEMENT

FEDERATION

ANNUAL CONVENTION

These committee reports HAVE NOT yet received Board action. They are the results of committee activity but should not be interpreted as finalized BIF guidelines, recommendation or policy.

BIF

May 22-23-24, 1978

Donaldson Brown Center
for
Continuing Education
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia

REPRODUCTION COMMITTEE
May 22, 1978

Bill Durfey, Chairman, Roy Lilley, Secretary

Durfey called the meeting to order and had each person introduce himself. Those in attendance were: James Riley Hill, Jr., William B. Dunlap, Arthur V. Bartenslager, Donald E. Ray, John E. Parks, Kay Brown, Craig Ludwig, Lee E. Nichols, Mary Garst, Robert Fincham, Roy Lilley, John Peters, Robert Sand, Don Franke, Ron Parker, Merlyn Nielsen, Jack Cooper and Wayne L. Eshelman.

Durfey said a report on the committee report from Bozeman last year had been sent to the committee and was also in the proceedings. Refer to report.

Mary Garst got the meeting off to a good start by raising the question as to the need for the committee since heritability is so low on fertility intended as Devil's advocate point.

Concensus was:

1. BIF must encompass a total record keeping program.
2. We may have overreacted to the reported low heritabilities on fertility.
3. Preliminary data points toward higher heritabilities of male fertility traits.
4. Tremendous economic importance.

All agreed we should pursue improving fertility and discussed matter another 20 minutes.

Balance of meeting was on calving interval. It was agreed that both individual calving interval on cows and herd averages were desirable. Desire was to come up with calving interval formula that would give credit to cows calving young and those breeding back early even in short breeding seasons - still tried to accommodate different starting ages. We worried about such things as a fixed calving season distorting potential improvement in calving interval and the problem of first calf heifers that calved a month early and subsequently lost that advantage. Finally settled on following formula:

(Average age at last calf - average age of weaning contempory group at first calving) + 365 divided by number of calves.

Chairman charged each committee member to:

1. Evaluate calving interval formula and report to chairman.
2. Evaluate other parts of Guidelines for next board meeting.

Jack Farmer Ch.

EVALUATION OF GROWTH & EFFICIENCY OF GAIN

Chairman - Dick Whaley; Sec. - J. W. Patterson

The committee was called to order by the chairman Dick Whaley with 18 persons present. Nine of the standing committee members were present. Dr. Larry Cundiff was called upon to give the charge to the committee. The charge was to consider the guidelines for growth and efficiency with three possible points to be considered:

(1) Age limits for taking 205 day weights.
(2) Calculations of yearling weights.
(3) Measures of efficiency.

The chairman suggested an informal round table type discussion. Glenn Butts noted that we should guard against any recommendation that would adversely affect reproductive efficiency.

The first subject to be discussed was the effect of early weaning (under 160 days) upon estimating 205 day adjusted weights. A lengthy discussion followed on the merits of the 160-250 day range and the 90 day calving interval. Other questions were discussed:

(1) How accurate are the adjustments outside the 160-250 day range?
(2) Is an adjusted weight taken earlier than 160 days better than no record at all?
(3) How much off are the adjustments for weights taken under 160 days and over 250 days?
(4) Do we have enough data to study these problems?

It was concluded by the committee that the 90 day calving interval was important and should not be changed. The question of early weaning seemed to need more study. A motion was made for the chairman to appoint a study committee to meet later and make recommendations on how to handle weights taken outside the 160-250 day range.

The chairman appointed Larry Cundiff, Glenn Butts, and Gene Schroeder.

The committee briefly discussed the calculations of yearling weights and decided to leave this to the Central Test Station committee.

The efficiency of gain was taken up. This topic was divided into two phases: (1) efficiency of gain; and (2) cow efficiency. For the efficiency of gain, many noted the importance of an end point in studying this topic. Three were suggested: (1) time constant; (2) weight constant; and (3) condition constant. No agreement was reached. Many felt that Will Butts' suggestion that weight, height, and fat had merit. Other questions asked were: (1) Should all traits be evaluated at a composition constant? (2) Do we need a different constant for different breeds and sizes of cattle? At this point, the discussion led into the cow efficiency. Richard Benson was called on to give his idea on cow efficiency. This was a ratio of output over input:

$$\frac{O}{I} = \frac{\text{Calf Wt.}}{\text{Feed (cow + calf)}} = \frac{WW}{MW_{cow} + \frac{205}{365} \times MW_{calf}}$$

He suggested that cow efficiency could be added by:

$$= \frac{WW \times \%\ \text{Calf crop}}{MW_{cow} + \left[\frac{205}{365} \times MW_{calf}\right] \times \%\ \text{Calf crop}}$$

After much discussion and no conclusions, it was recommended that the chairman appoint a study committee.

Richard Benson, Chairman
C. A. Dinkel
Dale Davis

CARCASS EVALUATION COMMITTEE

Jim Wolf, Chairman

I. BIF BCDS Brochure

A. We recommend that the brochure be revised to emphasize the following:

1. Both the BCES and BCDS programs should be fully and carefully explained, especially the availability and simplicity of BCES.

2. Whenever possible, BCES should be used because data is obtained rapidly and efficiently. BCES can and should be used whenever the producer maintains ownership of his cattle or has an adequate agreement regarding obtaining carcass cata with the buyer of his cattle. Many producers have not been fully aware of the workings and advantages of BCES.

3. When BCES is not feasible, BCDS may be used. However, users of BCDS should be award of the following:

a. The average rate of return on BCDS tags has been about 60%.

b. There has been some price discrimination against feeder cattle carrying BCDS tags.

c. Time for return of BCDS data is unpredictable.

B. The above points should be incorporated into the BIF Guidelines whenever the next revision takes place.

II. Revision of Recommended Procedures for Beef Carcass Evaluation and Carcass Contests. We recommend that the carcass committee be charged to revise this brochure. The BIF Carcass Committee should work cooperatively with the Meat Quality Division of the Food Safety and Quality Service, and The American Meat Science Association. The BIF members should include producers, Extension and research workers from meats and breeding. Primary goals should include:

A. More uniform and simplified systems for presentation of carcass data. For example, the committee discussed, in some detail, a numerical scale that more accurately relates marbling and quality grade.

B. Development of a carcass show procedure that can and will be used for all major U. S. carcass shows. The success of the National Pork Producers Council in developing a similar program should be studied.

LIVE ANIMAL EVALUATION COMMITTEE

C. K. Allen, Chairman

The Live Animal Evaluation Committee met with some 40 participants and committee members in attendance. As set forth in previous correspondence, the committee addressed itself to specific questions raised by the BIF Board following the report of the Ad Hoc Linear Measurements Committee in 1977. Present were all members of the executive committee for Live Animal Evaluation.

First on the agenda was a review of previous board minutes relative to the 1977 committee. Next comments addressed to specific questions raised by C. K. Allen were reviewed. This included comments from C. J. Brown, Harlan Ritchie, Dave Pingrey, Burke Healey and John Massey.

John Massey then reviewed his work in the state of Missouri relative to the Missouri frame scoring system. Also included was a review of data from Arkansas.

There was a general feeling that linear measurements are being used by breeders to obtain supplemental information to an ongoing comprehensive performance testing program. There was no indication that any organization should set established standards of what's ideal. Instead, the role of linear measurements would help give a better description of animals along with weight. It is up to the breeder to set his goals for both height and weight.

After discussion, the committee moved to recommend that a subcommittee be set up to evaluate and implement adjustment factors for age of calf and age of dam to hip and shoulder height. In the interim, the University of Missouri adjustment factors would be used.

Further discussion followed regarding adjustment procedures for measuring backfat. The committee then moved to set up a method to evaluate procedures for measuring and adjusting fat for bulls and steers coming off postweaning feet test.

The committee adjourned at 4:00 p.m.

SEEDSTOCK COMMITTEE REPORT
May 22, 1978

Don Vaniman, Chairman, Richard Willham, Secretary

The newly structured seedstock committee met for the first time at 1:30 p.m. under the leadership of chairman Don Vaniman.

The agenda was circulated and discussion began. How to encourage breed association membership and participation in BIF was discussed. It was noted that the breeds having strong performance programs were involved, but that many breeds were simply not present. The point that today the breed association performance programs are more active than many BCIA programs was brought up. Then the discussion centered on problems of the BCIA operations. It was suggested that possibly a generalized record of performance computer program could be written and made available to member organizations for their use, which might encourage BCIA groups. Centralized computing was brought up, but no concrete action was taken. The real need for a BIF publication on the performance programs available to the beef industry was voiced. How to encourage programs in every breed association was considered and both the need to stimulate the commercial buyer to want performance information and the breeder to need to evaluate were discussed. How to encourage breeds to merge performance and pedigree information and all have a national sire evaluation program were discussed. The point was made that the associations with sound performance programs were either doing both or had plans to develop both. The committee recommended that a sub-committee revise the seedstock program guidelines in the BIF guidelines. Although crossbreeding by the commercial producer enhances the need for breeds, development of guidelines for systematic programs probably should come from another committee. The group thought good progress was being made by the performance breeds in developing their own adjustment factors. Discussion on a "Performance Show" was had, but no concrete ideas came forward. Significant steps were made in defining who should belong to the committee. Each breed should have its performance staff representative and possibly a director who was also on the performance committee in attendance. Liaison should be set up with the seedstock committee of NCA. Possibly with such breed representation, new ideas and innovative procedures could be shared in committee to the total benefit of the industry.

Future agenda subjects were discussed. These included ways to launch a promotion campaign of education both to the commercial producers and to the breeders. The concrete recommendations to the Board of Directors are as follows:

1. That a publication be prepared and published annually by BIF on the details of the performance programs available from member organizations.

2. That a sub-committee of this committee be asked to revise the breeding stock program guidelines in the BIF guidelines.

3. That the breed association staff member responsible for the performance program and a director which is on the performance committee of the breed for each breed association in BIF be assigned to this committee.

4. That the BIF directors seek ways to help the BCIA's serve the beef industry.

The meeting adjourned at 3:45 p.m.

CENTRAL TEST STATION REPORT

T. D. Rich, Chairman

Present were:

Keith Zoellner, Kansas
Allan Hunter, Virginia
Jack Delaney, Minnesota
David Notter, Virginia
John Wise, South Carolina
Jack Crowner, Kentucky
Brian Duck, Sask., Canada
Wayne Gillis, Ottawa, Canada
Richard Deese, Alabama
Ike Eller, Jr., Virginia
T. D. Rich, Oklahoma
John Master, Kentucky
Roy Wallace, Ohio
Ray Woodward, Montana
Ben Wamsley, Jr., W. Va.
James Bennett, Virginia
Brent Helovin, Louisiana
Terry Stewart, Indiana
John Gerken, Virginia
Hayden Brown, Jr., Arkansas
Kent Loving, Virginia
Floyd E. Dominy, Virginia

Data was presented and discussed on comparing various procedures for calculating an adjusted yearling weight at central test stations. Following a thorough discussion, it was unanimously agreed by vote to recommend to the BIF Board for approval the following formula:

$$\text{adj. yrl. wt.} = \frac{\text{final test wt. - actual birth wt.}}{\text{age in days}} \times 365 + \begin{array}{c}\text{actual}\\\text{birth}\\\text{weight}\end{array} + \begin{array}{l}\text{additive}\\\text{age of dam}\\\text{adjustment for}\\\text{weaning weight}\end{array}$$

The committee also recommends to the Board that they encourage ratioing growth traits within 60 day age spread and maximum of 90 age spread. This motion carried unanimously.

Let it also be shown that the committee discussed the possibility of a standard method of reporting feed efficiency. The conclusion was that sufficient data was not at hand to make a firm recommendation and that a study of this should be made during the coming year. The subject should be discussed more thoroughly at the next BIF meeting.

It was brought to the group attention that Appendix 3 (page 79) is possibly in error and should be corrected as needed.

A brief discussion was held on the obtaining and reporting of linear measurements. No action was taken by this committee.

The executive committee of the Central Test Station Committee will review the BIF guidelines for central tests and submit to the BIF Board for approval prior to next publication as requested by Dr. Dixon Hubbard.

COMMERCIAL HERD COMMITTEE

Mark Keffeler - Chairman

J. D. Mankin; Dr. T. J. Marlowe - Co-chairmen

The committee reviewed the objectives and purposes of BIF and how these objectives related to the commercial herd committee. We discussed in detail the programs affecting the commercial producer.

The present guidelines concerning the commercial producer was discussed and the consensus of the committee was that they need complete study and revision. The guidelines should address the entire commercial industry and not just the large commercial producer.

The committee then listed the following areas of concern and study for developing the program for the commercial producer:

1. Identification systems
2. Bull selection (interpreting records)
3. Fertility (bulls, cows in herd, and heifer replacements)
4. Breeding season (time and length)
5. Heifer selection and cow culling
6. Herd health (nutritional requirement for bulls, cows and calves - disease, parasite, insect control)
7. Measurements to be taken, recorded and used (simple ⟶ complex)
8. Recommendations for crossbreeding
9. Optional performance testing program (examples)

The following list is the sub-committee members:

LARGE COMMERCIAL HERD PROGRAM

Chairman - A. G. Lewis - Union, W VA
W. A. 'Zan" Stuart, Rosedale, VA
Al Smith - Dublin, VA

1) IDENTIFICATION SYSTEMS
Chuck Jarecki - Irvin Flats, Polson, MT
CH. - Mel Kirkeide - Ext. An. Sc., Fargo, ND

2) BULL SELECTION
CH. - Larry Benyshek - Athens, GA
Dick Smith - Columbus, OH
Rulon Osmond - Logan, UT

3) FERTILITY
CH. - F. L. Schwartz - Colby, KS
W. L. Singleton - Lafayette, IN
Jim Brinks - Ft. Collins, CO

4) BREEDING SEASON
CH. - Ray Arthaud - St. Paul, MN
Chuck Jarecki - Irvin Flats, Polson, MT
Jim Ross - Columbia, MO

5) HEIFER SELECTION & COW CULLING
CH. - M. K. 'Curly' Cook - Athens, GA
Paul Humes - Baton Rouge, LA
Rich Hickenbottom - Macon, GA

6) HERD HEALTH

7) MEASUREMENTS TO BE TAKEN, RECORDED & USED (simple → complex)
CH. - K. G. MacDonald - Lafayette, IN
Paul Humes - Baton Rouge, LA
Arnold Wyffes - Pillager, MN

8) CROSSBREEDING
CH. - Tom Marlowe - Blacksburg, VA
R. F. Vaughn, Jr. - Clemson Univ., SC
F. L. Schwartz - Colby, KS

9) OPT. PERFORMANCE TESTING PROGRAM EX.
CH. - Curtis Absher - Lexington, KY
Dean Haddock - Beloit, KS

NATIONAL SIRE EVALUATION COMMITTEE

May 23, 1978

Larry Cundiff, Ch.

The committee met at 7:00 a.m. Those present included: Richard Willham, Paul Miller, Richard Spader, Don Vaniman, and Larry Cundiff.

The first item of business discussed was the need to include a procedure for dealing with genetic trend in the guidelines for National Sire Evaluation. Consensus favored recommending a procedure based on grouping of sires based on age or by previous expected progeny difference. Dr. Willham will draft an appropriate statement for inclusion in the BIF Guidelines.

The next item was a discussion of the use of "effective progeny number" as an alternate to "possible change" as an indicator of error on estimate of expected progeny difference. The consensus was for no change in Guidelines regarding this matter.

Attendance - BIF Conference, 1978

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Jefferson D. Chadwell, Teaching, Equitation
Charles R. Cooper, Extension, Swine
Jackson S. Copenhaver, Research, Teaching - Sheep Also Farm Manager
Arthur L. Eller, Jr, Extension, Beef Cattle (BCIA) Project Leader
Joseph P. Fontenot, Research & Teaching, Ruminant & Management
James A. Gaines, Research & Teaching, Animal Breeding
H. John Gerken, Jr., Extension, Beef Cattle Nutrition & Management
George G. Green, Teaching & Extension, Undergraduate Advising & Coordinator
Jerry L. Hale, (Acting) Research, Supt. Southwest VA Station
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Ervin T. Kornegay, Research & Teaching - Swine Nutrition
Dennis W. Lamm, Teaching & Research, Nutrition & Management
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William H. Mc Clure, Research Supt. Shenandoah Valley Station
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Thomas N. Meacham, Teaching& Research - Reproductive Physiology
Gary L. Minish, Teaching - Beef Cattle and Judging Team Coach
David R. Notter, Research & Teaching - Animal Breeding & Management Systems
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Kenneth E. Webb, Jr., Research & Teaching, Ruminant Nutrition
K. C. Williamson, Extension, Livestock Marketing

BIF AWARD'S 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 Glaus	SD	1973
Sig Peterson	ND	1973
Max Kiner	WA	1973
Donald Schott	MT	1973
Stephen Garst	IA	1973
J. K. Sexton	CA	1973
Elmer Maddox	OK	1973
Marshall Mc Gregor	MO	1974
Lloyd Nygard	ND	1974
Dave Matti	MT	1974
Eldon Wiese	MN	1974
Lloyd De Bruycker	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
Milton Mallery	CA	1977
Jack Pierce	ID	1977
Mary & Stephen Garst	IA	1977

1978

Odd Osteroos	ND	1978
Charles M. Jarecki	MT	1978
Jimmy G. Mc Donnal	NC	1978
Victor Arnaud	MO	1978
Ron & Malcolm Mc Gregor	IA	1978
Otto Uhrig	NE	1978
Arnold Wyffels	MN	1978
Bert Hawkins	OR	1978
Mose Tucker	AL	1978
Dean Haddock	KS	1978

The Seedstock Breeder Honor Roll of Excellence

John Crowe	CA	1972
Dale H. Davis	MT	1972
Elliot Humphrey	AZ	1972
Jerry Moore	OH	1972
James D. Bennett	VA	1972
Harold A. Demorest	OH	1972
Marshall A. Mohler	IN	1972
Billy L. Easley	KY	1972
Messersmith Herefords	NE	1973
Robert Miller	MN	1973
James D. Hemmingsen	IA	1973
Clyde Barks	ND	1973
C. Scott Holden	MT	1973
William F. Borror	CA	1973
Raymond Meyer	SD	1973
Heathman Herefords	WA	1973
Albert West, III	TX	1973
Mrs. R. W. Jones, Jr.	GA	1973
Carlton Corbin	OK	1973
Wilfred Dugan	MO	1974
Bert Sackman	ND	1974
Dover Sindelar	MT	1974
Jorgensen Brothers	SD	1974
J. David Nichols	IA	1974
Bobby Lawrence	GA	1974
Marvin Bohmont	NE	1974
Charles Descheemaeker	MT	1974
Bert Crane	CA	1974
Burwell M. Bates	OK	1974
Maurice Mitchell	MN	1974
Robert Arbuthnot	KS	1975
Glenn Burrows	NM	1975
Louis Chesnut	WA	1975
George Chiga	OK	1975
Howard Collins	MO	1975
Jack Cooper	MT	1975
Joseph P. Dittmer	IA	1975
Dale Engler	KS	1975
Leslie J. Holden	MT	1975
Robert D. Keefer	MT	1975

Frank Kubik, Jr.	ND	1975
Licking Angus Ranch	NE	1975
Walter S. Markham	CA	1975
Gerhard Mitteness	KS	1976
Ancel Armstrong	KS ~~VA~~	1976
Jackie Davis	CA	1976
Sam Friend	MO	1976
Healy Brothers	OK	1976
Stand Lund	MT	1976
Jay Pearson	ID	1976
L. Dale Porter	IA	1976
Robert Sallstrom	MN	1976
M. D. Shepherd	ND	1976
Lowellyn Tewksbury	ND	1976
Harold Anderson	SD	1977
Wm. Borror	CA	1977
Rob Brown, Simmental	TX	1977
Glenn Burrows, PRI	NM	1977
Henry & Jeanette Chitty	FL	1977
Tom Dashiell, Hereford	WA	1977
Lloyd De Bruycker, Charolais	MT	1977
Wayne Eshelman	WA	1977
Hubert R. Freise	ND	1977
Floyd Hawkins	MO	1977
Marshall A. Mohler, Red Poll	IN	1977
Clair Parcel	KS	1977
Frank Ramackers, Jr.	NE	1977
Loren Schlipf	IL	1977
Tom & Mary Shaw	ID	1977
Bob Sitz	MT	1977
Bill Wolfe	OR	1977
James Volz	MN	1977

1978

A. L. Grau		1978
George Becker	ND	1978
Jack Delaney	MN	1978
L. C. Chestnut	WA	1978
James D. Bennett	VA	1978
Healey Brothers	OK	1978
Frank Harpster	MO	1978
Bill Womack, Jr.	AL	1978
Larry Berg	IA	1978
Buddy Cobb	MT	1978
Bill Wolfe	OR	1978

Continuing Service Awards

Clarence Burch	Oklohoma	1972
F. R. Carpenter	Colorado	1973
E. J. Warwick	ARS-USDA, WA, DC	1973
Robert de Baca	IA State University	1973
Frank H. Baker	OK State University	1974
D. D. Bennett	Oregon	1974
Richard Willham	IA State University	1974

Larry V. Cundiff	U.S. Meat Animal Research Center	1975
Dixon D. Hubbard	USDA-FES, WA, DC	1975
J. David Nichols	Iowa	1975
A. L. Eller, Jr.	VPI&SU	1976
Ray Meyer	South Dakota	1976
Don Vaniman	Montana	1977
Lloyd Schmitt	Montana	1977

1978

Martin Jorgensen	South Dakota	1978
James S. Brinks	CO State University	1978
Dr. Paul D. Miller	American Breeding Service - WI	1978

Commercial Producer of the Year

Chan Cooper	MT 1972
Pat Wilson	FL 1973
Lloyd Nygard	ND 1974
Gene Gates	KS 1975
Ron Baker	OR 1976
Steve & Mary Garst	IA 1977

1978

Mose Tucker	AL 1978

Breeders of the Year

John Crowe	CA 1972
Mrs. R. W. Jones	GA 1973
Carlton Corbin	OK 1974
Leslie J. Holden	MT 1975
Jack Cooper	MT 1975
Jorgensen Brothers	SD 1976
Glenn Burrows	NM 1977

1978

James D. Bennett	VA 1978

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

1978

The American Hereford Association (Breed)	1978
Beef Performance Committee OR Cattlemen's Association (BCIA)	1978

Pioneer Awards

Jay L. Lush	Iowa State University	Research	1973
John H. Knox	New Mexico State University	Research	1973
Ray Woodward	American Breeders Service	Research	1974
Fred Willson	Montana State University	Research	1974
Charles E. Bell, Jr.	USDA-FES	Education	1974
Reuben Albaugh	University of California	Education	1974
Paul Pattengale	Colorado State University	Education	1974
Glenn Butts	Performance Registry International	Service	1975
Keith Gregory	US Meat Animal Research Center	Research	1975
Bradford Knapp, Jr.	USDA	Research	1975
Forrest Bassford	Western Livestock Journal	Journalism	1976
Doyle Chambers	Louisiana State University	Research	1976
Mrs. Waldo Emerson Forbes	Wyoming Breeder	Breeder	1976
C. Curtiss Mast	Virginia BCIA	Education	1976
Dr. H. H. Stonaker	Colorado State University	Research	1976
Ralph Bogart	Oregon State University	Research	1977
Henry Holzman	South Dakota State University	Education	1977
Marvin Koger	University of Florida	Research	1977
John Lasley	University of Missouri	Research	1977
W. C. Mc Cormick	Tifton, Georgia - Test Station	Research	1977
Paul Orcutt	Montana Beef Performance Association	Education	1977
J. P. Smith	Performance Registry International	Education	1977

1978

James B. Lingle	Wye Plantation	Breeder	1978
R. Henry Mathiessen	Virginia Breeder- Still House Hollow	Breeder	1978
Bob Priode	VPI & SU	Research	1978

1978 COMMERCIAL PRODUCER OF THE YEAR

Mose Tucker of Lafayette, AL, received the Commercial Producer of the Year Award.

He has been working his family farm since he graduated from Auburn University in 1957. The farm has been in the family since the early 1840's.

In 1958, he purchased 25 commercial heifers as he began to convert what had been row crop land into improved pastures. The Tucker herd has been built to 600 mother cows primarily through replacement females raised within the herd itself.

Until the early 1970's Tucker maintained a complete set of records on every cow in his herd through family effort. In 1972, he enrolled his herd in the American Hereford Association's Total Performance Records program. Since then, weaning weights on more than 550 calves have been reported each year. Tucker routinely culls cows which fail to calve or fail to produce and the bottom 10 per cent of the mother cows each year. The decision to cull a cow is based on the weaning and yearling weight ratios for the calves she produced.

In 1970, Tucker began using artificial insemination in his herds. The first year he bred only 75 cows. In 1975, he cooperated as a test herd for the American Hereford Association's National Reference Sire Evaluation Program.

Tucker has been active within the local, state and national Cattlemen's Association and has served in several capacities for the local organization. He also has been an area coordinator for some 4-H beef shows and exhibits.

1978 SEEDSTOCK PRODUCER OF THE YEAR

James D. Bennett of Red House, VA, was named BIF Seedstock Breeder of the Year. He has been engaged in the operation of Knoll Crest Farm, which he and his wife own, since 1951. The operation is a 1,148-acre farm whose major enterprise is an outstanding herd of performance tested, registered Polled Hereford cattle numbering about 400. The Knoll Crest herd is considered by many to be the best in Virginia and the surrounding states. Knoll Crest Farm has produced the record yearling weight bull for British breeds in Virginia and the record selling bull at $12,000.

In addition, Bennett owns and operates the Red House Bull Evaluation Center which is an official Virginia Beef Cattle Improvement Association central bull test station. He has been an innovator in bull testing, bring silage based rations into use at Red House. He had the idea for minimum pricing bulls at Red House sales and provided the idea for the first registered female test and sale which was conducted at the Red House station this year.

An active leader in local and state soil and water conservation activities, Bennett has served as president of the Virginia Polled Hereford Association, and the Virginia Beef Cattle Improvement Association. He has been a vice president of the Beef Improvement Federation and a director of the Virginia Beef Cattle Association.

1978 CONTINUING SERVICE AWARDS

Martin Jorgensen, a livestock producer from Ideal, SD received the award in recognition of his outstanding service to the beef industry and to the federation.

Jorgensen has more than 30 years experience as a livestock producer and in general farming while sharing the management of a brother partnership. Performance-selected Angus and Charolais seed stock have been integral portions of the Jorgensen Brothers operation, with Martin in charge of the breeding and selection process.

He implemented performance selection in 1956 with progeny tested sires in use since 1963. Angus, Charolais and Simmental are the basic ingredients of his herd.

President of the Beef Improvement Federation, Jorgensen is a director of the South Dakota Beef Cattle Improvement Association and is a past director of the South Dakota Beef Council.

In 1976, Jorgensen received the Beef Improvement Federation's Seedstock Producer of the Year Award in 1976 and is deeply involved in the National Sire Evaluation Program.

Dr. James S. Brinks, professor of animal science at Colorado State University received the award in recognition of his outstanding service to the beef industry and to the federation.

Brinks served as an animal geneticist with the Agricultural Research Service and as an investigation leader for the Ft. Collins, CO, Western Regional Beef Cattle Breeding Project, before joining the facility at Colorado State in 1967.

A 1956 graduate of Michigan State University, he also holds an M.S. from Michigan State and a Ph.D. degree from Iowa State, receiving the latter in 1960. Brinks was named to a similar award by the Agricultural Research Service in 1965. The author of more than 150 publications on beef cattle breeding and genetics, he is a member of the American Society of Animal Science, Biometrics Society, the American Genetics Association, Sigma Xi, Gamma Sigma Delta, Alpha Zeta and Alpha Gamma Rho.

He has been active in the Beef Improvement Federation since it was founded, serving as a speaker at numerous meetings and active in the design of the National Sire Evaluation program. He also has served as a consultant to the American Hereford Association and the North American Limousin Foundation.

Dr. Paul D. Miller of De Forest, WI, director of breeding programs for the American Breeding Service, received the award in recognition of his outstanding service to the beef industry and to the federation.

Miller currently heads the overall development of the American Breeding Service's breeding programs, incorporating new genetic techniques and applications as they relate to development of beef and dairy sire development programs.

A graduate of Iowa State University, Miller received his M.S. and Ph.D. degrees at Cornell University, where he also served on the faculty.

The Direct Comparison Method, which now is used for dairy evaluation in the Northeastern United States, is a direct outgrowth of his thesis work for the doctorate.

Miller served on the livestock and dairy judging teams at Iowa State and was a member of Alpha Zeta honorary and Farmhouse fraternities. He also holds membership in the Biometric Society, American Society of Animal Science and the American Dairy Science Association. At Cornell, he became a member of Phi Kappi Phi.

Miller serves as an adjunct professor at the University of Wisconsin animal science department and is vice chairman of the dairy herd improvement relations committee of the National Association of Animal Breeders. He has been very active in Beef Improvement Federation activities, especially in the National Sire Evaluation Program.

1978 PIONEER AWARDS

R. Henry Mathiessen, Jr. of Hume, VA was one of the 1978 recipients of the BIF Pioneer Awards. He was eight years old when his father started the Still House and Cobbler Mountain Hereford herds. He obtained an engineering degree from Yale University and went to work for General Time Corp. In 1961, Mathiessen quit his job in New York to devote full time to the farm. At that time he was a company vice president.

Mathiessen has served the beef cattle industry in numerous capacities - - as a treasurer, vice president, president and director of the Virginia Hereford Association, as president of the American Hereford Association, as director of the American National Cattlemen's Association, as director of the State Fair of Virginia and as a member of the Secretary of Agriculture's Cattle Industry Advisory Committee.

In addition to evaluating cattle for growth, progeny of bulls used in the Still House Hollow Farm herd have for many years been evaluated for carcass desirability through the Hereford association's Feedlot and Carcass Evaluation Program. Mathiessen was a major contributor to the formation of the Beef Improvement Federation and has served as vice president of the group and was a member of the original board of directors.

James B. Lingle of Queenstown, MD received the BIF "Pioneer in Performance" award. A native of Pennsylvania, retired in 1971 after serving for 33 years as manager of the Wye Plantation at Queenstown. Prior to that time he had managed farms in Pennsylvania, Delaware and Maryland.

Lingle is a 1917 graduate of Susquehanna University Academy and completed a two-year agricultural course at Pennsylvania State University in 1919. In 1958, he received a certificate of merit in agriculture from the University of Maryland. The visitors center at Wye Plantation has been named in his honor.

Lingle is the author of numerous publications on cattle breeding and production testing. He is a member of the American Angus Association, and the National Association of Animal Breeders. He is a director of the Performance International Association and a past director of the Eastern Shore of Maryland Angus Association.

Bob M. Priode received the BIF Pioneer Award at the 1978 BIF Conference at Virginia Tech.

Bob Priode was born in 1912 on a small farm in Dickenson County, southwest Virginia. He was among the last of thirteen children. He graduated from VPI with a B.S. in Animal Husbandry in 1936. Bob worked his way through school, was an end on the football team and was undefeated in collegiate wrestling. In November 1936 he began a long and distinguished career in livestock agriculture. Serving first as soil fertility specialist for TVA in Tazewell County, he became county agent in 1938, entered the U.S. Air Force in World War II, and returned as county agent to Tazewell until September 1948.

Priode's Master's thesis under the late Dr. Charlie Kincaid, concerned "Differences in Performance of Potential Herd Sires". In July 1949 he became the first farm manager for the Beef Cattle Research Station at Front Royal. In 1952 he was appointed Station Superintendent. At Front Royal, Priode and Kincaid initiated a long-term breeding experiment comparing two mating systems; inbreeding and mass-selection, in Angus, Hereford and Shorthorn cattle. Priode's background in livestock production and farm management were keys to the success in the Front Royal performance testing work and the overall research program. He directed its growth in animal numbers from about 150 cattle in 1950 to over 1200 in the late 1950's, supervised a farm operation and station maintenance crew and directed the farm operation. He is the author or co-author of at least 18 journal articles or station bulletins and 34 abstracts dealing with research at the Front Royal Station.