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PROCEEDINGS

BEEF IMPROVEMENT FEDERATION

RESEARCH SYMPOSIUM & ANNUAL MEETING

B I F

MAY 7 - 9, 1986

HYATT REGENCY LEXINGTON

LEXINGTON, KENTUCKY

BEEF IMPROVEMENT FEDERATION

ANNUAL CONVENTION

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PROGRAM

WEDNESDAY, MAY 7

2:30 p.m. - BIF Board of Directors Meeting - Wyandotte Room.

5:30 p.m. - Board Dinner - Wyandotte Room

4:00 -
7:00 p.m. - **REGISTRATION** - Lobby Booth

7:30 p.m. - Symposium - **MALE FERTILITY** - Regency Ballroom
Presiding - Roy A. Wallace
"Semen Production" - Richard Saacke - Virginia Tech
"Physical Attributes" - James Brinks - Colorado State University
"Libido & Serving Capacity" - Don Lunstra - US MARC
"Application in a Commercial Herd" - Norman Parrish - King Ranch, Kingsville, Texas

THURSDAY, MAY 8

Breakfast on your own - Hyatt Regency Glass Garden & Roots

7:00 -
9:00 a.m. - **REGISTRATION** - Conference Center Registration Booth (Open all day).

8:00 -
11:45 a.m. - Symposium - **SUPPLYING SPECIFICATION SEEDSTOCK TO THE COMMERCIAL PRODUCER** - Patterson A&B - Presiding - Richard Willham
"The Commercial Producer's Needs for Specification Seedstock" - Tom Price, Interwest Ranch & Farm Mgt. Inc., Pendleton, OR
"Sire Evaluation-Where We've Come From" -Larry Benyshek, University of Georgia
"Sire Summary Data-What's New & Why" - John Pollak, Cornell University

10:00 a.m. - **COFFEE BREAK** - Compliments of AI organizations
"Sire Summary Data - Unscrambling the Confusion" - Roy A. Wallace, Select Sires, Inc.
"The Challenge of Producing & Selling Specification Seedstock"
Breed Association View - Greg Martin, NALF
Breeder View - J. David Nichols, Nichols Farm

12:15 p.m. - **LUNCHEON** - Patterson C&D
Henry Gardiner, President, Presiding
Welcome to Kentucky
Seedstock & Commercial Nominee Introductions - Rick Whitman & Wayne Vanderwert
Charge to Committees - Henry Gardiner & Dixon Hubbard

1:45 -
5:00 p.m. - **BIF COMMITTEE MEETINGS** - Attend the meeting(s) of your choice.
°**SIRE EVALUATION & REPRODUCTION** - Patterson A - Larry Cundiff & Roy Wallace, Chairmen
°**LIVE ANIMAL EVALUATION** - Patterson B - John Crouch, Chairman
°**SYSTEMS** - Patterson C - Jim Gibb, Chairman
°**CENTRAL TEST** - Regency Center - Roger McCraw, Chairman
°**UTILIZATION** - Regency East - Al Smith & Steve Wolfe, Chairmen

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

5:00 p.m. - **CAUCASS FOR ELECTION OF DIRECTORS** - Patterson A&B - Henry Gardiner in charge.

PROGRAM

6:00 p.m. - **SOCIAL HOUR** - Patterson A

7:00 p.m. - **AWARDS BANQUET** - Patterson B,C&D
Presiding - Steve Radakovich, Earlham, IA.
Awards: Roy Wallace, Chairman, Awards Committee
Entertainment - Tour of Kentucky in slides
Address: Henry Gardiner

FRIDAY, MAY 9

6:00 a.m. - BIF Board of Directors Meeting - Wyandotte

7:00 a.m. - **BREAKFAST** - Patterson C & D
Presiding: Bob Vickery, Pres. KBCA
Speaker:
"What Can Be & Is Being Done" - A. L. (Ike) Eller, Jr., BIF Executive Director

9:00 -
11:30 a.m. - Symposium - **WHAT IMPACTS ON BREEDING AND RAISING BEEF FOR PROFIT?** - Patterson A&B
Presiding: Frank Baker, Winrock
"Shifting Preferences Based on Consumer Attitudes" - Bobby D. VanStavern, Ohio State University.
"Future Marketing Practices To Move Beef and Other Red Meats" - James Darazsdi, Rocco, Inc., Harrisonburg, VA
"The Effect of Future Demand on Production Programs - Biological vs. Product Antagonism" - Larry V. Cundiff, US MARC

12:00 Noon - Board buses to BBQ Lunch & Tour

12:20 p.m. - **BEEF BARBECUE LUNCH** - U. K. Coldstream Farm - Sponsored by Kentucky Beef Cattle Association.

1:00 -
10:00 p.m. - **KENTUCKY TOUR** - ($25/person - covers everything including dinner). Buses leave at 1:00 p.m. and will return to the Hyatt Regency before going to the Red Mile Track.
-Tour University of Kentucky, Coldstream and Spindletop Farms.
-Visit Kentucky Horse Park
-Dinner and racing at Red Mile Harness Track

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LADIES PROGRAM

THURSDAY, MAY 8

7:30 a.m. - **Board buses to Paris.** Visit Duncan Tavern. Brunch and tour of antiques, shopping, and visit to Claibourne Farm.

11:30 a.m. - Return to Hyatt - afternoon on your own.

FRIDAY, MAY 9

9:00 - 11:30 a.m. - Program in Neville-Hathaway Room. Demonstrations and discussions on: **"The Lighter Side of Beef"; "Beef Nutri-Facts"; and "Microwave Beef"**

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PROCEEDINGS OF BEEF IMPROVEMENT FEDERATION
1986 ANNUAL CONVENTION

Table of Contents

COMMITTEE REPORTS

TECHNICAL NOTES

SEMEN PRODUCTION BY THE BULL AND FERTILITY

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The purpose of this discussion is to relate semen production by the bull to fertility independent from libido or physical traits. However, these latter traits, important to intromission and serving capacity scores, are in turn important considerations in maximizing herd fertility along with semen production. The bull possesses a complex system to accomplish the production and delivery of sperm to the female and proper function of the system's components is essential to maximizing fertility. In a simplistic way we might define the system as being composed of: 1) sperm factory (testis), 2) sperm maturation and storage area (epididymis); 3) sperm alteration glands (accessory sex glands - seminal vesicles, prostate, cowpers glands), and 4) seminal delivery (urethra and penis). The proper function of the system (including behavior) is quite highly dependent upon the endocrine (hormonal) system, in particular, the hormones of the hypothalamus, anterior pituitary and testes. From the reproductive physiologists standpoint, the only function of the animal's entire body is to maintain and haul the reproductive system (only kidding).

Our discussion should begin with semen, its characteristics, and the semen requirements of the female for maximum fertility. A working hypothesis is that "maximum fertility of the cow bred artificially or naturally is dependent upon the quantity and quality of semen deposited." This relationship is shown in Figure 1. Salisbury and Van Demark proposed this asymptotic model in 1961. It contends that maximum fertility for a given population of females is attained by increasing to a given level (threshold) the numbers of sperm having certain qualitative characteristics. Further increases in sperm having this/these characteristics would not improve fertility. Thus there is a quantitative as well as qualitative requirement of the female for sperm if maximum conception is to be expected.

Semen Quality

Traits of semen quality have been classified as 1) viability related or 2) morphological. Viability measures of semen quality have been based upon such characteristics as those outlined in Table 1. Viability tests of semen quality can therefore be defined as those tests quantifying the life processes of spermatozoa. Viability measures of bull semen known to have the asymptotic effect on fertility shown in Figure 1 include motility, acrosomal integrity, sperm membrane integrity and filterability through Sephadex (Pace et al., 1981). There are undoubtedly more viability traits in Table 1 which would also fit the female requirements depicted in Figure 1 but simply have not been studied in this manner. The most important aspect of this concept is that once threshold numbers of viable sperm are delivered to the cow, further increases in percent viability of semen will not improve fertility.

Presented at the 1986 BEEF IMPROVEMENT FEDERATION ANNUAL CONVENTION, Lexington, KY, May 7, 1986.

Table 1. General basis for viability measurements of semen

Motility
Velocity
Penetration of cervical mucus
Metabolic activity
Cell content of
DNA
Enzymes
Lipids
Structural integrity of
Cell membrane
Acrosome
Ability to agglutinate in presence of blood serum (head to head)
Ability to pass through sephadex-glass wool filter

Our present understanding is that viability of semen is important for sperm to be retained and transported within the female reproductive tract as well as to penetrate the ovum (egg). Following natural mating or artificial breeding, the numbers of sperm deposited decline rapidly with relatively few actually reaching the ampullary-isthmus junction of the oviduct where fertilization occurs. However, several studies have shown that, though small in number, the population of sperm reaching the ovum at fertilization are nearly 100% viable indicating that the female reproductive system poses barriers over which only

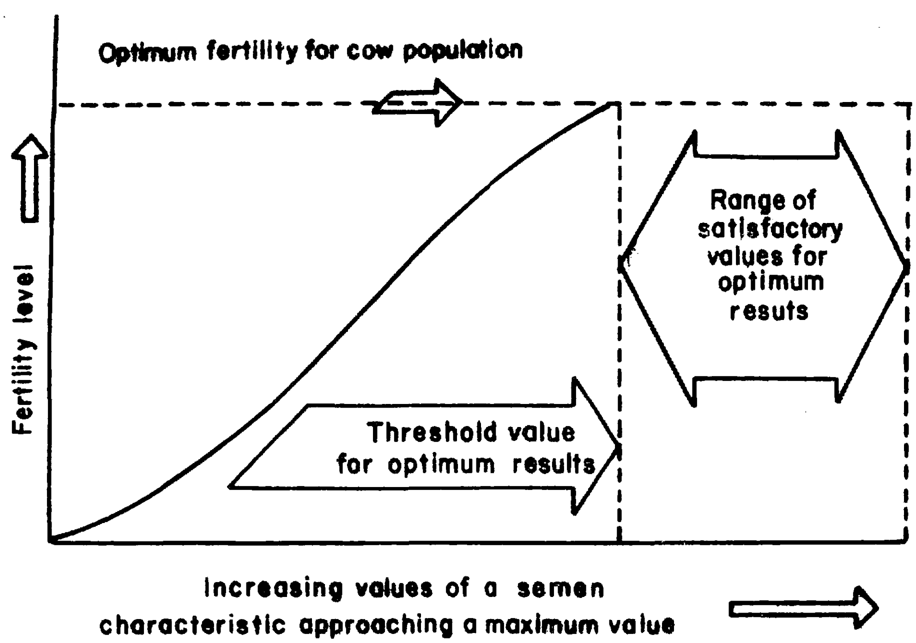

Figure 1. A positive response in fertility accompanies increasing numbers of quality sperm in the dose or ejaculate of semen until the threshold for optimum fertility of the cow population is reached. (Salisbury and Van Demark, 1978)

viable sperm may pass (reviewed by Saacke, 1982). Thus, threshold numbers of viable sperm delivered would ensure maintenance of this population over the fertile life of the ovum.

The second major component of semen quality is the morphology of spermatozoa. Aberrations in sperm morphology have been classified into major and minor defects by Blom (1972) based upon documented impact of the defect on fertility at that time (Table 2). For purposes of quantifying defects in semen, Saacke and White (1972) suggested the use of primary, secondary, and tertiary for anomalies related to the sperm head, occurrence of protoplasmic droplet on the tail (immature sprem) and tail deformities, respectively. In general, deformities of the head and occurrence of protoplasmic droplets are of greater concern than tail deformities unless numbers of abnormal tails were excessive, which would interfere with the motility of sufficient sperm that attainment of adequate numbers of sperm at the site of fertilization would be depressed (discussed under semen viability). On the contrary, the presence of primary abnormalities in semen, and perhaps the secondaries, can result in subfertility despite the numbers of sperm delivered. These abnormalities signify a disturbance or pathology associated with sperm production or sperm maturation in the bull and may represent incompetent sperm capable of reaching the site of fertilization and competing with normal sperm for the ovum. Some specific sperm abnormalities are also congenital and/or heritable as opposed to being transient in nature. It is particularly important to guard against use of bulls capable of passing such genes on to future generations.

Table 2. Types of abnormal sperm[a]

Major Defects	Minor Defects
Underdeveloped	Narrow head
Double forms	Small normal head
Knobbed sperm defect	Giant and short, broad heads
Decapitated sperm	Free heads (normal)
"Diadem" defect	Detached acrosomal cap
Abnormal shaped head	Abaxial implantation of tail
Pyriform (pear shaped)	Distal droplet
Narrow base of head	Simple bent or coiled tail
Abnormal contour	Terminally coiled tail
Small abnormal shape	
Free abnormal heads	
Corkscrew defect	
Other middle piece defects	
Proximal droplets	
Strongly folded or coiled tail	

[a]As classified by Blom (1972)

Relationship of Semen Quality and Fertility

Most relationships of semen quality and fertility have been based on artificial insemination (AI). AI differs from natural service in that far fewer sperm are required since the major barrier to sperm is bypassed, namely, the cow's cervix. Also, AI bulls would be expected to vary less in semen quality and fertility than would a population of unselected beef bulls being presented for initial semen evaluation. Another major difference is that numbers of sperm per dose of semen would be more controlled in AI; however, inseminator expertise is a variable that can affect delivery of sufficient sperm numbers at the appropriate site and time. Nevertheless, AI and natural service do not differ regarding the concept depicted in Figure 1 except for the magnitude of sperm numbers considered "threshold," i.e., considerably fewer sperm numbers are required in AI because the cervical barrier is bypassed. With these differences in mind, correlations of semen quality with fertility can be discussed.

Many studies correlating semen quality and fertility have been conducted with correlations ranging from very good to zero. The reasons for this variation in results resides in a number of problems among experiments which include low repeatability of certain tests, poor ability to measure fertility accurately, and inadequate variation in fertility or semen quality among bulls. For correlations to be interpreted, the importance of knowing the variation in fertility over which such relationships were obtained is also critical. Linford et al. (1976) illustrated the importance of this concern by comparing correlations of semen quality tests and fertility for two populations of bulls (Table 3). The correlation of the tests with fertility were improved by using a population of males with lower average fertility and a greater variance. Variation in fertility and semen quality traits is greater among males than it is from ejaculate-to-ejaculate within males (Saacke and White, 1972). A

Table 3. Relationship between nonreturn percentages and evaluation tests for bovine semen comparing two populations of bulls[a]

Test	Correlation coefficients (r value)	
	Exp. I[b]	Exp. II[c]
Progressive motility (%)	.22	.77**
Vigor of motility (0 to 5)	.08	.64**
Vital stain (neat semen)	.33	.67**
Abnormal sperm (%)	-.21	-.64**

[a]Modified from Linford et al. (1976).

[b]Five bulls having a mean ± SE 112-d NR = 62.8 ± 7%.

[c]24 bulls having a mean ± SE 112-d NR = 57.9 ± 10.7%.

**$P<.01$.

comparison of correlations obtained for ejaculate characteristics and fertility with variance due to males present and removed is shown in Table 4. Clearly, for this sample of bulls, variance was associated with bulls and the lack of good correlation within bulls did not render the test useless. There simply was not sufficient variance within bulls to judge the relationship. Both experiments (Tables 3 and 4), address points important to the selection of breeding bulls. First, semen quality is important to fertility. Based on Linford's experiment, a less select population of bulls shows a greater relationship of semen quality and fertility because of the greater variance. Finally, the major difference in both semen quality and fertility is due to bulls, not different ejaculates of the same bull. Thus bulls, not ejaculates, must be culled. Exceptions to this latter point would be changes within a male due to health or environmental conditions.

Table 4. Correlation of semen quality traits and fertility (90-day non-return for 158 ejaculates from 16 different bulls (all ejaculates) compared with correlations with variance due to bull removed (Ejaculates within bulls)

	r values	
Semen trait	All ejaculates	Within bulls
% motility (estimate)	.42**	.10
% intact acrosomes	.60**	.22*
% abnormal heads (primary)	-.34**	.03
% protoplasmic droplets (secondary)	-.37**	.01
% abnormal tails (tertiary)	-.06	.03

Saacke and White (1972).
*P<.05.
**P<.01.

Semen Quantity

Quantitative aspects of semen production cannot be considered a stranger to livestock producers. Measuring scrotal circumference of the paired testes of growing and mature bulls is becoming a prerequisite to screening bulls for reproductive soundness. Scrotal circumference of normally shaped testes correlates well with paired testicular weight which, in turn, is highly related to sperm production in the healthy testis. Although variable among breeds, within breeds the growth of the testes is quite well related to growth of the animal (Figure 2).

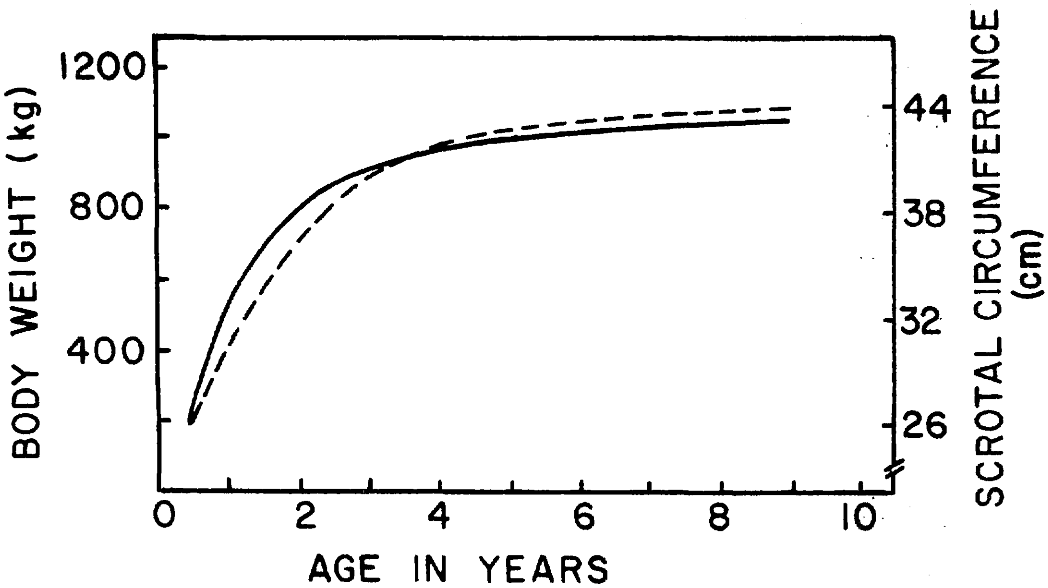

Figure 2. Growth of Holstein bulls in relation to scrotal circumference Calo et al (1973) and Coulter et al (1975) as adapted by Amann (1976).

Sperm production by the mature bull averages 6-8 billion sperm/day (70,000 sperm/sec); however, based on testis size (weight), young bulls would produce appreciably less as shown for Holstein bulls which do not reach full sperm production until they are 2-3 years of age (Table 5). Rate of maturation regarding full semen production also differs among breeds. Shown in Figure 3 is a comparison of Charolais, Holstein, Angus, and Hereford with regard to rate of maturation based on sperm production per week.

Table 5. Development of sperm production in Holstein bulls

Age	No. bulls	Gross weight paired testes (g)	Daily sperm production	
			10^6/bull	10^6/g testis
0-4 mo	25	20	0	0
5-7 mo	15	97	104	1
8-10 mo	20	284	1750	7
11-12 mo	15	370	3300	10
17 yr	13	480	4480	10
3 yr	10	586	6040	11
4-5 yr	11	647	6530	11
> 7 yr	11	806	8000	11

Almquist and Amann, 1961, 1976.

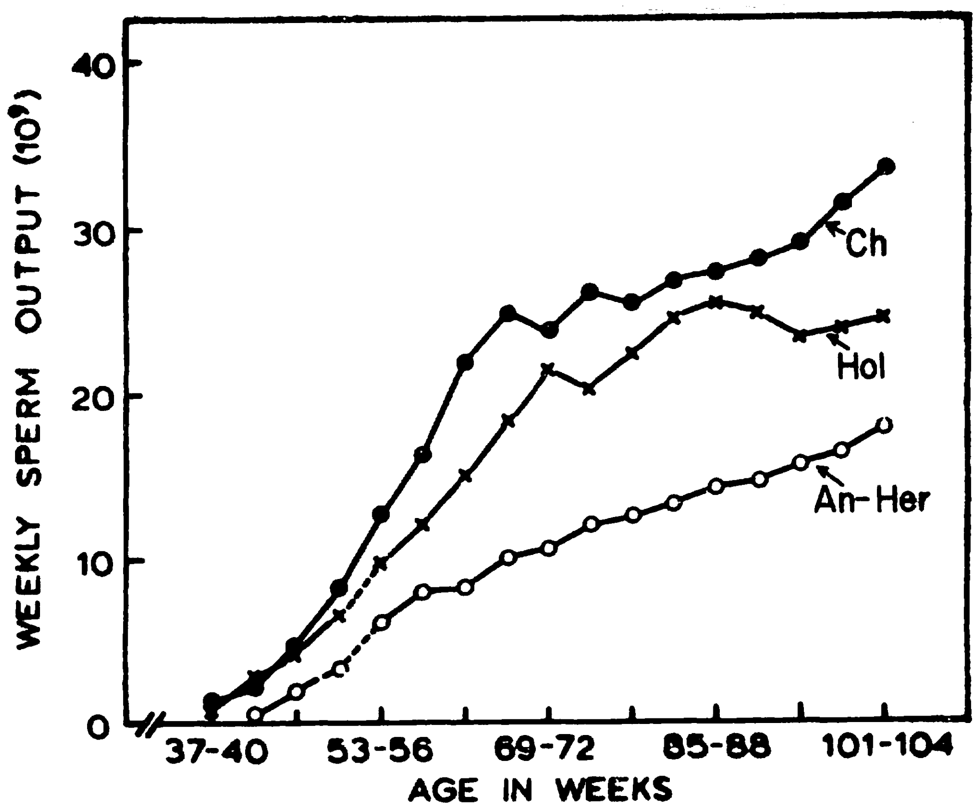

Figure 3. Postpubertal development of sperm production in Charolais (CH), Holstein (HOL), Angus and Hereford (An-Her) based on weekly sperm output when ejaculated 6 x weekly. From Amann (1976).

The average sperm content of a single ejaculate for a mature bull is approximately 6-7 billion sperm, almost identical to the daily sperm production cited earlier. Thus, one ejaculate or mating per day would utilize a bull's normal production. However, there are times when several cows are in heat per day and often a cow is serviced more than one time. The effect of successive ejaculation on sperm numbers per ejaculate is presented in Figure 4. This data shows the depletion of the male's extragonadal sperm reserves. Fortunately, the epididymis, composed of a long torturous tube more than 650 feet

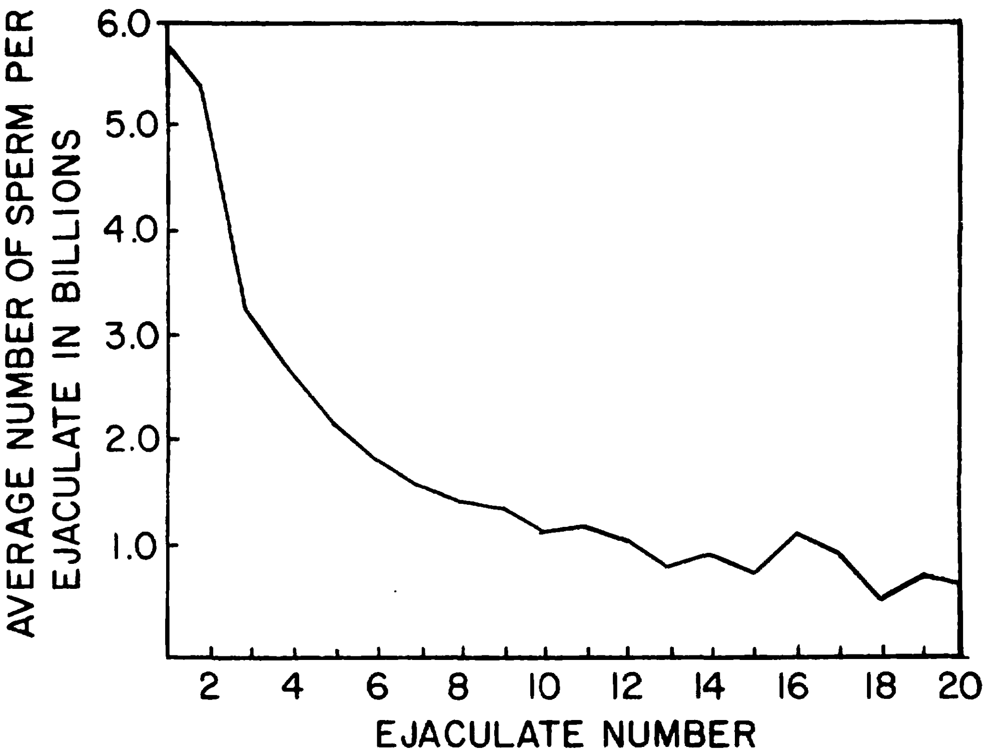

Figure 4. Sperm numbers per ejaculate (mature Holstein bulls) during successive ejaculation into an artificial vagina. From Almquist and Hale, 1956.

long residing next to the testis, provides a place for sperm to not only mature but also be stored. The initial segment of the epididymal duct in the head of the epididymis (which receives the effluent from the testis) along with the middle segment (in the body of the epididymis) are involved in alteration of the epididymal fluid along with maturation of the sperm passing through. The terminal segment (in the tail of the epididymis) is the major cite of storage for sperm available for ejaculation. The tail of the epididymis and the vas deferens which conveys the sperm to the urethra can store nearly a week's production of semen (Figure 5). Successive ejaculations result in declining numbers of sperm per ejaculate as depletion of these extra-gonadal storage reserves occurs (Figures 4 and 5). However, it is also clear from Figure 5 that only mature fertile sperm from the epididymal tail and vas are ejaculated. Immature, less fertile sperm from the epididymal head and body are not available for ejaculation even under a high mating frequency.

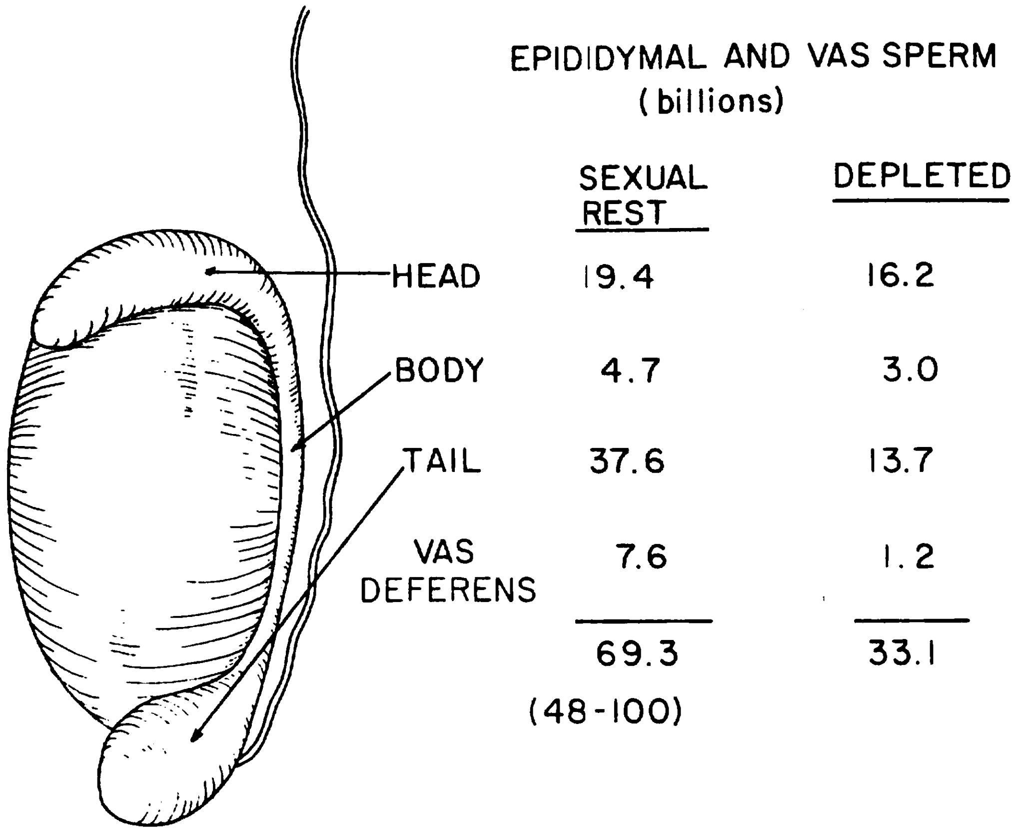

Figure 5. Comparison of sperm reserves in the epididymis of sexually rested and depleted Holstein bulls (following 20 successive ejaculations). Modified from Almquist and Amann, 1961.

Under pasture mating conditions, it is not clear how many sperm are required to meet threshold numbers for maximum conception in cattle, i.e., what should be considered the upper limit of matings per unit time? For sheep, Fulkerson et al., (1982) demonstrated that rams could be depleted sufficiently to ejaculate insufficient numbers of sperm resulting in depressed conception. In their study, the threshold number of sperm required for normal conception was near 60 million. For cattle, we might expect young bulls to definitely be more limiting than older bulls in providing sufficient sperm under a high mating frequency. As shown in Table 6, young bulls not only have less daily sperm production, they also have not reached the sperm storage capacity of the older males, suggesting that the rate of sperm decrease per ejaculate would be sharper than that shown for mature bulls in Figure 4. The same could be stated for bulls having the heritable conditions of unilateral cryptorchidism or gonadal hypoplasia. In both cases, semen quality and fertility could be quite normal until mating frequency is increased to a point where insufficient numbers of sperm are ejaculated. This, of course, would be sooner than that expected for normal bulls.

Table 6. Age associated differences in daily sperm production, epididymal sperm reserves and the time required for sperm to pass through the epididymis of Holstein bulls

	Young bulls (15-17 mo)	Mature bulls (2-12 yr)
Daily sperm production (10^9)	3.1	7.2
Caput-corpus reserves (10^9)	11.2	24.2
Cauda reserves (10^9)	7.6	37.6
Transit in caput-corpus (days)	3.6	3.4
Transit in cauda (days)	2.4	5.2

Amann, 1976

Lastly, season or stress can also affect sperm production. Summer heat or winter months, depending upon breeds and individual bulls within breeds, can result in depressed sperm production and lower semen quality. This, in turn, translates into a lower mating capacity to meet threshold requirements.

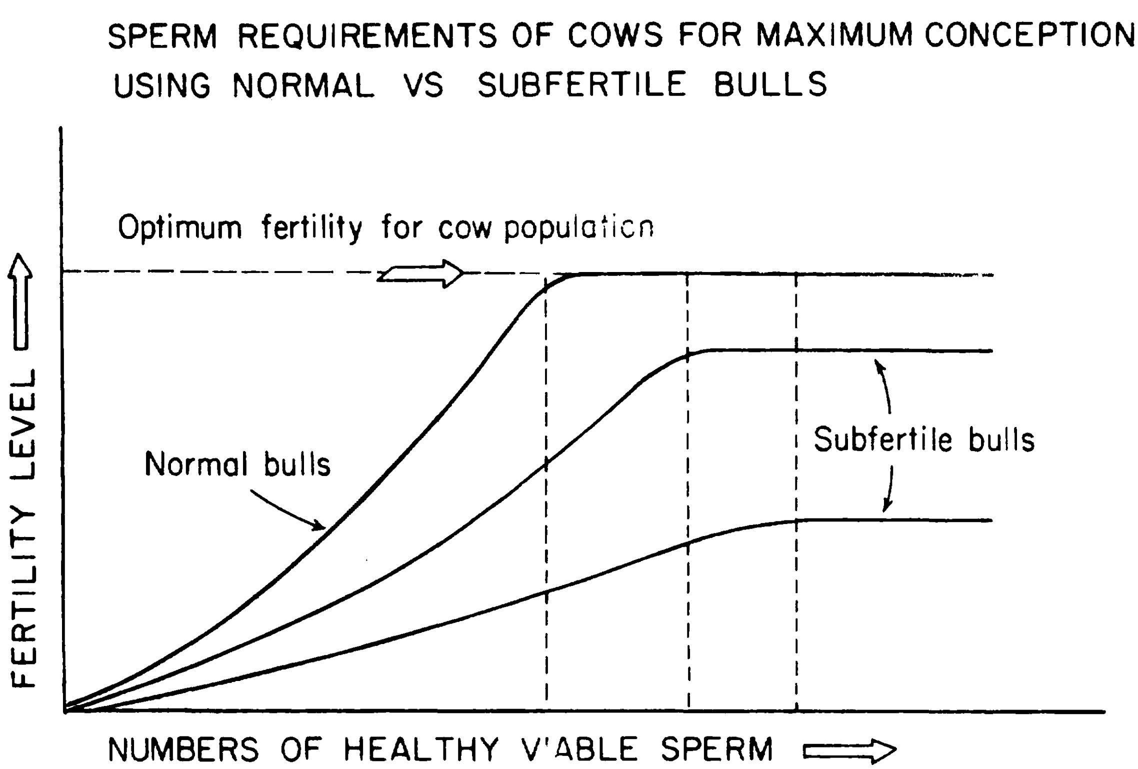

Figure 6. A comparison of the requirements for healthy sperm for maximum fertility from normal and subfertile bulls.

Conclusions:

Our ability to clearly identify the bulls capable of maximum fertility under a wide variety of breeding conditions is still sufficiently complex to evade simplistic recommendations based on rigid values. However, we do recognize the importance of qualitative and quantitative semen traits to conception as well as certain factors affecting these traits such as: 1) age of bull, 2) breed of bull, 3) health of bull, 4) environment (temperature, season, unknown), 5) genetics, and 6) duration since last ejaculate.

Based on this knowledge, we can say that: 1) normal bulls giving semen of normal quality can be a source of subfertility where mating frequency, season, health conditions, or combinations of such factors, results in subthreshold numbers of viable sperm delivered to the female. Subfertile bulls providing semen of abnormal morphology reflect errors in sperm production (spermatogenesis) and/or maturation. Such bulls generally require more sperm to meet thresholds; however, they still cannot reach levels of fertility equal to normal males despite sperm numbers deposited. It is quite possible that insufficient sperm are reaching the ovum egg or that those reaching the site of fertilization are simply incompetent. Figure 6 illustrates a concept of these two general problems. The subfertile bull should be avoided and the normal bull must be managed within the limits of his ability to ensure that cows will not be bred with subthreshold levels of healthy sperm.

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MALE FERTILITY - PHYSICAL ATTRIBUTES

J. S. Brinks

Colorado State University

There are many physical attributes that may affect male fertility in cattle. Many of these physical characteristics are checked when conducting the Breeding Soundness Examination (BSE) on bulls. The BSE, developed by members of the Society for Theriogenology, has gained much wider acceptance by veterinarians, reproductive physiologists and cattlemen over the past few years. The BSE is an important tool for improving reproduction efficiency in cattle. In addition to those attributes covered by the BSE, mating ability must be observed on bulls at work to ascertain if the bull can successfully mount and service a large number of times over an extended time period. This can partially be accomplished by a mating ability or serving capacity test.

These physical attributes can be divided into the following general categories, with some overlap between I and IV.

I. General Physical Attributes.
II. External Genital Organs.
III. Internal Genital Organs.
IV. Mating Ability.

I. General Physical Attributes.

Weight and Condition. Bulls should be in good breeding shape but not overly fat at joining. Height or general size may also be important when using yearling bulls on very large cows.

Locomotion. Rear leg structure and sound feet are important for mobility in traveling long distances and for successfully mounting a large number of times. Some of the more common defects of the locomotor system are shown in table 1.

Table 1. Defects of the Locomotor System[1]

Defect	No. affected	% affected
Hoof trim needed	336	3.1
Interdigital Fibroma (corns)	92	.8
Nonspecific lameness	61	.6
Foot rot	38	.3
Arthritis	35	.3
Luxations (stifle)	17	.2

[1] Modified from Carroll et al., 1963 (10,940 exams).

Hoof growth has been shown to be highly heritable and arthritis is more prevalent in certain lines of cattle.

Eye Lesions. Vision is probably not a big problem in breeding efficiency; however, a bull must be able to see to perform adequately and bothersome eyes or vision may affect a bull's attitude. Some of the more common eye problems are listed in table 2.

Table 2. Lesions of the Eye[1]

Lesion	No. affected	% affected
Papilloma	209	1.9
Carcinoma	84	.8
Keratitis	74	.7
Conjunctivitis (pinkeye)	38	.3
Corneal ulceration	16	.1

[1] From Carroll et al., 1963 (10,940 exams).

Of the 10,940 bulls examined, 6,836 were Hereford. Cancer eye has been shown to be about 30% heritable in populations of Hereford cattle.

Teeth. Again, teeth are probably not a big problem in reproductive efficiency. However, a bull must have enough teeth and be able to chew properly or he will lose weight rapidly during the breeding season.

II. External Genital Organs.

An examination of the external genital organs which includes the penis, prepuce, testes and epididymides, is performed during a BSE.

Penis. The penis should be examined for indications of injury or disease. There are several deviations or other abnormal configurations of the penis, some of which can be caused by electroejaculation. Therefore, many of these defects must be evaluated by observing natural mating. Some bulls are unable to completely erect their penis which results in ventral deviation of the penis when they attempt to copulate. Lateral deviation of the penis usually results in failure to copulate successfully. Bulls having a corkscrew penis will not intromit. The Australians have reported that the incidence of corkscrew penis is much higher in the polled breeds of cattle.

Virgin bulls should be examined for normal development of the penis and freedom from prepuberal adhesions such as persistent penile frenulum. Shorthorn, Angus and Santa Gertrudis cattle have a higher incidence of persistent penile frenulum than other breeds.

Prepuce. Palpation of the prepuce allows for determination of the presence of adhesions. Bulls of Bos Indicus breeding often have a loose, pendulous prepuce which predisposes to traumatic lesions. Eversion of the prepuce is found to some degree in all bulls carrying the polled gene and in Bos Indicus breeds. Bulls with a high degree of eversion are more subject to lacerations, frostbite, etc. Some of the defects of the penis and prepuce are listed in table 3.

Table 3. Defects of the Penis and Prepuce[1]

Defect	No. affected	% affected
Deviation	190	1.7
Neoplasms	100	.9
Persistent penile frenulum	57	.5
Lacerations	26	.2
Urethral fistula	19	.2

[1] From Carroll et al., 1963 (10,940 exams).

Testes. Testes size, shape, form and consistency should be evaluated during the BSE. Testes size, as measured by scrotal circumference, is an important component in determining the total BSE score. Scrotal circumference is about 50% heritable and is a good measure of age at puberty in bulls themselves and in their female offspring. It is favorably related to both sperm quantity and quality, especially in young bulls. It is a good tool for improving reproductive efficiency in cattle.

Shape of testes does not appear to affect semen production. Elongated, rounded, rotated or testes with distinct cleavage are usually fertile.

Testes held close to the body wall and sometimes tilted posteriorly are usually small. Varying degrees of testicular hypoplasia or degeneration are frequently encountered and lower sperm production and an increase in sperm abnormalities usually occurs.

The cryptorchid condition occurs in bulls but more often one testis is only partially descended into the scrotum. The affected testis can usually be palpated in the inguinal canal and can be verified by rectal palpation. Bulls with abnormalities of the testes should not be used since many of these defects appear to be heritable.

Epididymides. The epididymis consists of the head, body and tail and attention should be given to their size, form and consistency. Hypoplasia, inflammations, tumors, abscesses and spermatic granulomas may occur. Affected bulls should be rejected for breeding purposes. Some of the defects of the testes and epididymides are shown in table 4.

Table 4. Defects of the Testes and Epididymis[1]

Defect	No. affected	% affected
Testes		
Reduced size, hypoplasia	960	8.8
Soft	806	7.4
Abnormal shape	104	1.0
Fibrosis	47	.4
Cryptorchid	14	.1
Epididymis		
Tumors, abscesses, granulomas	52	.5
Epididymitis	40	.4
Segmental aplasia or hypoplasia	20	.2

[1] Modified from Carroll et al., 1963 (10,940 exams).

III. Internal Genital Organs.

Internal genital organs are evaluated by rectal palpation. They include the vesicular glands, ampullae, prostrate and internal inguinal rings. The vesicular glands are lobulated paired organs that lie in the pelvis. Vesiculitis is a pathological condition encountered in the bull and is diagnosed by palpation of changes in vesicular gland size, shape and consistency. An increased number of white blood cells in the semen occurs with vesiculitis. Aplasia or hypoplasia of vesicular glands is seen occasionally.

The ampullae lie between the vesicular glands. Ampullitis usually occurs in conjunction with inflammation of other reproductive organs. Pelvic inflammation generated by vesiculitis can also affect the prostrate gland. The internal inguinal rings contain the spermatic cords. Herniation of the viscera into the rings can occur and can be determined by palpation. Some of the defects of the internal genital organs are listed in table 5.

Table 5. Defects of Internal Genital Organs[1]

Defect	No. affected	% affected
Enlarged vesicular glands	338	4.6
Vesiculitis	181	2.5
Scrotal hernia	17	.2
Enlarged inguinal rings	11	.2

[1] Modified from Carroll et al., 1963 (10,940 exams).

In addition to internal genital organs, pelvic measures such as pelvic height, width and area could be taken by rectal examination. Pelvic area is highly heritable (50%) and it appears that significant progress could be accomplished through selection which should result in decreased calving difficulty.

Some additional information on the occurrence of physical defects of the reproductive organs is presented in table 6. These data were obtained on bulls located at the San Juan Basin Research Center, Hesperus, CO.

IV. Mating Ability.

Physical defects that cannot be seen through examination could be observed in conjunction with a serving capacity test under natural mating conditions. These would include deviations of the penis or the corkscrew condition. Also, arthritis, lameness or other structural defects could be observed for possible effects on reproductive efficiency.

Summary

The use of the Breeding Soundness Exam which includes both the physical exam and semen evaluation should be encouraged. This should be combined with a serving capacity test to pick up additional physical defects as well as libido or willingness to serve whenever possible. In addition, pelvic measures on bulls should be included as part of the BSE.

More detailed information on items discussed herein along with a list of related literature is contained in the "Manual for Breeding Soundness Examination of Bulls" published by the Society for Theriogenology.

Table 6. DISTRIBUTION OF ABNORMALITIES OF THE REPRODUCTIVE ORGANS BY LINE

	No. ob.	Cryptorchid	Hypoplasia	Testicles abnormally shaped	Segmental aplasia of epididymis	Enlargement of epididymis	Enlargement of seminal vesicles	Seminal vesiculitis	Prepuberal adhesions	Penile neoplasma	Persistent penile frenulum
Bonanza	8 (13)[a]					1	(2)		1		
Brae Arden	35 (84)	(1)	5 (3)			1 (2)	5 (1)	6 (2)		(1)	
Colorado	15 (16)		1	1	1			1 (1)			
Don	23 (24)		11 (2)	1		3 (2)	3	(1)		1 (2)	2
Monarch	27 (32)		3 (3)			2 (2)	2 (1)				
Prospector	38 (64)	(1)	2	(1)		2 (2)	2 (4)	1 (1)	1	1 (2)	
Royal	27 (67)		2 (5)	2	2 (2)	(3)	2 (1)	(1)	(1)	(1)	(1)
San Juan	30 (56)		2 (2)			1 (8)	(2)	1 (3)			2
Tarrington	47 (44)		3 (1)	1		(2)	(3)	1 (2)	1 (1)		
Real Prince	15 (28)		3 (4)			1	(2)	(1)		(1)	1
Total	265(428)	0(2)	32 (20)	5 (1)	3 (2)	11 (21)	16 (16)	10 (12)	3 (2)	2 (7)	5 (1)
Percent		0(.5)	12.1(4.7)	1.9(.2)	1.1(.5)	4.2(4.9)	6.0(3.7)	3.8(2.8)	1.1(.5)	.8(1.6)	1.9(.2)

[a] Value by line of the sire for the linecross population are listed in parentheses.

LIBIDO AND SERVING CAPACITY OF BEEF BULLS[1]

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INTRODUCTION

In the United States, artificial insemination is widely used in dairy cattle, but natural mating programs account for greater than 95% of the pregnancies achieved each year in the beef cattle industry. However, current procedures for selecting herd sires to be used in natural mating of beef cattle are based on factors other than reproductive potential, reflecting the lack of reliable reproductive selection criteria for predicting herd bull fertility. It is well known that great variation in the natural mating fertility of herd sires occurs, even among bulls exhibiting similar acceptable semen quality. It is hypothesized that much of this variation in fertility is due to differences in the sexual aggressiveness (libido) and copulatory proficiency (serving capacity) of herd sires. The following report summarizes results of studies on bull sexual behavior and discusses the interrelationships between sexual behavior and bull testicular development, semen quality, endocrinology, and fertility.

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[1]Presented at Symposium on Male Fertility, Beef Improvement Federation Annual Convention, Lexington, Kentucky (May 7-9, 1986).

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VARIATIONS IN HERD BULL FERTILITY

Among beef bulls used for single-sire natural mating, large ranges in pregnancy rates have been reported. Smith et. al. (1981) reported a range of 0 to 85% pregnancy rate per estrous female among 40 two-year-old Santa Gertrudis bulls in Texas, and Wiltbank et. al. (1965) reported a range of 0 to 100% pregnancy rate per female exposed among 232 mature Hereford, Angus, and Shorthorn bulls in Nebraska. The bulls in these studies exhibited a wide range in semen quality, but only low correlations between fertility (pregnancy rate) and semen characteristics (motility, abnormal sperm, live sperm, etc.) were found.

In a study conducted at Clay Center (Lunstra and Laster, 1982), twelve mature Angus bulls that were similar in scrotal circumference (38 ± 1 cm, range 37 to 39 cm), % motile sperm (73 ± 4%, range 65 to 77%), % live sperm (74 ± 2%, range 71 to 76%) and % abnormal sperm (18 ± 2%, range 14 to 22%) were hand-mated to estrous heifers withing 6 hr of onset of estrus. Pregnancy rate averaged 62.4 ± 4.7%, but a wide range in pregnancy rate of individual sires was obtained (0 to 95%, Table 1). Relatively low correlations between sire fertility and semen characteristics (r=-.43 to .48) and scrotal circumference (r=.39; Lunstra and Laster, 1982) were found.

TABLE 1. RANGE IN PREGNANCY RATE AMONG BULLS USED FOR SINGLE-SIRE MATINGS[a]

Bull[b]	Rank	No. of heifers mated/bull	Pregnancy rate[c] (%)
H	1	20	95 ± 5[d]
A	2	20	80 ± 12[d,e]
L	3	17	74 ± 7[d,e]
J	4	21	73 ± 4[e]
B	5	19	68 ± 11[d,e]
I	6	20	64 ± 7[e]
D	7	18	63 ± 7[e]
E	8	21	62 ± 6[e]
C	9	21	62 ± 7[e]
K	10	19	61 ± 11[e]
F	11	19	12 ± 6[f]
G	12	14	0 ± 0[f]

[a]From Lunstra and Laster (1982) Theriogenology 18:373-382.

[b]Twelve mature Angus bulls, 3 to 5 years old, were used. Bulls did not differ in scrotal circumference, semen quality and BSE scores.

[c]Mean ± SE of single-service and multiple-service pregnancy rates combined for each bull.

[d,e,f]Values without a common superscript within a column differ (P<.01).

Fertility of yearling beef bulls (15-16 mo. of age) also varied widely during pasture breeding trials at Clay Center (5.9 to 94.1% pregnancy rate; Table 2). Although some relationship between scrotal circumference and fertility appeared to exist, the overall correlation was only .35 (Table 2), which was significant but explained less than 12 percent of the variation observed in fertility. Again, only low correlations between semen quality and fertility were found (r=-.31 to .23).

TABLE 2. RELATIONSHIP BETWEEN TESTIS SIZE AND FERTILITY OF YOUNG BEEF BULLS[a]

Classification	No. of bulls	Yearling scrotal circumference (cm)[b]	Pregnancy rate per heifer exposed (%)[c]
Scrotal circumference:			
Less than 28 cm	3	27.6 ± .2[d]	54.6 ± 1.3[d]
28 to 32 cm	13	31.2 ± .3[e]	63.6 ± 6.6[d]
Greater than 32 cm	31	34.7 ± .3[f]	81.8 ± 1.4[e]
All bulls	47	33.2 ± .4	75.0 ± 2.5
Range (for 47 bulls)	--	27.4 to 38.9 cm	5.9 to 94.1%
Correlation (Circumference _vs_ pregnancy rate)			r=.35 (P<.03)

[a]Data (Mean ± SE) from GPU project.

[b]Scrotal circumference was measured at 12 to 13 mo of age and adjusted to 365 days of age.

[c]Bulls were fertility tested at 15 to 16 mo of age by exposure of each bull to 15-20 heifers for 45 days (single-sire natural mating). Pregnancy rate based on palpation at 50 days postbreeding.

[d,e,f]Values without a common superscript within a column differ (P<.01).

These results emphasize the inadequacy of methods currently used for evaluating reproductive potential and selecting herd sires to be used for natural mating. A better understanding of factors that contribute to reproductive potential and fertility of beef bulls must be developed before effective selection of herd sires for improved reproductive capacity can be practiced.

EVALUATION OF SEXUAL BEHAVIOR IN BEEF BULLS

Sex drive (libido) and copulatory proficiency (serving capacity) in beef bulls are essential for the impregnation of females in natural-mating programs. Several methods for testing sexual behavior in beef bulls had been reported prior to 1980 (Hultnas, 1959; Blockey, 1976; Lunstra et. al., 1978, 1979; Chenoweth et. al., 1979). The serving capacity test proposed initially by Blockey (1976) required a long observation period (7.5 hr) and large numbers of estrous heifers, but serving capacity scores were highly correlated with total number of heifers served (r=.98) and were related to first estrous pregnancy rate (Blockey, 1978). Short-term tests of libido (5 to 10 min/bull) were performed more easily, but only low correlations to pregnancy rate were reported (r=.09, Chenoweth, 1978; r=.32, Sullins et. al., 1979).

Studies conducted at Clay Center have concentrated on assessing sexual behavior in yearling beef bulls (13-16 months of age), since evaluation of bulls at a young age is essential for the effective selection of herd sires with high reproductive potential. Initial studies (Lunstra et. al., 1978, 1979; Lunstra, 1980, 1981) demonstrated that young beef bulls exhibited sexual behavior more readily when tested in groups of three or five than when bulls were tested individually (Table 3). The percentage of bulls mounting and percentage of bulls achieving at least one service/test increased dramatically when three or five bulls were tested together, compared to activity of the same bulls when tested individually. Results when three bulls were tested together did not differ (P>.10) from those obtained when five bulls were tested together (Table 3). Number of behavioral events exhibited per bull were also affected by male:female ratio (Table 4). Number of disoriented mounts/bull decreased (P<.01), and number of oriented mounts and number of services/bull increased (P<.01) when bulls were tested in groups, compared to bulls tested individually.

A variety of test systems have been used at Clay Center for evaluating sexual behavior in young beef bulls, including pasture observations and evaluation in various-sized pens with and without restraint of females. Summarized results of these behavioral tests indicate that most yearling beef bulls with no previous mating experience: 1) must undergo a "learning process" and/or "acclimation" to the test environment before exhibiting sexual behavior readily; 2) require at least two tests before sexual behavior stabilizes and becomes highly repeatable; 3) require a uniform interval (minimum 3 days) of sexual rest prior to each test; 4) require restrained females during tests; 5) require females in estrus; 6) exhibit increased sexual activity during tests if allowed to observe other bulls mating immediately before being tested (i.e. prestimulation); 7) exhibit increased sexual activity if tested in the presence of other sexually-active bulls; 8) require a bull:female ratio (restrained females) of approximately 1:1 for optimal sexual activity during tests of short duration (i.e., bulls show an undesirable increase in social aggressiveness and infighting whenever the number of bulls/test exceeds the number of restrained females/test by more than one bull); 9) exhibit reduced sexual activity when tested on hot, humid days (ambient temperatures > 85°F); 10) should be of similar age and bodyweight, and all bulls to be tested should have been penned together for at least one week prior to testing.

TABLE 3. EFFECT OF MALE-TO-FEMALE RATIO ON SEXUAL BEHAVIOR OF YEARLING BEEF BULLS[a]

	Type of libido test (male-to-female ratio)		
Activity	1:1[b]	3:4	5:4
% bulls mating[c]	48 ± 6***	72 ± 5	70 ± 4
% bulls mounting[c]	78 ± 4**	89 ± 3	91 ± 3
Reaction time (min)[cd]	9.0 ± 1.1*	7.0 ± .8	6.3 ± .8

[a]Fifty-four yearling bulls were evaluated twice in each test type.

[b]Activity differs from that observed for 3:4 and 5:4 ratio (*P<.10, **P<.05, ***P<.01).

[c]Average activity observed per test (Mean ± SE).

[d]Data given only for bulls achieving at least one service.

TABLE 4. EFFECT OF MALE-TO-FEMALE RATIO ON SEXUAL BEHAVIOR OF YEARLING BEEF BULLS[a]

	Type of libido test (male-to-female ratio)		
Activity	1:1[b]	3:4	5:4
No. of minor events[c]	12.5 ± .7**	9.2 ± .7	6.0 ± .7
No. of disoriented mounts[c]	3.1 ± .2**	1.7 ± .2	1.8 ± .2
No. of oriented mounts[c]	8.0 ± .3**	12.5 ± .3	11.8 ± .3
No. of services[c]	.6 ± .1**	1.3 ± .1	1.3 ± .1

[a]Fifty-four yearling bulls were evaluated twice in each test type.

[b]Values differ from those observed for 3:4 and 5:4 ratio (**P<.01).

[c]Values are number of events/bull/test (least squares mean ± SE).

Subsequent studies at Clay Center have used the behavioral testing area depicted in Figure 1. Bulls are tested in groups of 3-to-5 bulls with four ovariectomized, estrous-induced heifers restrained in headgates. Each group of bulls is allowed to observe other bulls mating during a 30-min pre-test stimulation period immediately before being tested. A test duration of 30 min is used, bulls are subjected to at least three consecutive tests conducted with uniform intervals between tests (minimum 3 days between tests), and the bulls are classified according to the average number of mounts and services achieved in their best tests (i.e. the two or three tests with highest activity). Repeated tests are recommended because yearling beef bulls with no previous mating experience undergo a "learning" process and/or "acclimation" to the test environment during consecutive tests (Figure 2). Sexual behavior of young bulls stabilizes and becomes highly repeatable (r=.59 to .98) after two consecutive tests (Lunstra, 1980; Blockey, 1981). The test duration of 30 min is longer than the 5 to 20 min recommended by others (Chenoweth, 1981; Blockey, 1981), but longer exposures are required before young inexperienced bulls display repeatable sexual behavior in tests (Lunstra, 1980; Blockey, 1981). Each ovariectomized heifer is used for approximately 120 min per test date and is replaced upon exhibiting nonreceptivity as evidenced by lateral escape efforts during mounting (i.e., testing of 60 bulls requires 12 to 15 estrous-induced heifers). Heifers are selected to be compatible in size to the bulls tested and usually are 2 to 6 mo older than the bulls tested.

All events of sexual behavior (minor events, disoriented mounts, oriented mounts, and services) are recorded for each bull during each 30-min test. An open-ended scoring system is used, based on the average number of behavioral events each bull achieves in the repeated tests. Yearling bulls are classified into one of four categories of sexual aggressiveness (libido), based primarily on the average number of services achieved per test: 1) Inadequate Libido, 0.0 services/test and 0 to 3 mounts/test; 2) Low Libido, 0.1 to 1.0 services/test; 3) Medium Libido, >1.0 to 2.0 services/test; 4) High Libido, >2.0 services/test.

RELATIONSHIP BETWEEN BULL SEXUAL BEHAVIOR AND NATURAL-MATING FERTILITY

In an initial study to evaluate the relationship between sexual behavior and fertility in beef bulls (Lunstra, 1980), 50 Hereford bulls were evaluated at 14 months of age and classified into the four categories of sexual aggressiveness (inadequate, low, medium, and high libido). Twelve bulls (four bulls each from the low, medium, and high libido categories) that did not differ in body weight, scrotal circumference, and semen quality were selected for fertility testing. Each of the twelve bulls was single-sire exposed to 50 naturally-cycling heifers per bull for 20 days and estrous and mating data recorded. Pregnancy rate (fertility) was determined by rectal palpation of the 600 heifers at 50 days postbreeding. The pregnancy rate achieved by low libido bulls (32.6%) was markedly lower (P<.01) than that achieved by medium and high libido bulls (49.7 to 50.8%; Table 5). Low libido bulls mated significantly fewer heifers in estrus (70.6%) than did medium and high libido bulls (87.2 to 95.3%), and the correlation between number of services/libido test and fertility achieved per bull was r=.67 (P<.01; Lunstra, 1980).

FIGURE 1. DRAWING OF AREA USED FOR TESTING OF BULL SEXUAL BEHAVIOR

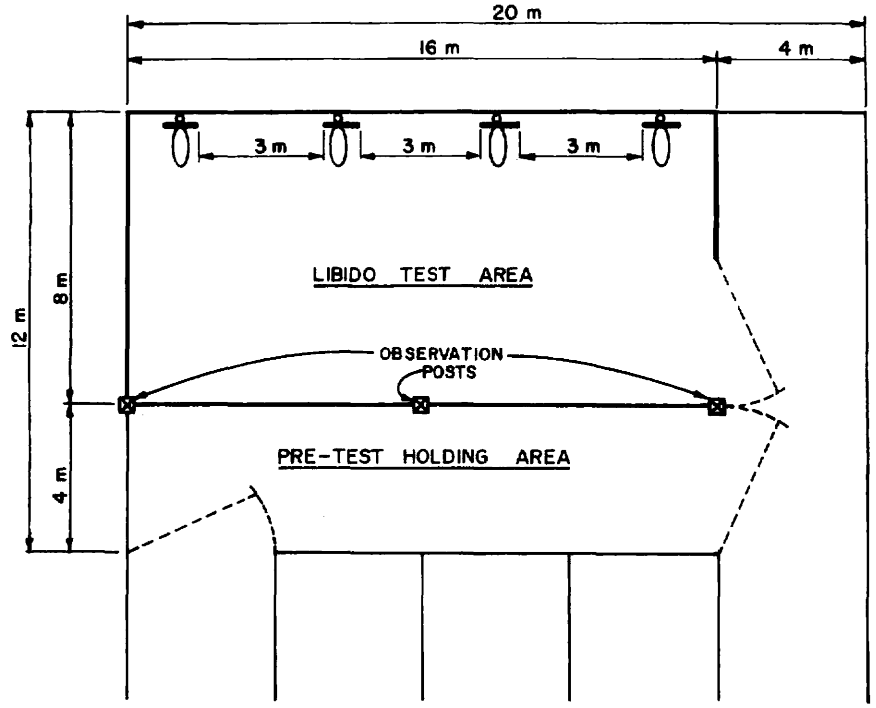

FIGURE 2. MOUNTING AND MATING ACTIVITY OF 45 YEARLING BULLS SUBJECTED TO SIX 30-MINUTE TESTS OF SEXUAL BEHAVIOR

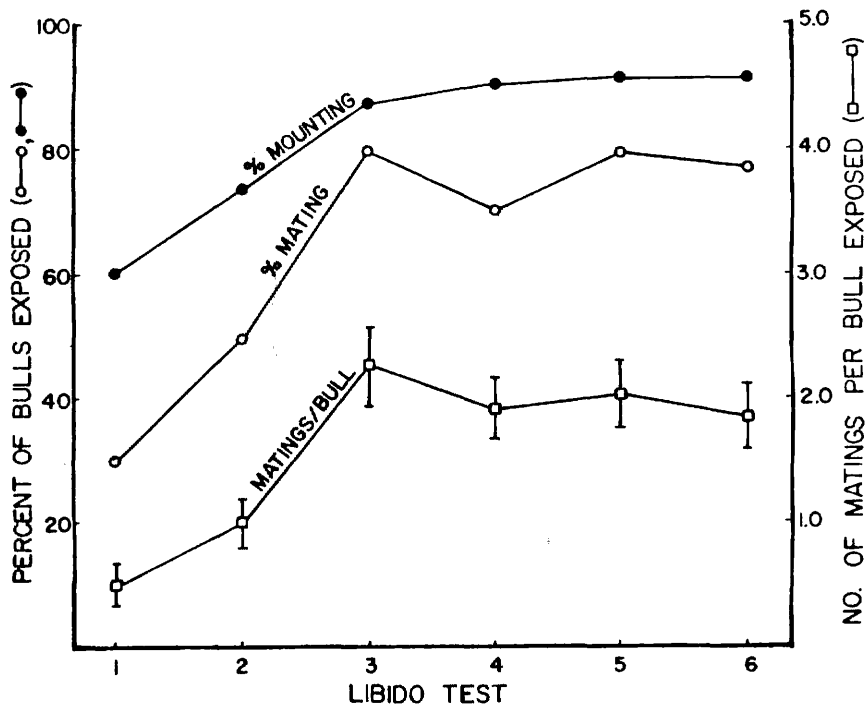

TABLE 5. ESTROUS, MATING AND PREGNANCY DATA FOR YEARLING BEEF BULLS NATURALLY-MATED TO 50 CYCLIC HEIFERS/BULL[a]

Bull libido category	No. of heifers exposed	Exhibiting estrus(%)[b]	Mated (%)[c]	Pregnancy rate (%) of heifers: Exposed	Exhibiting estrus
High (n=4)	198	90.4[d]	87.2[d]	46.0[d]	50.8[d]
Medium (n=4)	200	95.5[d]	95.3[d]	47.5[d]	49.7[d]
Low (n=4)	202	92.6[d]	70.6[e]	30.2[e]	32.6[e]

[a]Single-sire exposure for 20 days (50 heifers/bull). Percentage values without a common superscript within a colummn differ (P<.01).

[b]Based on number of heifers exposed.

[c]Based on number of heifers marked of those exhibiting estrus.

TABLE 6. COMBINED ESTROUS, MATING AND PREGNANCY DATA FOR YEARLING BEEF BULLS NATURALLY MATED TO 50 HEIFERS/BULL (TWO EXPERIMENTS)

Bull libido group[a]	Heifers in estrus/bull[b]	Estrous heifers mated/bull[b]	Pregnancy rate (%) per heifer[b]: Exposed	In estrus	Mated
High and medium (n=12)	46 (94 ± 2%)	42 (91 ± 2%)	48 ± 4%	51 ± 3%	56 ± 3%
Low libido (n=8)[c]	46 (94 ± 2%)	33 (73 ± 5%)**	23 ± 6%**	24 ± 6%**	31 ± 8%*

[a]Libido was assessed during six 30-min tests. Bulls did not differ in age, semen quality or testis size.

[b]Each bull was exposed to approximately 50 heifers for 20 days (single-sire matings; n=980 heifers). Estrous and marking data were collected twice daily (a.m. and p.m.) throughout the 20-day breeding period. Pregnancy was determined by palpation at 50 days postbreeding. Percentage values in parentheses are mean ± SE/bull.

[c]Percentage values with asterisks are lower than values obtained for medium and high libido bulls (*P<.05, **P<.01).

The experiment described above was repeated again the following year. Fifty-one yearling Hereford bulls were evaluated and classified. Eight bulls (4 low and 4 high libido) that did not differ in body weight, scrotal circumference, and semen quality were selected and fertility tested. Only low and high libido bulls were fertility tested, since the fertility of medium and high libido bulls had not differed in the first experiment. Again, the low libido bulls mated significantly fewer (76.5%) of the heifers in estrous than did the high libido bulls (90.2%), and the low libido bulls achieved a markedly lower pregnancy rate (16.2%; P<.01) per heifer in estrus than did the high libido bulls (53.8%). The data combined for the two experiments are shown in Table 6. Percentage of estrous heifers mated (73 ± 5%) and percentage pregnant per heifer exposed (23 ± 6%), per heifer in estrus (24 ± 6%), and per heifer mated (31 ± 8%) were all significantly lower for low libido bulls than for medium and high libido bulls (48 to 56%; Table 6). The decreased pregnancy rate for low libido bulls was related, at least in part, to their decreased desire and ability to detect and mate heifers in estrus. During the twice daily observations of estrous activity, it was noted that low libido bulls exhibited less sexual activity than other bulls throughout the 20-day breeding period, and low libido bulls tended to exhibit sexual interest toward only one estrous heifer while neglecting other heifers in estrus. However, the decreased pregnancy rate achieved by low libido bulls is not explained entirely by the reduction in number of heifers mated, since the fertility of low libido bulls was significantly lower per heifer mated (31%, Table 6) than was the fertility of medium and high libido bulls (56%). The decreased pregnancy rate per heifer mated may be attributable to the reduced number of services per heifer mated by low serving capacity bulls (Blockey, 1976; Farin, 1980) or the inherently lower fertility per service in low libido bulls when hand-mated (Lunstra, 1980).

The correlations between the level of sexual activity, expressed as average number of services achieved per test by these 20 bulls, and the natural-mating fertility achieved by these bulls were highly significant (r=.72 to .74; Table 7). Strong correlations between serving capacity and natural-mating fertility also have been reported by others (Blockey, 1976; Smith et al., 1981). Regardless of the cause of the reduced fertility for low libido bulls, the high correlation between libido test activity and fertility indicate that assessment of sexual behavior in yearling beef bulls may become a very useful tool for the selection of young herd sires for improved fertility.

RELATIONSHIP BETWEEN BULL SEXUAL BEHAVIOR AND OTHER REPRODUCTIVE CHARACTERISTICS

In the combined fertility studies with the 20 low, medium, and high libido bulls, neither scrotal circumference nor body weight was related significantly to bull fertility (Table 7), nor were they related to level of sexual behavior exhibited by the bulls. Correlations between characteristics of sexual behavior and body weight, scrotal circumference, and semen quality of 54 yearling beef bulls from another study are shown in Table 8. None of the behavioral events were related (P>.10) to any aspect of semen quality, nor was behavior related to scrotal circumference or body weight (Lunstra, 1981). However, semen quality was related significantly to scrotal circumference (Table 8). A strong relationship between semen quality and scrotal circumference of young beef bulls has been reported in other studies (Coulter and Foote, 1979; Smith et al., 1981; Lunstra and Echternkamp, 1982).

TABLE 7. CORRELATIONS FOR BULL LIBIDO-FERTILITY STUDIES[a]

Fertility characteristic[b]	No. of events/bull per 30 min libido test[c]		Bull scrotal circumference[d]	Bull body weight[d]
	Mounts	Services		
% Pregnant/heifer exposed	-.26	.72**	.25	.25
% Pregnant/estrous heifer	-.25	.74**	.26	.19
% Pregnant/heifer mated	-.27	.72**	.22	.15

[a]Calculated for the 20 bulls (8 high, 4 medium, and 8 low libido bulls) used in fertility trials (**P<.01).

[b]For fertility trials, each bull was exposed to 50 cyclic heifers for 20 days (single-sire breeding). Pregnancy was determined by palpation at 50 days postbreeding.

[c]Six 30-min libido tests were conducted at 4-day intervals during 21-day period, beginning 5 wk prior to fertility trials. Bulls averaged 14 mo of age at beginning of libido tests and 15 mo of age at beginning of fertility trials.

[d]Measured 2 wk before beginning of 20-day breeding period.

TABLE 8. SIMPLE CORRELATIONS BETWEEN SEXUAL BEHAVIOR AND BODY WEIGHT, SCROTAL CIRCUMFERENCE, AND SEMEN QUALITY OF 54 YEARLING BEEF BULLS[a]

Factor	Body weight	Scrotal circumference	Semen quality			
			Conc.	% Motility	% Live	% Abnormal
Body weight	--	.50**	.17	.21	-.07	-.12
Scrotal circumference	.50**	--	.49**	.47**	.33*	-.44**
Sexual behavior:						
No. of minor events[b]	.11	.08	.11	.15	.10	-.10
No. of disoriented mounts[b]	.05	.07	.04	.07	.07	-.06
No. of oriented mounts[b]	.09	.09	.10	.18	.11	-.07
No. of services[b]	.09	.08	-.09	.03	.07	-.08

[a]Level of significance is indicated (*P<.05, **P<.01).

[b]Number of events/bull/test (data combined for tests with male:female ratios of 3:4 and 5:4).

In a third study at Clay Center involving a large number of yearling beef bulls (n=295; Table 9), level of sexual activity again was not related (P>.10) to either scrotal circumference or characteristics of semen quality. Although tremendous ranges in sexual behavior, scrotal circumference, and semen quality were present, the correlations remained essentially zero. These data provide convincing evidence that aspects of bull sexual behavior are unrelated to testis size and semen quality in postpubertal beef bulls (Tables 8 and 9), and similar results have been reported by others (Smith et al., 1981).

The interrelationship between blood hormone concentrations and sexual behavior in beef bulls is unclear. Blockey (1975) and Smith et al. (1981) reported a positive correlation between serving capacity and blood testosterone levels, but no relationship was found in other studies (Bindon et al., 1976; Foote et al. 1976; Blockey and Galloway, 1978; Lunstra et al., 1984; Price et al., 1986). In a study conducted with low and high libido Hereford bulls at Clay Center, no significant relationship was found between level of sexual behavior and basal or post-GnRH stimulated levels of luteinizing hormone (r=.14) and testosterone (r=.33) in sequential blood samples. The patterns of hormone concentrations in blood samples collected every 15 min for 4.5 hr from these low and high libido bulls did not differ (P >.10; Figure 3) and remained very similar in the two groups of bulls throughout the sampling period. Fertility (pregnancy rate) also was evaluated in these bulls, and again had no relationship (P>.10) to body weight, scrotal circumference, and blood hormone levels (Table 10), but was highly correlated to average number of services achieved per libido test (r=.83). It was concluded that circulating and post-GnRH stimulated levels of luteinizing hormone and testosterone were unrelated to sexual behavior in beef bulls.

REPEATABILITY OF SEXUAL BEHAVIOR AND FERTILITY AS BULLS MATURE

A large range is serving capacity and sexual behavior is known to exist among yearling (Table 9) and mature beef bulls (Blockey, 1975, 1978; Smith et al., 1981). However, no information was available concerning the stability or changes that occur in sexual behavior as beef bulls mature. The following study (Lunstra, 1984) was conducted to determine if the sexual behavior expressed by a yearling beef bull changes as that bull matures. Eight Hereford bulls were libido and fertility tested at 15 to 16 months (yearling) and again at 39 to 40 months of age (mature). As yearlings, four bulls exhibited low libido and four high libido. The eight yearling bulls did not differ in age, body weight, scrotal circumference, or semen quality, and this remained true at maturity (Table 11).

Repeatability of yearling and mature serving capacity was highly significant among these bulls (r=.71; Table 12). Bulls that were high libido as yearlings exhibited very similar sexual behavior when mature. Bulls that were low libido as yearlings showed some increase in serving capacity (.3 to 1.6 services/test) and a decrease in number of abortive mounts (21.3 to 6.3 mounts/test) when mature, but their serving capacity remained lower (P<.01) when mature than that of bulls classified as high libido (Table 12).

TABLE 9. LACK OF RELATIONSHIP BETWEEN SEXUAL BEHAVIOR AND TESTICULAR DEVELOPMENT IN YEARLING BEEF BULLS[a]

Libido category	No. of bulls tested	No. of services/test		No. of mounts/test		Scrotal circumference (cm)	
		$\bar{x} \pm$ SE	Range	$\bar{x} \pm$ SE	Range	$\bar{x} \pm$ SE	Range
Inadequate	30(10%)	.0±.0	.0- .0	1.2± .7	.0- 3.0	33.5±.5	27.4-37.2
Low	46(16%)	.7±.1	.3-1.0	11.3±1.7	1.0-54.2	33.7±.6	27.3-39.3
Medium	50(17%)	1.8±.1	1.3-2.0	13.2± .9	5.0-28.5	34.2±.4	29.0-39.0
High	169(57%)	4.1±.1	2.3-9.5	11.3± .3	2.5-23.5	33.4±.2	23.0-38.7
All bulls	295	2.7±.1	.0-9.5	11.7± .4	.0-54.2	33.6±.2	23.0-39.3
Correlations:							
No. of services		--		-.06		.00	
No. of mounts		-.06		--		-.13	
Semen quality		-.05 to .03		-.12 to .00		-.27 to .30	

[a]Data from GPU bulls measured at 14 months of age (12 breeds, ~25 bulls/breed).

FIGURE 3. SERUM HORMONE CONCENTRATIONS IN LOW LIBIDO(LL) AND HIGH LIBIDO(HL) BULLS

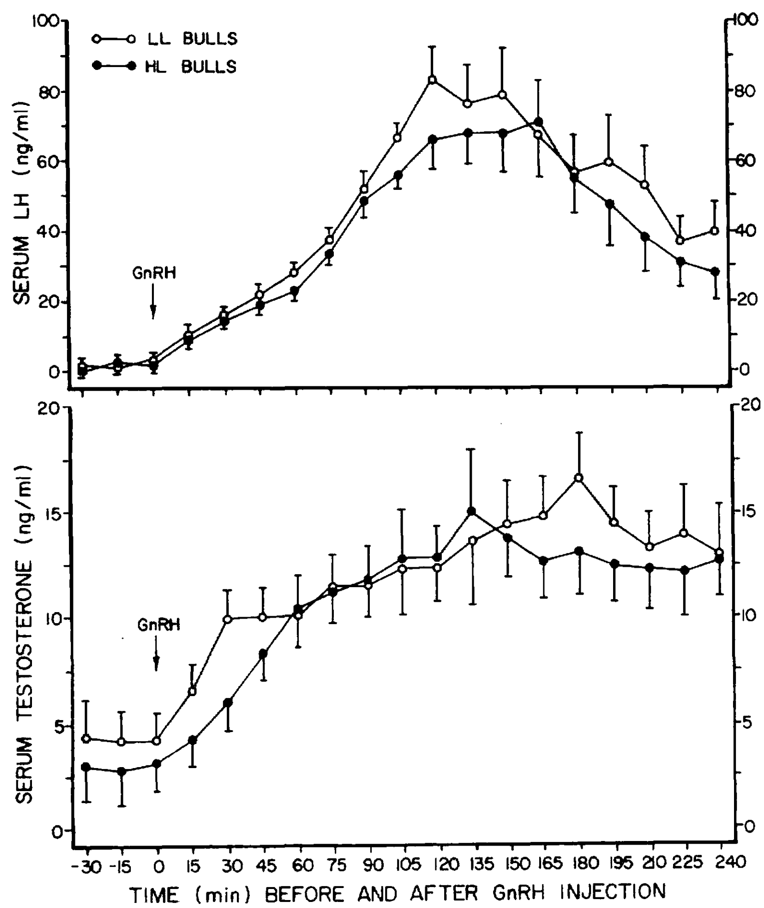

TABLE 10. RELATIONSHIPS BETWEEN LIBIDO, FERTILITY, TESTIS SIZE AND PLASMA HORMONE CONCENTRATIONS IN MATURE HEREFORD BULLS[a]

Factor	Level of sexual aggressiveness: Low libido	Level of sexual aggressiveness: High libido	Correlation to % pregnant
No. of bulls	6	8	---
Body weight (kg)	627 ± 29	654 ± 25	.39[NS]
Scrotal circumference (cm)	34.9 ± 1.0	36.6 ± .9	.34[NS]
No. of services/test	.8 ± .3	3.1 ± .3	.83**
No. of mounts/test	4.9 ± 1.1	4.9 ± .9	.17[NS]
LH concentrations (ng/ml)[b]:			
Basal ave. (Pre-GnRH)	1.7 ± .3	1.3 ± .3	.17[NS]
Maximal ave. (Post-GnRH)	41.7 ± 7.3	47.6 ± 6.3	.34[NS]
T concentrations (ng/ml)[b]:			
Basal ave. (Pre-GnRH)	4.4 ± 1.8	3.7 ± 1.6	.29[NS]
Maximal ave. (Post-GnRH)	10.0 ± 2.5	14.0 ± 2.2	.38[NS]
Pregnant/female exposed (%)[c]	47.7 ± 5.3%	75.5 ± 4.6%	---

[a]Hereford bulls (28 to 40 months of age) were exposed to an average of 32 females/bull for 20 days. Bulls were libido-tested (3 tests @ 30 min each), semen-tested and blood samples collected following the breeding period.

[b]Bulls were cannulated and blood samples collected every 15 min for 4.5 hr. First 3 samples were used to determine Basal levels of T and LH. Each bull was injected with 150 μg GnRH immediately after collection of third blood sample, and the 16 post-GnRH concentrations of T and LH were averaged to obtain Maximal stimulated concentrations.

[c]Determined by palpation at 50 days postbreeding.

**$P<.01$, [NS]Non-significant ($P>.10$).

TABLE 11. AGE, BODY WEIGHT AND TESTICULAR SIZE OF YEARLING AND MATURE BULLS[a]

Bull libido group	Age (d)	Body weight (kg)	Scrotal circumference (cm)
High libido (n=4):			
Yearling	475 ± 6[b]	449 ± 12[b]	32 ± 1[b]
Mature	1196 ± 6[c]	658 ± 45[c]	38 ± 2[c]
Low libido (n=4):			
Yearling	456 ± 6[b]	442 ± 11[b]	33 ± 1[b]
Mature	1177 ± 6[c]	636 ± 20[c]	36 ± 1[c]

[a]Data collected one wk prior to beginning of single-sire natural-mating period.

[b,c]Values ($\bar{x}$ ± SE) without a common superscript within a column differ ($P<.05$).

TABLE 12. REPEATABILITY OF SEXUAL AGGRESSIVENESS AS BEEF BULLS MATURE[a]

Bull libido group	No. of events/bull/libido test[b] Services	Abortive mounts
High libido (n=4):		
Yearling	3.9 ± .4[e]	5.5 ± .9[c]
Mature	3.5 ± .4[e]	5.0 ± .9[c]
Low libido (n=4):		
Yearling	.3 ± .1[c]	21.3 ± 2.6[d]
Mature	1.6 ± .2[d]	6.3 ± .9[c]
Repeatability (yrlg vs mature)	.71 (P<.01)	.21 (NS, P>.10)

[a]Hereford bulls were subjected to six libido tests (30 min/test; 4-d intervals) at 15 mo (yearling) and again at 39 mo (mature) of age.

[b]Values ($\bar{x}$ ± SE) for the last three libido tests at each age. Means without a common superscript within a column differ (P<.01).

TABLE 13. REPEATABILITY OF FERTILITY AS BEEF BULLS MATURE[a]

Bull libido group	% Mated per female in estrus	Pregnancy rate (%) per bull per:[b] Female exposed	Estrous female	Female mated
High libido (n=4):				
Yearling	93 ± 3[d]	58 ± 5[d]	59 ± 4[d]	64 ± 3[d]
Mature	90 ± 1[d]	74 ± 3[e]	80 ± 3[e]	89 ± 2[f]
Low libido (n=4):				
Yearling	76 ± 3[c]	15 ± 8[c]	16 ± 8[c]	21 ± 9[c]
Mature	79 ± 4[c]	58 ± 3[d]	63 ± 3[d]	79 ± 3[e]
Repeatability (yrlg vs mature)	.77 (P<.01)	.90 (P<.01)	.93 (P<.01)	.63 (P<.05)

[a]Hereford bulls were single-sire exposed at 16 mo (yearling) and again at 40 mo (mature) of age to 50 females exhibiting natural estrus during a 20-d breeding period. Values ($\bar{x}$ ± SE) without a common superscript within a column differ (P<.05).

[b]Pregnancy rate was determined by palpation at 50 d postbreeding.

Repeatability of yearling and mature natural-mating activity and fertility (pregnancy rate) also was highly significant among these bulls (r=.63 to .93; Table 13). Low-libido bulls mated a lower percentage of the females in estrus (P<.01) as yearlings (76%) and at maturity (79%) than did high-libido bulls at the same ages (93% and 90%, respectively), and yearling and mature low-libido bulls achieved significantly lower pregnancy rates than did yearling and mature high-libido bulls (Table 13).

TABLE 14. CORRELATIONS BETWEEN SEXUAL BEHAVIOR AND FERTILITY OF YEARLING AND MATURE BULLS[a]

Factors compared	Correlation
Yearling libido[b] vs yearling pregnancy rate[c]	.81***
Mature libido[b] vs mature pregnancy rate[c]	.58*
Inclusive[d]	.66**
Yearling libido[b] vs mature pregnancy rate[c]	.78***

[a]Correlations calculated for eight bulls (4 high and 4 low libido) that were tested for libido and fertility at 15-16 mo (yearling) and again at 39-40 mo (mature) of age. *P<.10, **P<.05, ***P<.01.

[b]Average number of services/test/bull for the last three libido tests at each age.

[c]Pregnancy rate/female exposed. Bulls were exposed single-sire to 50 females/bull for 20 d at each age.

[d]Yearling and mature bull data combined (fertility versus serving capacity).

The correlations between yearling serving capacity and yearling pregnancy rate (r=.81) and between mature serving capacity and mature pregnancy rate (r=.58) remained significant indicating that libido and fertility remain strongly related (r=.66) as beef bulls mature (Table 14). Mature bulls, regardless of libido classification, exhibited improved fertility (pregnancy rate; P<.05; Table 13) compared to that they had achieved as yearlings (Lunstra, 1984). This increased fertility as bulls matured was accompanied by increased testicular size (Table 11) and improved semen quality (Lunstra and Echternkamp, 1982; Lunstra, 1984) in both low-libido and high-libido bulls. However, serving capacity remained as the factor most highly correlated with fertility in both yearling and mature bulls (Table 14). Not only was serving capacity in yearling beef bulls highly correlated with their mature serving capacity (r=.71, P<.01) but yearling serving capacity was highly correlated with both yearling (r=.81, P<.01) and mature natural-mating fertility (r=.78, P<.01). These results indicate that the assessment of and selection for increased sexual behavior (particularly serving capacity) in yearling beef bulls may become a very useful method for identifying herd sires that will have above-average fertility. Relatively high heritability estimates for serving capacity in yearling beef bulls have been reported ($h^2=.59 \pm .16$, Blockey et al., 1978; $h^2=.68$, Dr. C. A. Morris, 1982, personal communication). These high estimates of heritability and the wide range for serving capacity among bulls (Table 9), coupled with the high correlation between serving capacity and natural-mating fertility (Table 14), indicate that the evaluation of serving capacity in yearling beef bulls should be a very useful selection criterion for rapidly improving and more accurately predicting herd-bull fertility in the beef cattle industry.

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BULL SELECTION FOR POTENTIAL FERTILITY
"APPLICATION IN A COMMERCIAL HERD"

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Bulls are usually selected for conformation, growth and soundness, without thinking much about their reproductive potential. An infertile bull or a bull of low fertility will sire no calves or only a few calves, so he should not be used even if his personal performance record is good.

Successful reproduction involves both the male and the female. Viable sperm from the male must be deposited in the female reproductive tract near the time of ovulation for reproduction to be successful. In natural mating, the bull must have the desire and ability to mate successfully and deposit a sufficient number of normal viable sperm in the female to cause fertilization to occur. The best measure of a bull's ability to produce sperm is scrotal circumference while the viability of sperm is best measured by large numbers of normal sperm. Libido must be observed or tested if he is to be used in a single sire situation.

There are three problems when a female fails to calve: (1) female does not show heat, (2) female is bred and fails to conceive or becomes pregnant, and (3) embryo is lost.

The failure of a female to show heat is strictly a female problem, while the failure to conceive or become pregnant can be either a female or a male problem. Available data indicates that bulls with high fertility will fertilize 95% of the normal eggs, while only 70 to 75% of the eggs are fertilized by bulls with low fertility. Percentage loss of embryo is similar in bulls of high and low fertility.

We are trying to show how pregnancy can be improved by selecting bulls for reproductive potential in a commercial herd.

We conducted two preliminary experiments which brought to light the fact that there is a lot of variation in bull fertility, and that this fertility problem was not just in the Santa Gertrudis breed but in bulls of other breeds also. The differences in fertility in bulls mated naturally indicate the importance of selecting bulls for fertility. It also indicated that Santa Gertrudis cows are highly fertile when mated to highly fertile bulls.

While the number of cows used in these studies were small, this data emphasized that bulls can be selected for fertility.

Methods of identifying bulls with large numbers of normal sperm are currently being used at King Ranch.

In order to identify some of the causes of variation in bull fertility in natural service, a study was conducted at the King Ranch with Dr. J. N. Wiltbank, in 1977. One thousand two-year old, virgin Santa Gertrudis crossbred heifers were test mated to Santa Gertrudis bulls.

The forty two-year old bulls were selected from a total of 220 bulls which were evaluated for breeding soundness. The bulls used were selected on the basis of differences in scrotal circumference and number of normal sperm. The bulls ranged from those estimated to be highly fertile, to those estimated to be infertile.

The one thousand heifers were palpated cycling, identified and divided into 10 pens, each containing 100 heifers.

Each bull was fitted with a marking harness and placed in a pen of 100 heifers for a four-day breeding period. Heifers were checked twice daily for heat and breeding marks. The pen was left vacant for one day and another bull was placed in the pen -- the experiment lasted 19 days, thus four bulls were used in each pen. Libido was measured as the proportion of heifers in heat that were bred.

Pregnancy was established by rectal palpation at 35 to 60 days post mating. Each bull was examined for reproductive soundness 40 days prior to the start of the experiment and again immediately after removal from pen.

The relationship between libido and fertility is shown in Table 1. Based upon the number of females marked and those observed in heat, the 40 bulls were grouped into high, medium, low, and no libido groups. Most of the bulls fell into the medium and high libido groups. Two bulls had no libido. Bulls with no libido will obviously not get any cows pregnant. The percent of pregnant females exposed to medium and high libido bulls varied, indicating that factors (semen quality and testicle size) other than libido also cause variation in fertility.

TABLE 1

LIBIDO AND FERTILITY

	NONE	LOW	MEDIUM	HIGH	TOTAL
NO. BULLS	2	2	12	24	40
Pregnant (%)					
0	2	0	1	2	5
1-20	0	1	6	5	12
21-40	0	1	2	10	13
41-60	0	0	3	5	8
over 60	0	0	0	2	2

Table 2 shows that all bulls used in this study with a scrotal circumference of less than 30cm had poor fertility. The highest fertility was seen in bulls with large testicles. Bulls with large testicles can have low fertility rates, indicated that other factors (libido and semen morphology) affect fertility. Two of the bulls with less than 30cm testicles had libido and greater than 70% normal sperm. These two bulls still got less than 20% of the heifers they bred pregnant.

TABLE 2

SCROTAL CIRCUMFERENCE AND FERTILITY

	Scrotal Circumference (cm) <30	31-35	36-42
Number of bulls	4	14	22
Pregnant (%)			
0	2	0	2
1-20	2	4	7
21-40	0	6	7
41-60	0	4	3
over 60	0	0	2

Bulls with over 75% normal cells had significantly higher pregnancy rates as is shown in Table 3. This data indicate bulls should have 75% or more normal sperm to be selected as highly fertile bulls. However, there was still a great deal of variation even if they had high percentage of normal sperm indicating that other factors (Scrotal circumference and libido) are affecting fertility.

TABLE 3

RELATIONSHIP BETWEEN NORMAL SPERM AND PREGNANCY

	NORMAL SPERM Less than 35%	35-64%	65-74%	75% or over
Number of bulls	15	6	5	6
Approx. number of hfrs bred per bull	18	18	18	18
Heifers Pregnant	%	%	%	%
Less than 20%	20	17	60	17
20-40%	53	67	40	0
50% or more	27	17	0	83

In selecting bulls for use in Single Sire herd:

1. Cull all 2-year old bulls with 30cm or less testicle size.

2. Cull all bulls with less than 75% normal sperm.

3. Cull all bulls that fail to demonstrate libido. Without libido the bulls will not get cows settled no matter what the test score shows.

4. If you are using bulls with Brahaman influence, cull bulls with long pendulous sheath.

Next, the proportion of bulls which should be culled using these criteria will be discussed. As noted previously 4 out of 40 bulls (10%) had little or no libido. An additional study with another group of 240 two-year old Santa Gertrudis bulls showed approximately the same incidence of libido problems.

In the study reported here (Table 4) 3% of the bulls had a scrotal circumference of less than 30cm however, in another group of 223 bulls the proportion of bulls having a scrotal circumference of less than 30cm was 6% at 20-22 months of age. However, at 14-16 months of age, 21% had a scrotal circumference less than 30cm.

TABLE 4

INCIDENCE OF S. G. BULLS WITH VARIOUS SCROTAL CIRCUMFERENCES AT 2 YEARS OF AGE

Scrotal Circumference	1976 1st Study Age 20-24 mos.	1977 2nd Study Age 14-16 mos.	20-22 mos.
29cm or less	3%	21%	6%
30-32 cm	14%	37%	22%
33-35 cm	43%	34%	41%
36-38 cm	32%	7%	28%
over 38 cm	9%	1%	5%
Number of bulls	240	223	223

The proportion of bulls with over 70% normal sperm was 26% in bulls 14 to 16 months of age and 74% in bulls 20-22 months of age. (Table 5) Thus, a marked improvement in semen quality occurred in this 6 month period.

TABLE 5

PERCENT NORMAL SPERM IN SANTA GERTRUDIS BULLS
AT TWO DIFFERENT AGES

% Normal Sperm	Approximately 14-16 mo. of age		Approximately 20-22 mo. of age	
90-100	3%		9%	
80-89	8%	26%	36%	74%
70-79	15% *		29%	
0-69	74%		26%	
Total number of bulls	223		223	

* Acceptable level of normal sperm.

At 16 months of age only 26% of the bulls would be selected for high potential fertility if they had adequate testicle size. These bulls have passed the same rigid test used on the 2 year old bulls at a much younger age and should be used in increasing fertility in the herd. As these bulls are used, more sons of these bulls will have high potential fertility at early ages. Also more daughters of these bulls will reach puberty at an early age.

At 22 to 24 months of age, approximately 70% of the bulls could be selected for high potential fertility if they had adequate testicle size.

Our more recent data shows that at least 50% of these 16 mo. old bulls could be selected for high potential fertility at this early age.

Adding up bulls with low libido (approximately 10%) small testicle size (3-6%) and bulls with poor semen quality (approximately 26%) you would cull approximately 40% of the bulls at 2 years of age. However, it should be remembered that these variable factors are not independent of each other and some bulls with small testicles had poor semen quality, and some had good semen quality. Some bulls with poor libido had poor or good semen quality and small or large scrotal size. Cull a bull when any one of these factors is in the unacceptable range.

Experiments have been conducted for two years to determine if pregnancy rates can be improved in multiple sire pastures using bulls selected for large numbers of normal sperm and a large scrotal circumference. This experiement was also conducted with Dr. Wiltbank's help.

Most commercial and some of the purebred ranches, breed their cattle in multiple sire pastures. King Ranch breeds a majority of its purebred and all of its commercial cattle in multiple sire herds.

Two pastures of about equal size and with similar numbers of cows were used. Two year old cows were palpated pregnant with their first calf in the fall of 1979, and placed in these two pastures to calve.

Seventy-nine 3-year old bulls were subjected to a Breeding Soundness Evaluation in January 1980. Bulls were selected for use on the basis of normal sperm.

The criteria set up before the program started were:

1. Four bulls per 100 cows.

2. Control - bulls with a full range of semen quality. The same proportion of bulls with different number of normal sperm as in the original population.

3. Treatment - a highly selected group of bulls with 80% or more normal sperm.

4. All bulls used in the treatment or control had acceptable testicle size, 35cm or greater, and were sound in all other aspects.

5. The breeding season would be the same as all the multiple sire pastures on the ranch.

6. The cows from both pastures to be palpated for pregnancy at the same time and all pregnant cows be maintained in the two separate groups until weaning of the calves from this breeding.

7. Weaning - All calves be mass weighed as soon after removal from dams as practical, handling all of them the same.

Mother Nature dealt us a very bad breeding season the winter and spring of 1980, with only traces of rain from October to May. A decision was made to extend the breeding season leaving the bulls out from the middle of March to the middle of October.

Both herds were palpated for pregnancy the middle of October.

Table 6 shows the results as determined by palpation. The cows bred to bulls with 80% or more normal sperm had a 93% pregnancy rate, while cows bred to random selected bulls had an 87% pregnancy rate.

TABLE 6

PREGNANCY RATES IN MULTIPLE SIRE PASTURES - 1980

	Random Group	80 + % Normal Sperm
Number of cows	571	656
% Pregnant	87%	93%
Difference-random & selected		6%*

* p>.001

This 6% improvement in pregnancy rate was tested statistically. This difference would occur by chance less than once in 1,000 times. Thus a lot of confidence can be placed in the results because of the large numbers involved.

Perhaps of equal importance is the results of the second year's study. The criteria of bull selection were similar except a group of 2 year old bulls were selected with 80% or more normal sperm and another group of bulls with 70% or more normal sperm. These were compared to a group of bulls which represented all ranges of normal sperm, all bulls had a scrotal circumference of 32 cm or more.

The females used in this experiement were 2 year old virgin heifers. They were selected by SGBI classification into S quality - 522 heifers with 80+% normal sperm; S- quality - 769 heifers with 70+% normal sperm bulls and a control group made up of 1179 second (2X) cross heifers from a grading up program using random mix bulls.

The environment was exceptionally good, starting with Hurricane Allen in August, we had rains all through the fall of 1980 and the winter, spring and summer of 1981. It was a perfect year for cattle breeding.

Bulls were placed with these heifers the latter part of February and taken out 90 days later in the latter part of May. Heifers were palpated 45 days later.

Table 7 shows both the 1980 and 1981 results, however, in 1981 the cows bred to bulls with 80% or more normal sperm had 90% pregnancy rate while cows bred to bulls with 70% or more normal sperm had 91% pregnancy rate. The random group bulls achieved 85% pregnancy rate.

TABLE 7

PREGNANCY RATES IN MULTIPLE SIRE PASTURES

	1980	80+%	1981	80+%	70+%
	Random Group	Normal Sperm	Random Group	Normal Sperm	Normal Sperm
Number of cows	571	656	1179	522	769
% Pregnant	87%	93%	85%	90%	91%
Difference-random & selected	-	6%*	-	5%**	6%*

*p<.001
**p<.005

Again a lot of confidence can be placed in the results because of the large number of animals involved. Statistically the changes of the 5% difference in pregnancy rate in cows bred to bulls with 80% or more normal sperm and cows bred to a random group of bulls occurring by chance is one in 500. The 6% difference between cows bred to the random group of bulls and those bred to bulls with 70% or more normal sperm would occur less than 1 in 1000 times by chance. Thus it appears you can select bulls with over 70% normal sperm for use in multiple sire herds and expect to improve pregnancy rate 5 to 6% over unselected bulls.

Bulls going into the breeding herds should be given a breeding soundness examination each year because semen quality does change with trauma, stress, infection, etc. Each bull must have the 70+% normal sperm each year going into the breeding season to insure maximum bull fertility.

Libido is necessary, however, in a multiple sire situation bull numbers may take care of or mask the few low libido bulls and insure high fertility.

We have some more data and recent studies which bring together our thinking on the Breeding Soundness Evaluation. As you can see, we have not mentioned motility as a parameter of use in selected bulls. In 1965, Wiltbank and others used two bulls which had poor motility on three collections but which had a large number of normal sperm. They were exposed to 20 heifers each. The pregnancy rate was as high with these bulls as when heifers were bred by bulls with good motility and high percentage of normal sperm. Pregnancy rate was decreased in heifers bred by two other bulls where poor motility was associated with low number of normal sperm. These data indicate there are reasons for low motility not associated with low fertility and consequently, using motility to predict fertility is questionable.

This test was repeated with larger number of bulls for 3 years with similar results. A one year test in Texas showed the same results.

Either a more reliable method for estimating motility must be utilized or motility should not be used as an indicator of potential fertility in naturally mated bulls. At King Ranch, we have made a decision not to use motility as a culling parameter in bull selection.

Motility and pregnancy rate.

	NORMAL SPERM			
	Low (0-69)		High (70-100)	
	Poor Motility (0-60%)	Good Motility (80-100%)	Poor Motility (0-60%)	Good Motility (80-100%)
Nebraska (1yr)				
No. bulls	2	-	2	2
Mot. %	60-45	---	36-53	87-93
Normal Sperm	47-46	---	94-79	89-89
Preg. %	35-22	---	52-64	41-58
Nebraska (3yrs)				
No. bulls	12	6	5	24
Preg. rate (%)	42	52	65	59
Range	0-69	31-62	52-100	14-86
Texas (1yr)				
No. bulls	9	18	---	9
Preg. rate (%)	32	31	---	50
Range	0-50	0-85	---	10-100

In the summer of 1985, we turned 8 years of Breeding Soundness Evaluation data on 20-24 month olds bulls over to Dr. Randel and Bob Godfrey at Overton Texas A&M Experiment station. Data was presented in February at Southern Section of A.S.A.S.

In retrospect, this study was designed to determine the effect of using the BSE on 20-24 month old bulls over an extended period of time on the quality of bulls in subsequent generations.

We collected the data and used it internally for making decisions on bulls to be used in the breeding herds, but the data was kept the same way year after year; consequently, the data for this study.

Represented were (2,863) 20-24 month old Santa Gertrudis bulls from 2 divisions of King Ranch (RD1, RD2). Scrotal circumference (SC) and semen quality were recorded for each bull at the time of testing. Semen quality consisted of % Motile sperm (Mot), Progressive Motility (PMot), and % normal sperm (MOR).

All semen was collected by electroejaculation using the Ideal Electrojac as the instrument of choice.

Points were given for SC, Mot and MOR according to the BSE scoring system set up by the Society for Theriogenology and a total score was obtained for each bull.

We modified the Breeding Soundness Evaluation a little in that we established a minimum Scrotal circumference for age and all bulls were culled which did not meet that standard. At this 20-24 month test and all subsequent tests, a bull must have at least 70% normal sperm or be culled.

During year 1-4, bulls with a scrotal circumference <30.0 cm were not tested and years 5-8, bulls with a scrotal circumference < 32.0 cm were not tested.

All the data was subjected to statistical analysis.

RESULTS

CORRELATION OF SC WITH BSE TRAITS OVER ALL Y AND RD

	TRAIT			
	PMOT	MOT	MOR	SCORE
R-VALUE	+.033	+.169	+.133	*+.488
P <	.077	.0001	.0001	.0001

The results of the correlation analyses are shown here. The analyses showed that SC was positively correlated with PMOT, MOT, MOR and SCORE. SCORE had a high positive correlation which is logical, because SC is used to develop SCORE. MOT and MOR had the next highest positive correlations. This may indicated that one or both of these traits of the BSE is gaining in value in the determination of a bulls SCORE on the BSE. PMOT had a low positive correlation, which was not as statistically significant as MOT or MOR.

SC OVER ALL YG ON RD1 AND RD2

	SC[a] (cm)
RD1	35.2 + .1[b]
RD2	35.1 + .08[b]

[a] LSM + SELSM

[b] VALUES WITH THE SAME SUPERSCRIPT ARE NOT DIFFERENT (P>.10).

There was no difference in scrotal circumference between ranch divisions so all this data was combine for the study.

SC OF TESTED BULL (N=2,810) THAT PASSED OR FAILED THE BSE

TEST RESULT	SC[a] (cm)
PASSED	35.8 + .07[b]
FAILED	34.5 + .1[c]

[a] LSM + SELSM

[b,c] VALUES WITH DIFFERENT SUPERSCRIPTS APE DIFFERENT (P>.0001).

There is only 1.3 cm difference between those that passed and failed but that difference is highly significant.

The first 3 years data shows a large variance between the SC of those failing, 32.3 cm and those passing 34.4 cm.(Fig. 1) This is 2.1 cm difference. The last 5 years data shows a very small variance between those failing 35.8 and passing 36.7. This is only .9 cm difference and probably indicates some genetic effect from selecting sires for scrotal circumference. For the last 3 years we have been testing and selecting on SC, the entire herd battery on these two divisions. Scrotal circumference can be changed over time.

The information shows a similar trend.(Fig. 2) The difference in SC between bulls passing and failing is quite high the first 3 years and drops thereafter until the 8th year; there is no difference. In 1985 there was only .2cm difference between those passing and failing.

The information on % of bulls passing the BSE over time is not as easy to interpret because of the tremendous variation over years. (Fig. 3)

We were culling these 20-24 month old bulls each year based on the BSE until 1983 when disaster struck. We tested these bulls the middle of January just a month after the disastrous freeze in our area in December. We retested the bulls that failed the test and found 76% that passed which was not spectacular but with 79% in 1984 and 80% in 1985 there appears to be a trend toward higher percentage of bulls which are passing the BSE each year.

In conclusion based on almost 3000 two year old bulls over the last 9 years, our data indicates a slight improvement in bulls passing BSE from about 70% in 1977 to 80% in 1985, however, there are some environmental effects affecting results in between.

Morphology and scrotal circumference are the two factors on which bulls are actually culled. Data on these 3000 bulls show very conclusively that there is no difference in scrotal circumference between those that pass and fail the BSE. However, over this same period of time, we have documented a highly significant increase in scrotal circumference from 33.2cm to 37.2cm average.

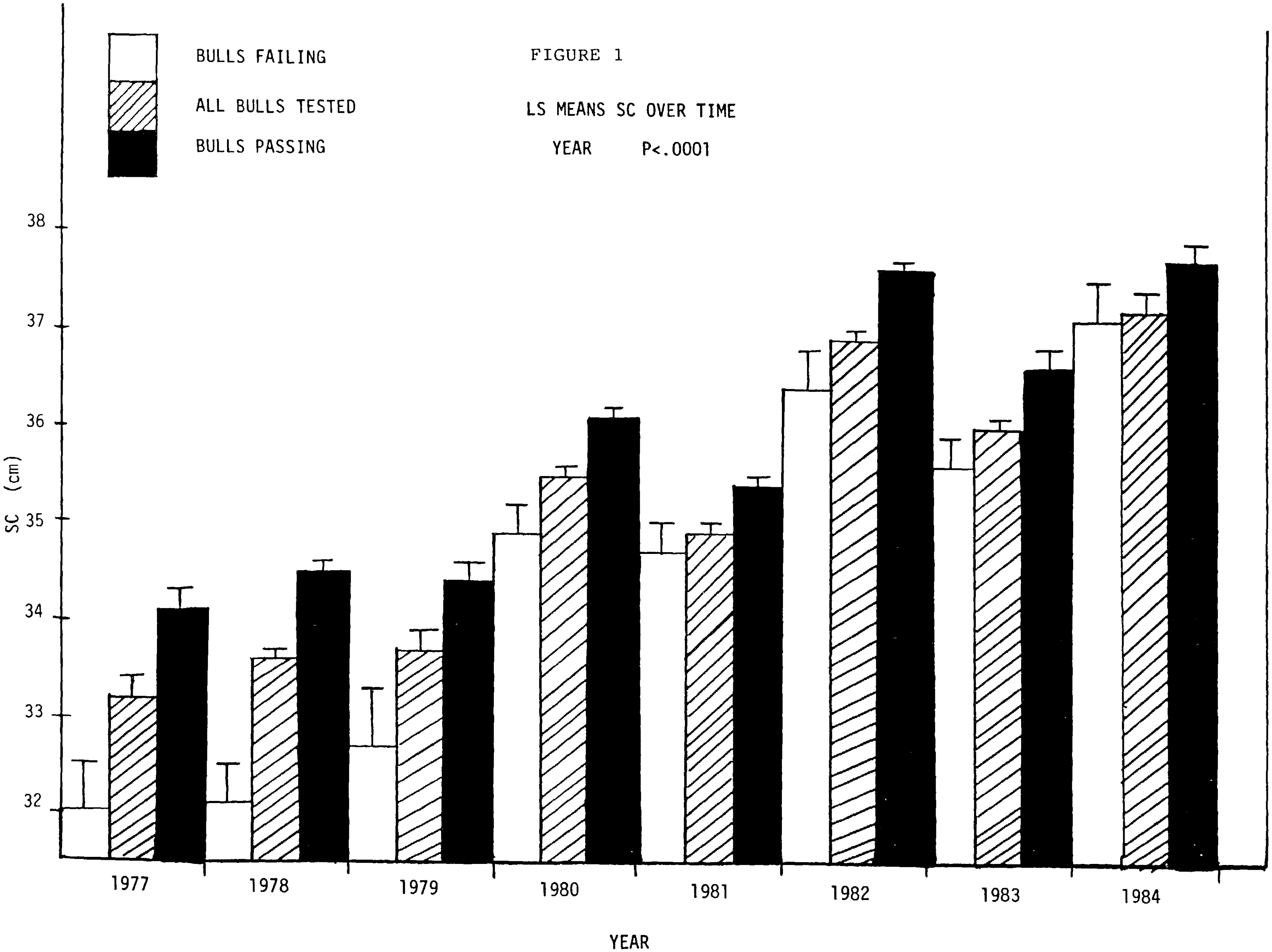


FIGURE 1

LS MEANS SC OVER TIME

YEAR P<.0001

FIGURE 2

DIFFERENCE IN $\bar{x}$ SC BETWEEN BULLS PASSING AND FAILING BSE OVER TIME

* = NOT SIGNIFICANT (P>.10)

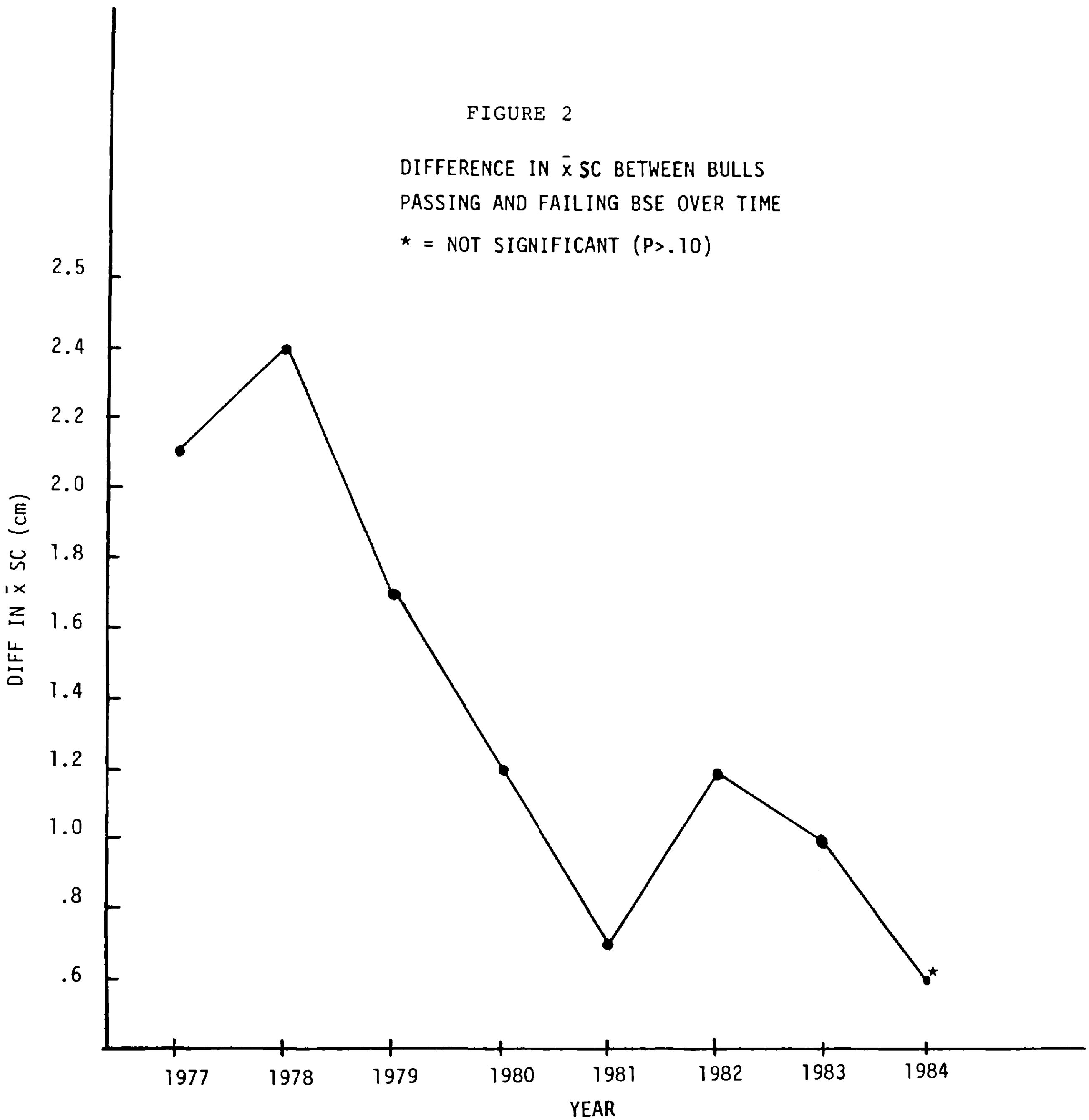
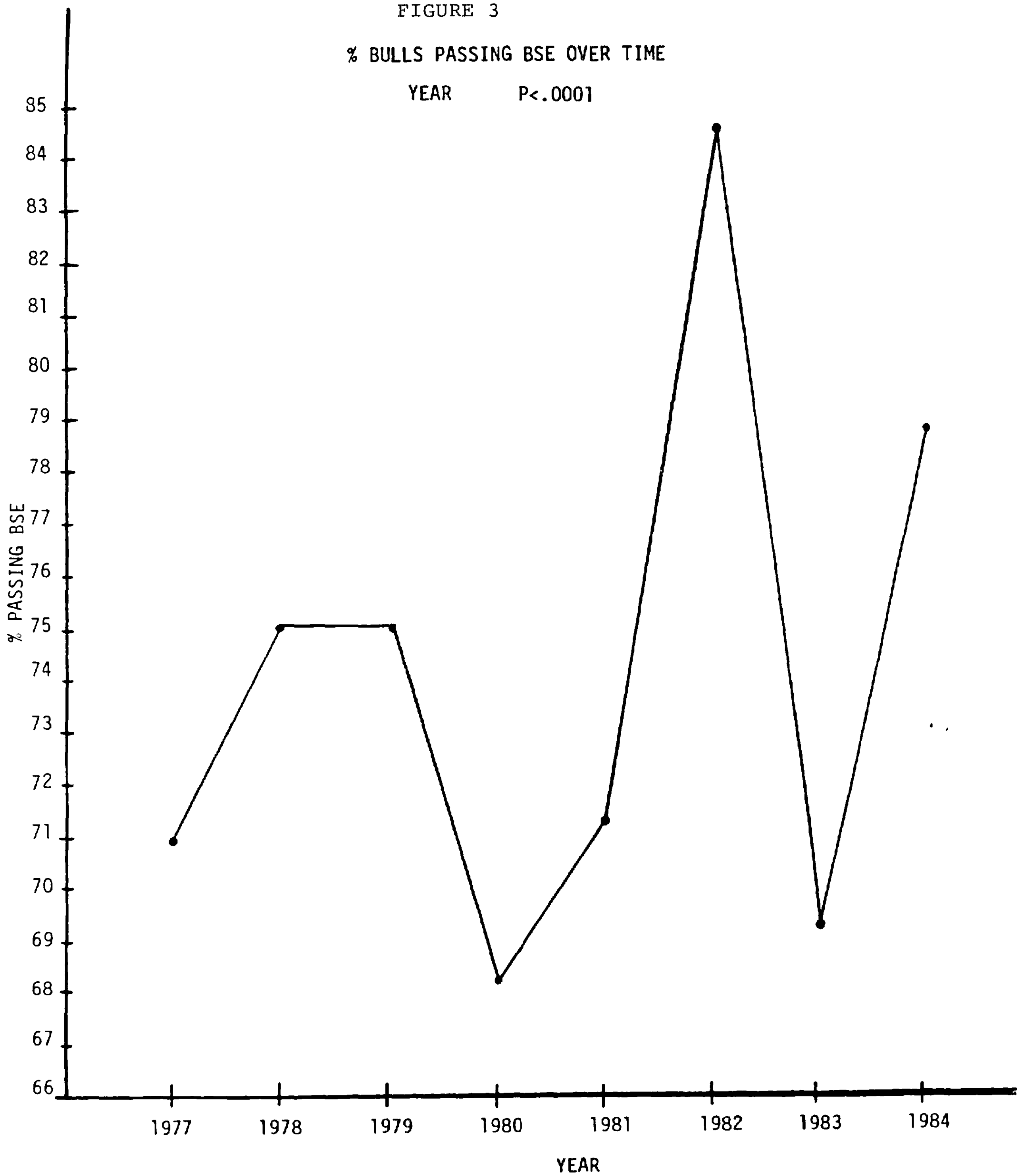


FIGURE 3

% BULLS PASSING BSE OVER TIME

YEAR P<.0001



Since fewer bulls each year are being culled on scrotal circumference, more emphasis is being placed on morphology on which bulls are culled. All bulls with less than 70% normal sperm are culled.

Many cattle breeders throughout the United States are breeding in a multiple sire situation. From this data there is a positive indication that the selection of bulls on scrotal circumference and normal sperm could significantly increase the pregnancy rate in well managed herds. Criteria: Two year old bulls should have at least 32cm of scrotal circumference and in a morphology test have at least 70+% normal sperm.

Mature bulls should have at least 35cm of scrotal circumference and at least 70+% normal sperm.

All bulls should have clear eyes, good sound feet and legs and have an acceptable sheath.

With a good herd health program, proper nutrition and the use of these bull fertility parameters, a 5 to 6% improvement in herd fertility should be attainable.

In selecting bulls for use in Single Sire herds these same bull selection parameters need be used, however, libido or serving capacity becomes very important for none of the factors affecting bull fertility mean anything unless he has the desire and ability to mount and deliver semen into a large number of cycling cows. Each breeder must observe his bull or libido test and have confidence he is doing a good job of breeding the cows when they are in heat.

THE COMMERCIAL PRODUCER'S NEED FOR SPECIFICATION SEEDSTOCK

Thomas D. Price
InterWest Ranch and Farm Management, Inc.

Commercial cow-calf production is in a transition of ownership and management. Today's commercial cattlemen have received the education of hard knocks during these most difficult times of recent years. Commercial cattlemen are :

1. Better informed and more disciplined.
2. More conservative and risk-management oriented.
3. More production and efficiency conscious.
4. More marketing and sales oriented.

The commercial operator must concentrate on efficiency of production and marketing in order to compete with the vast numbers of small herd owners who will own cows regardless of profitability Commercial operators recognize they must use every tool available to reduce costs or otherwise increase the efficiency of their production.

The definition I have chosen for "Specification Seedstock" is "breeding stock which have been developed for specific attributes to meet the economic needs of commercial cattlemen producing cattle under different environments". You could add to this "producing cattle for different markets." as we witness the shift to "low fat" beef i.e., ultra-lite, chi-beef, low cal. etc

Unlike other livestock production, including hogs, poultry, and indirectly dairy, the environmental conditions which we produce beef cattle are very diverse. However, even with the differences in environments we have production measures and costs which are common and which are significantly influenced by our selection of breeding stock.

For example, we can examine operating budgets and show that feed and pasture costs are a major expense, generally ranging from 40% to 60% of the total operating cost of a commercial operation. Labor and management costs are also major expenses. Interest expense is proportionate to these and other costs and accumulated debt.

The costs of production are significantly influenced by the economical traits of the cow and her calf. This audience does not need a dissertation of what are the economic traits but I would add that different environments and markets necessitate different emphasis. For example, in the sparse feed areas of the west, emphasis needs to be first on those traits or breeding schemes which will influence reproductive performance. While, in the more abundant feed areas, we can put more emphasis on selection for growth and milk production.

Maternal Traits	Calf Traits
Puberty	Calving Ease
Fertility	Growth Rate
Calving Ease	Feed Efficiency
Mothering Ability	Carcass Quality

Milking Ability
Rustling Ability
Longevity
Freedom from Health and Physical Disorders
Temperament

Freedom from Disease
Temperament
Polledness

Most noteworthy is the fact that the costs of improving the economic traits are small relative to other costs, i.e., improving the genetic quality of a cow-herd through breeding is very cost effective.

Three breeding applications are available to the commercial cattlemen:

1. Improvement in the heritable traits by means of selection - additive genetic action.
2. Improvement in the traits of low heritability by utilizing hybrid vigor through crossbreeding.
3. Improvement of production measures and environmental adaptation by means of using breed combinations, i.e., utilizing the best traits of the different breeds in a crossbreeding system.

By combining all three breeding applications substantial advancement can be made to increase production and decrease costs per unit of production.

I would like to share with you how we utilize each breeding application on two commercial ranches with which I work and in so doing shed light on the need for Specification Seedstock.

On each ranch we begin by first identifying which traits we want to concentrate improvement. Goals are established with consideration given to environmental conditions and marketing outlets.

Secondly, we decide which breeds and type of bulls and females will give us the greatest improvement. Consideration is made how different breeds can be utilized in a crossbreeding system.

Finally, we decide from whom we will acquire the breeding stock to fulfill our objectives.

Each ranch has a unique set of circumstances which requires thorough evaluation before a breeding program can be identified.

For example, on the Flying M Ranch of western Nevada we are faced with a vast amount of acreage with limited feed resources during all but the summer months. Our primary objective is to increase and maintain a higher percent calf crop which is born within a 90 day calving season. Although we recognize breeding performance and calf crop percentage is largely the result of nutrition and management, we also know we must develop the cattle to perform under a marginal environment. We are confident we can improve reproductive performance by making use of the breeding applications.

Our next most important objective is to increase the growth performance of the cattle. Depending upon the fall calf market and projected spring feeder market and because of our proximity to the winter California grass we maintain the option to retain ownership of calves after weaning. If the economics look right we will ship Flying M calves to California in mid- December. It is there that the calves will express their genetic potential for growth

Fortunately, in our breeding program aimed at improving both reproductive performance and growth rate, there is not total antagonism. We can make improvement in both measures simultaneously by selecting breeds and individuals with rapid early growth rate and moderate mature size.

We have noticed on the Flying M that cows with an influence of Brahman characteristics perform better than the average British type straight or crossbred cows. The Brahman crossbreds maintain a superior body condition coming off of winter range with a calf in the spring. As yet I do not have the records to prove our observation, but it appears that the Brahman cross cows have superior breeding performance and wean a heavier calf in the fall

The superior performance of the Brahman crosses could be the result of their breed, or because of the amount of hybrid vigor they possess, or because they are superior in their heritable genetic makeup. Whatever the reason, these cattle appear to more effectively utilize the limited feed resources available to them

As a result of our objectives to increase reproductive performance and growth rate, and because of our observations with the Brahman cross females, we have embarked on a breeding program utilizing Brahman derivative breeds of bulls

In the same breath that I say we have selected Brangus bulls to use in 1986, I emphasize that individual bull selection is most important

Selection criteria has been for growth rate, structural soundness, scrotal circumference, and temperament. Body type, to the extent it reflects mature size, is also considered. Our objective is to produce moderate size cows with easy fleshing qualities. Less consideration is given to birth weight as bulls are used on mature cows Production history of the dam is also important, but unfortunately not always available. Our primary concern is calving interval and the fact that the dam raises a calf each year

We selected Brangus for several reasons:

1. The base cow herd is predominately Hereford, thus the resultant F_1 calves will be polled black-Brangus baldies and express maximum hybrid vigor.

2. The calves sold from this cross are easily marketed.

3. The resultant Brangus cross females will meet our objective for a slight amount of Brahman influence and transmit the traits to improve both maternal characteristics as well as growth rate, carcass quality and pigmentation.

We also selected Brangus over some of the other derivitive breeds because there are a larger population of 2 year-old performance tested bulls from which to select. This is particularly true for bulls in the western and northwestern states.

On this particular ranch, the Brangus breed of bulls will meet the specific needs of the ranch until such time as we have a larger population of Brangus type females. When this occurs, we must then search for the breeds and bulls available to cross on these females to maintain hybrid vigor, without sacrificing the heritable qualities. For example, we can use Beefmaster, Santa Gertrudis, or Simbra and maintain a nearly one-quarter Brahman female, while incorporating the beneficial traits of the other breed characteristics.

Let us look at another ranch which is more typical of mountain states' beef production.

This is the Maggie Creek Ranch of Elko, Nevada; a large and productive ranch where cows are wintered inside, calve in the spring, and summer on high mountain country with calves weaned in the fall.

We have initiated an aggressive program to upgrade the quality of the cattle herd. Objectives are established to increase pregnancy rates and weaning rates by 6-8 percentage points each and weaning weights by 35 percent.

Maggie Creek Ranch is divided into two ranch units...one unit, known as the Hadley Ranch, consists of predominately Angus x Hereford cross cows and the other unit, known as the Hunter Banks Ranch is predominately Hereford cows. After giving consideration to all the ranch resources we have decided to maintain the two herds but with modification. With a natural split of the ranch we have launched a program whereby we will manage two herds...one as a Maternal herd and the other as a Terminal herd.

The purpose of the Maternal herd is to produce replacement heifers for the entire operation. This herd will consist of the younger superior females from the Angus x Hereford cowherd. These cows will be bred with the objective to improve maternal traits in their heifer offspring. Realizing we need to produce medium sized cows with good milk production and fertility, we have chosen to use Angus, Hereford, and Shorthorn in a crossbreeding-backcross rotation. Until such time as we can cross-fence the range into breeding pastures, and thus sort the cattle into breeding groups, we will sacrifice some hybrid vigor. However, what we give up in hybrid vigor will be offset by our strict selection of bulls and heifers for their heritable genetic quality.

All heifers raised in the Maternal herd will stay in the Maternal herd until they are pregnant with their fifth calf, at which time they will transfer to the Terminal herd.

It is in the Terminal herd that all the older females will be kept until leaving the ranch. In 1986, individual sires selected for terminal use include bulls from the Limousin and Simmental breeds. Simbra was also of interest, but we had difficulty locating high quality two-year old bulls which were 5/8 or 3/4 Simmental. The use of terminal sires is to improve growth rate and carcass yield. In selecting individual bulls, emphasis was for bulls with average or smaller than average birth weights, average to superior growth rate, structural soundness, scrotal circumference, and temperament.

Making rapid progress within the cowherd is difficult due to the long generation interval of cattle. Consequently, we have chosen to retain only a fraction of the very best heifers raised on the ranch and purchase the balance as bred heifers. In 1985 and1986, the economics of purchasing top quality bred heifers was superior to raising heifers.

The heifers which are desired for the ranch are ideally top quality Angus x Hereford crosses bred to a calving ease Angus bull. We have managed to find some of this quality but they are in short supply. Most of what we have purchased are high quality straightbred Angus heifers which are bred AI and natural service to calving ease Angus bulls.

The calving results of both the raised and purchased heifers have been excellent. Out of the 575 heifers which calved in 1986, we experienced only 23% calving difficulty in the 193 head of raised heifers and an exceptionally low 10.5% calving difficulty in the 399 head of purchased heifers. Clearly, the calving performance of both the raised and purchased heifers was the result of high quality heifers bred to bulls either proven for calving ease or sons of known calving ease bulls with small birth weights.

The emphasis of the breeding program at Maggie Creek Ranch is to utilize the benefits of 1) genetic selection 2) hybrid vigor and 3) particular attributes of various breeds. We anticipate rapid progress in meeting the production goals set forth.

I have discussed what is being done on these ranches with regard to breeding stock, but let's ask the question..."Could other breeds, or a "composite" breed be used more effectively? What other considerations should be made?"

I believe other breeds could also be effectively used. We know there are wide differences within breeds, and therefore selection within other breeds for specific attributes could lead us to the same end point. Admittedly, however, the progress may be slowed by the availability of other seedstock.

Considerations which have a bearing on what seedstock is eventually selected include:

1. Availability of the type of seedstock desired - both bulls and heifers.
2. The genetic make-up and quality of the cattle and the records which substantiate their background and performance.
3. Integrity of the breeder from whom the seedstock are to be purchased.
4. Location - consideration given to adaptability of the purchased cattle to the new environment, health testing required upon delivery to the ranch, and transportation costs.
5. Cost of the seedstock.

Composite breeds, also known as synthetic hybrids are also to be considered. These cattle are being produced and marketed to commercial producers for the same purposes I have identified. At this time however, the number of composite breed seedstock is very limited.

Additional considerations for composite breed seedstock should include the following:

1. The percentage of the various breeds within the hybrid-composite.
2. The quality of the purebred foundation stock which make up the heritable portion of the composite breed(s).

The Future is Now

The commercial producer's need for "Specification Seedstock" is proportionate to the perception that he/she needs improvement in particular traits.

Thanks to our dedicated researchers, AI studs, breed associations and breeders, we have the genetic tools to breed cattle to be productive under most environmental conditions.

The use of AI with genetically superior bulls has the greatest influence on genetic quality and remains the best tool to realize genetic improvement. Couple AI with other genetic advancements, including more accurate sire evaluation, embryo transfer, etc., and the ability to identify and produce seedstock for specific purposes are limitless.

As commercial operators we know what can be done genetically and will take steps to capitalize on these advancements.

In the future the progressive commercial producer will need a ready supply of superior seedstock of both purebred and hybrid variety.

Sire Evaluation--Where We've Come From

Larry Benyshek
The University of Georgia

Selection is defined (Wright, 1969) as any process in a population that alters the frequency of genes affecting a particular characteristic in a directed fashion without change of the genetic material (mutation) or introduction from without (immigration). The idea of population genetic change is difficult for breeders to understand because they must deal with individuals in making selection decisions and in their merchandising programs. Nevertheless, those breeds (populations) which practice intense selection for characteristics of economic importance to the cattle industry will change genetically and eventually be the populations with greatest fitness in the cattle industry. Fitness is defined here as those leaving the most progeny in the next generation. Quantitative genetics certainly does not overlook the individual because the individual, if selected, is the vehicle containing the genes which will be passed to the next generation. Obviously the selection of bulls is central to directed changes in the gene frequency of any defined beef cattle population. Thus, there has been tremendous emphasis on sire selection in beef cattle populations probably since early domestication.

The chronology of beef cattle performance testing (Baker, 1967, 1975) begins in the 1930's with research initiated at the U.S. Range Livestock Research Station, Miles City, Montana. Research continued through the 1940's with large regional programs (W-1, NC-1 and S-10) and the first bull test stations appeared. In the late 1940's and early 1950's beef cattle improvement (BCI) programs began in several states (California, New Mexico and Montana). In 1955 the first Beef Cattle Improvement Association (BCIA) was founded in Virginia and Performance Registry International was intitiated. In 1959 beef cattle breed registry associations began to formalize the collection of records by their members. In the 1960's performance programs were nurtured and began to flourish providing sound objective information which breeders could use in making selection decisions. In 1968 an extraordinary event occurred with the formation of the Beef Improvement Federation (BIF). At that point in time BIF began to provide the framework for the standardized and systematic procedures which the beef cattle performance movement so desperately needed. The BIF Guidelines became the performance "bible" for the beef industry.

One of the working committees established within BIF during that first meeting was to address National Sire Evaluation (NSE). The committee functioned well and drawing upon the experiences of the dairy industry guidelines were approved by the BIF board in 1971 and published in 1972. The work of this committee was to have an astounding impact on the purebred beef cattle industry. In 1971-72 the American Simmental Association published the first National Sire Summary. Only a few far ranging thinkers really understood what the publication of this document really meant to the beef industry. Bulls were now compared across herds and/or generations. Beef cattle breeding had entered the twentieth century!

The proliferation and implementation of technology in the area of beef sire evaluation has been fantastic. Dr. C. R. Henderson presented an invited paper at the 1972 American Society of Animal Science meetings which formalized his mixed model procedures providing best linear unbiased predictions of breeding value. It was certainly fitting that this paper "Sire evaluation and genetic trends" published in 1973 was given at the animal breeding symposium in honor of Dr. Jay L. Lush. The term BLUP, short for best linear unbiased prediction, was soon to be part of beef national sire evaluation guidelines and a part of the vocabulary of the serious beef breeder.

Willham (1972) discussed the concept of breeding value at a BIF regional meeting held in Montgomery, Alabama. He outlined a procedure for estimating breeding values which was to become a cornerstone in the structure of beef cattle improvement programs. The procedure provided estimated breeding values (EBV's) at the same time that within herd performance summaries were being computed. The EBV concept was soon adopted by the Angus, Hereford, Polled Hereford and Simmental breeds. The effect of this procedure on the selection of sires has been substantial.

The development of technology has been indeed astounding. However, the educational effort needed to ensure the proper and continued use of the technology has lagged which is usually the case in periods of rapid technological improvements. Most purebred breeders have heard of the concept of breeding value and a number understand the concept. There is need for a major educational effort in the commercial industry with respect to the usefulness of the breeding value concept. It is of paramount importance to remember that commercial producers are the ultimate consumers of the results of this technology. Unless the commercial industry begins to use and pay for the results of today's breeding technology it is not unlike a castle built of sand waiting to be washed away with the next high tide.

The Evolution of Mathematical Models

Mixed model methodology leading to best linear unbiased predictions of breeding value is dependent on proper mathematical models describing the data to be analyzed. Models used in sire evaluation attempt to approximate reality because they simplify the system they are designed to represent. Models used in NSE programs are based on assumptions which may or may not be always true. If the assumptions cannot be met for a particular model then many times it is thought or in some cases can be shown that the consequences are minor and thus can be ignored. Scientists in the area of breeding and genetics know the seriousness of models not meeting the assumptions and this has led to continued research into refinement and further development of mathematical models.

The increased use of artificial insemination in beef cattle has provided a data structure which lends itself to rather sophisticated models. The increased sophistication of mathematical models used in NSE has paralleled the improvements in computer hardware. The introduction of large-scale scientific "super" computers has certainly opened the door to applications of models not thought possible only a few years ago. Clearly, the point to be made is that model development is one of the most important areas in NSE research and perhaps the most difficult for producers to understand.

The first mathematical model used in NSE was a rather basic model incorporating contemporary group effects, sire effects and random error. The contemporary groups were assumed fixed environmental effects. The sire effects were assumed random and became the "Expected Progeny Differences" (EPD's). The model required that sires and contemporary groups be connected, that is at least some sires must be used over more than one contemporary group thereby forming "ties" between sires and contemporary groups. Each contemporary group must also have had at least two sires represented. The model assumed that sires had been mated to comparable sets of cows (cows randomly allotted to sires) and that progeny were treated similarly within contemporary group. The model assumed genetic trend was not existent or relatively unimportant in the population. These were essentially safe assumptions in the early 1970's for analyses of field data from the newly imported Continental breeds.

In the first analyses of the domestic British breeds the programs were designed to meet these assumptions. The analyses procedures of the early 1970's approximated the true mixed model procedures described by Henderson (1973). The BLUP procedures as described by Henderson with this basic model were fully implemented in the analysis of the designed sire evaluation programs of the British breeds (Angus, Hereford, Polled Hereford and Shorthorn, 1974-77) and in the 1976 Limousin field data analysis.

The first improvement in the basic contemporary group-sire model was to include a sire by contemporary group interaction effect in addition to the two main effects of contemporary groups and sires. This reduced but did not eliminate the model's dependence on the assumption of equal treatment within contemporary groups and random allotment of dams to sires. This interaction effect was routinely included in the field data analyses of the Hereford, Angus and Polled Hereford breeds.

The assumption of nonexistent genetic trend was of much concern to those researchers working in NSE particularly in field data analyses. Henderson (1973) discussed the use of "genetic grouping" to account for genetic differences among subpopulations of bulls and to compare sires across subpopulations. This resulted in the incorporation of a sire-birth year genetic grouping component to the basic contemporary group-sire model to account for genetic trend. This procedure was first used in the British breeds (Angus, Hereford and Polled Hereford) field data analyses of 1981 and the Limousin analysis of 1982.

Henderson (1973) discussed the use of the inverse of Wright's Numerator Relationship matrix to enhance the accuracy of genetic prediction. The relationship matrix provided the means to incorporate pedigree information in the analysis procedure and a method to account for genetic trend. However, taking the inverse of this matrix seemed computationally infeasible at that time. Henderson (1975) published a paper concerned with a rapid method for computing the inverse of a relationship matrix. This opened the door to one of the major improvements in mathematical models used for sire evaluation. This improvement was not incorporated immediately but by 1983 the Limousin and Red Angus analyses had incorporated relationships among sires. In 1984 Angus, Polled Hereford and Hereford began using the relationship matrix. Today all breeds use the relationship matrix in their analysis procedures. The use of the A-inverse, as it is now referred to, certainly was a major breakthrough in NSE because pedigree breeding now began to take on real meaning.

Even with the improvements in models, breeders and researchers alike continued to question the effect of non-random mating of dams to sires on sire evaluation results. At the same time (late 70's and early 80's) computer hardware was improving at a phenomenal rate. By 1984 it seemed feasible to include a dam effect in the basic model for sire evaluation. This was accomplished in the 1984 summaries for Hereford, Angus and Limousin breeds. In 1984 model dependency on difficult to verify assumptions was becoming less and less a problem in sire evaluation. The incorporation of dams into the model along with the A-inverse provided breeders the most accurate prediction of breeding values to date.

Another problem which continued to burden breeders and researchers alike was the older age at which bulls were entering national sire summaries. Scientists were concerned because the generation interval increases with the age of the parents in a population and this may result in reduced genetic change per year. Breeders like to use young bulls therefore they were making selection decisions based on information other than that contained in sire summaries.

Most researchers have contended that national sire evaluation was a means to an end rather than the ultimate in genetic improvement of performance characteristics. It was generally recognized that unless NSE was somehow merged with on-farm and ranch testing programs genetic progress would be slow particularly in the commercial industry (Willham, 1979, 1982).

Henderson and Quaas (1976) discussed methods for best linear unbiased prediction of breeding values utilizing records on large numbers of relatives as well as the individual's own record. The procedures were further discussed and developed in papers by Quaas and Pollak (1980) and Pollak and Quaas (1981). The mathematical model termed the "animal model" by these researchers was less dependent on hard-to-verify assumptions and it incorporated the sire's own record into the analysis. It also provided genetic values on dams and young animals not yet producing progeny. The procedure adjusted for the merit of the mates of the individual reducing substantially if not totally eliminating the effects of non-random mating. Finally, the procedure provided simultaneous breeding values (or EPD's) for direct growth and maternal ability for those traits which are maternally influenced.

The "animal model" along with the data structure the purebred beef industry had established by ten years of AI and NSE programs seemed to provide the ultimate in genetic evaluation of beef cattle -- across herd and/or generation evaluations of all individuals (male and female) in the breed. However, the complexity of the model resulted in a computational nightmare. In the 1980 paper by Quaas and Pollak an equivalent model, the reduced animal model, was also discussed. The reduced animal model was less of a computational nightmare but seemed beyond computing strategy and hardware of the time.

In 1983 a workshop sponsored by Winrock International concerning the prediction of genetic values for beef cattle laid the groundwork for the next improvements in prediction of breeding values. A dialogue developed between researchers and industry representatives; both groups came away from the conference with a greater understanding of the problems and possibilities for beef cattle genetic improvement. Richard Willham's opening statement concerning the purpose of the workshop - "to share ideas and experiences" - had certainly been accomplished.

The availability of large scale scientific computers and the experience gained in developing computing strategy for the sire-dam model in 1983-84 was encouraging with respect to the application of the reduced animal model. In late 1984 the model was applied in the Limousin and Brangus breeds. The Hereford, Angus and Gelbvieh breeds developed analyses based on the reduced animal model in 1985-86.

The technology in prediction of genetic values is rapidly being adopted across the beef cattle industry because now the commercial industry can share directly and much earlier in the purebred industry genetic progress. Young bulls not yet producing progeny now have genetic values (EPD's) comparable across herds and/or generations just as the older progeny tested sires have had for years in NSE. In 1985 the purebred cattle industry had moved from **National Sire Evaluation** to **National Cattle Evaluation.**

The application of the reduced animal model solves many problems in the prediction of genetic values; however, for maximum benefit it requires a multiple trait analysis. That is, the analysis of two or more traits simultaneously. Research with the Simmental and Gelbvieh breeds has resulted in sire summaries in 1986 for those breeds based on multiple trait analyses. The Gelbvieh analysis uses the reduced animal model while the Simmental uses a sire-maternal grandsire model (latter provides same values for sires as the reduced animal model). Other breeds are certain to follow as computing strategy and hardware develops.

Some Evidence that Sire Evaluation Works

The procedures used in National Sire Evaluation have been developed on a sound theoretical basis. Genetic theory has always been difficult to directly substantiate and must rely many times on indirect proof. Research efforts must be enhanced to continue challenging the theory and assumptions on which beef cattle genetic improvement programs are based. Without research and education the programs in place today would not have been initiated.

Perhaps the first place to look for evidence that sire evaluation has worked is genetic trend in breeds utilizing such programs. Figures 1-4 plot the genetic trend for weaning and yearling weight in the Angus and Horned Hereford breeds. It should be encouraging to all interested in beef cattle genetic improvement that the trends are positive. The genetic change per year is approximately the same in both breeds 2.4 and 4.6 pounds for weaning and yearling weights, respectively.

The number of bulls in the Hereford and Angus NSE programs became significant in years 6 and 7. Observation of figures 1-4 shows a gentle bending of the lines upward from that point. In both breeds the change after NSE is almost double that before NSE (eg. approximately 3 pounds/year prior to NSE (year 6) and 6 pounds/year after NSE for yearling weight.). Sire evaluation is directly responsible for part of this difference but perhaps as important indirectly is the change in philosophy and the awareness of performance caused by NSE.

In the spring breeding season of 1977 a project was initiated at the Northwest Georgia Branch Experiment Station (NWBS), Calhoun, Georgia to determine the magnitude of genetic change for single trait (yearling weight) selection. The selection practiced in this herd was through NSE, that is bulls used in the selection line were the top yearling weight EPD bulls from the American Hereford Association Sire Evaluation program. A control line was maintained to quantitate environmental changes in the project. Genetic trends for several traits of economic importance were obtained by regressing differences between the selection line and the control line on years. Most of the genetic change was due to sire selection since little selection was practiced on the heifer replacements going into the selection line. Hough et al. (1985) summarized the study.

Differences between the selection and control line are shown in Table 1. Observation of the yearling weight differences in Table 1 show a linear increase from 30 pounds in 1978 to 95 pounds in 1983. This represents genetic change of 14 pounds per year. This is double or triple the trend shown in the industry at present. Obviously part of the difference between industry change and genetic change in this research project is due to the single trait selection practiced. Single trait selection is seldom the situation in a beef breeding program; however, the project does show that rapid genetic change can be made in a beef cattle herd.

Observation of the differences in Table 1 between lines for other traits gives an indication of the response of traits correlated with yearling weight to the intense selection for yearling weight. Generally the correlated responses have been favorable. Birth weight has increased but not as dramatically as expected. Perhaps of some concern was the small change in postweaning average daily gain. Much of the progress in yearling weight seems to be coming through weaning weight. This result may point to the need for a multiple trait analysis which would more accurately account for the effects of selection at weaning on yearling weight (many records are lost between weaning and yearling). The project has not addressed changes in fertility; however, it is encouraging to see only small changes in calving difficulty and positive changes for scrotal circumference and pelvic size.

FIGURE 1. WEANING WEIGHT GENETIC TREND FOR ANGUS

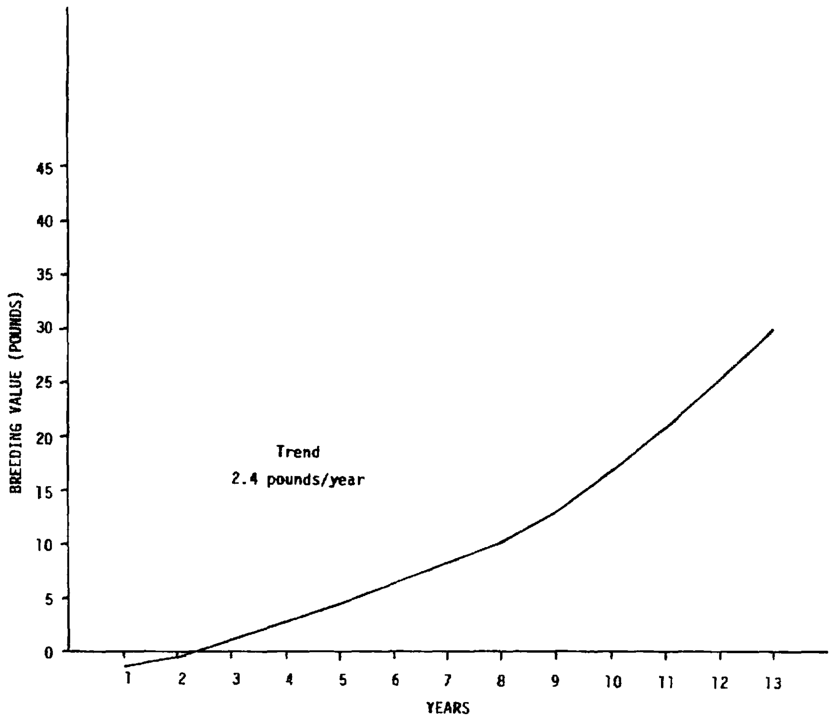


FIGURE 2. YEARLING WEIGHT GENETIC TREND FOR ANGUS

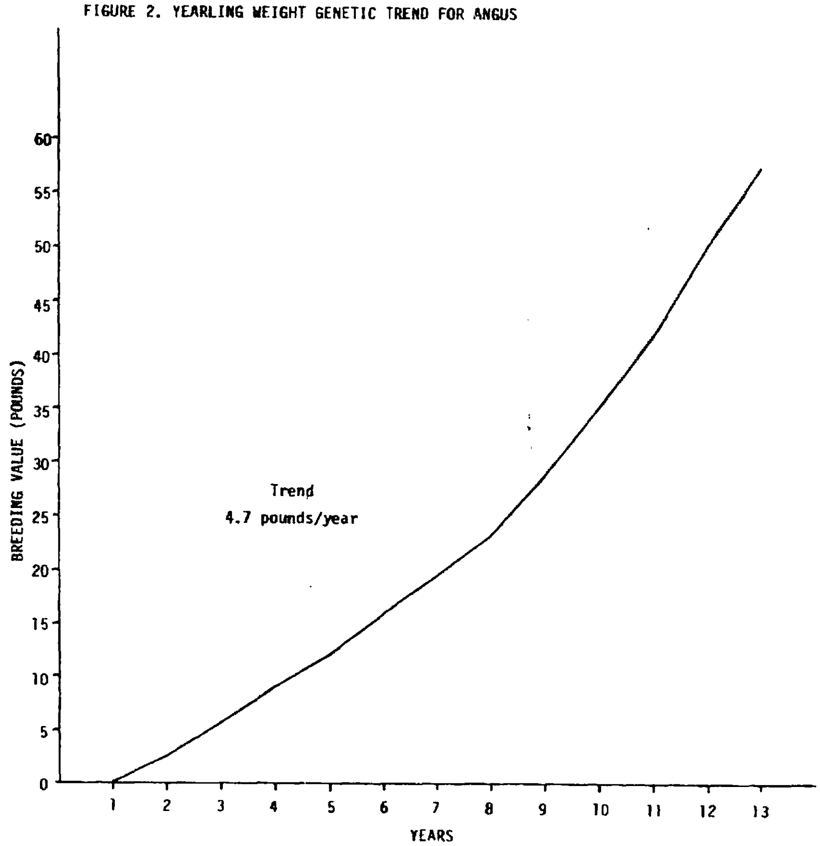


FIGURE 3. WEANING WEIGHT GENETIC TREND FOR HORNED HEREFORDS

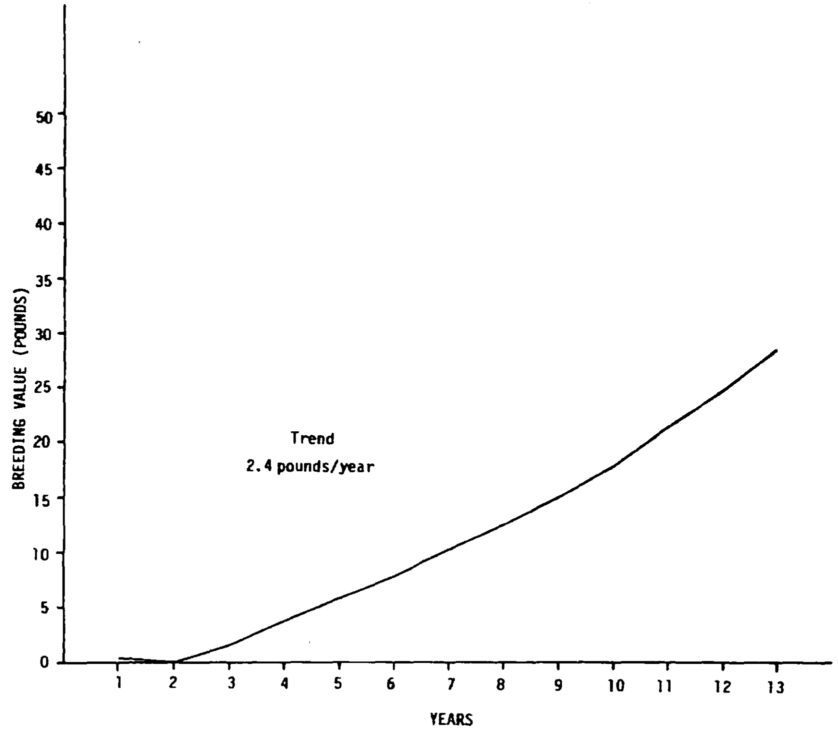
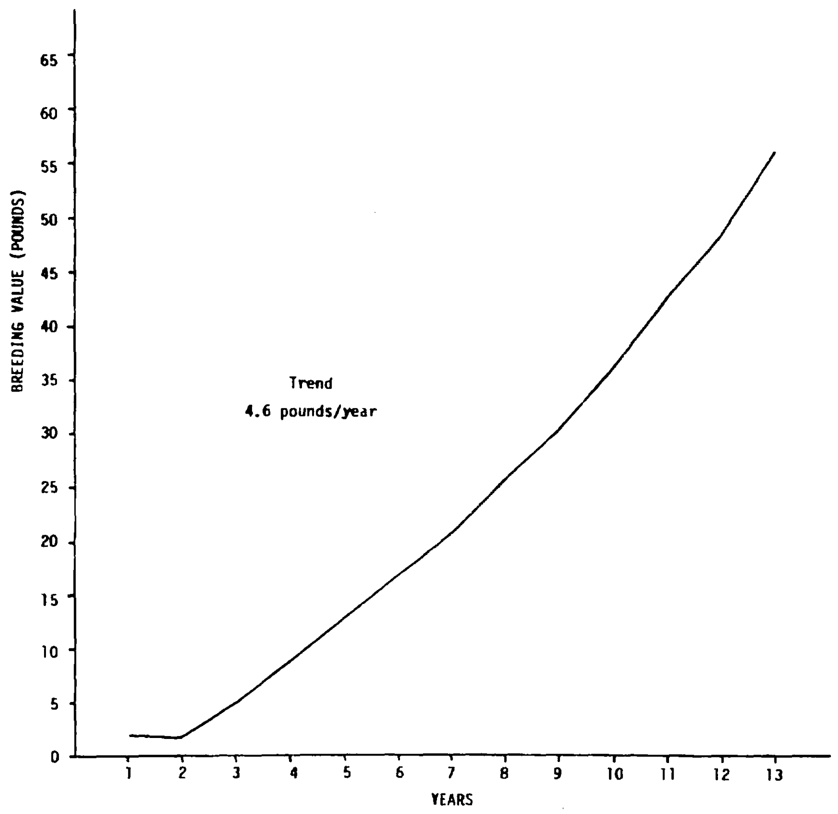


FIGURE 4. YEARLING WEIGHT GENETIC TREND FOR HORNED HEREFORDS



Figures 5 and 6 compare genetic trends in the NWBS experimental herd with genetic trend in the Horned Hereford breed. The line graphs vividly depict the possible genetic change from selecting the right bulls for a program. It appears that the genetic trend could be at least doubled and there still be selection pressure for the other characteristics such as structural soundness, maternal ability and fertility.

The Limousin and Brangus breeds have been analyzed for two years using the reduced animal model. Rank correlations between the two year's analyses for sires with progeny are high (greater than .9) for all traits as it should be.

A question of importance to both commercial and purebred cattle breeders is how well do the non-parent EPD's reflect the breeding worth of an individual based on progeny. A preliminary study concerning this question has been conducted in Limousin for postweaning gain. The study involved 71 bulls all of which had legitimate postweaning records. Expected progeny differences were computed for these bulls using the reduced animal model, first based on record plus pedigree and secondly based on only progeny and pedigree. The 71 bulls all had between 10 and 30 progeny each. The rank correlation between these two sets of EPD's was found to be .59. This is in contrast to correlations for within contemporary group ratios and actual gain with the EPD's based on progeny only which were .17 and .06, respectively. This does not prove conclusively that non-parent EPD's are the best predictors of breeding worth; however, it does show that basing selection decisions on weights and ratios may not retain those bulls which will have high EPD's based on progeny. These three correlations point out the necessity of accounting for genetic competition in the contemporary group when comparing across herds.

Generally, National Sire Evaluation has been firmly established in several beef cattle breeds. Theoretically the procedures are sound; however, considerable research needs to be done in refinement of the procedures and education of producers for maximum success in the industry. Indications are that programs are working and genetic change is taking place in the cattle industry. The time is now for the industry to determine the future of beef cattle genetic improvement. The year 2000 is only 14 years away, the same amount of time NSE has been available to the industry. Fourteen years is hardly two cattle generations -- plans for the future must be formulated immediately if beef cattle breeding is to address the needs of the 21st century.

FIGURE 5. GENETIC TREND FOR THE NORTHWEST GEORGIA STATION HERD AND THE HORNED HEREFORD BREED

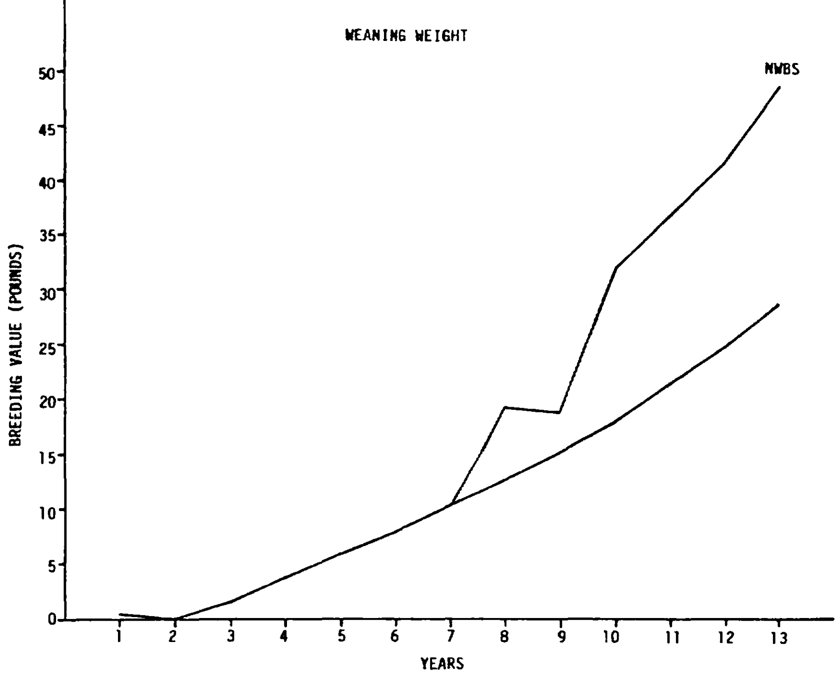


FIGURE 6. GENETIC TREND FOR THE NORTHWEST GEORGIA STATION HERD AND THE HORNED HEREFORD BREED

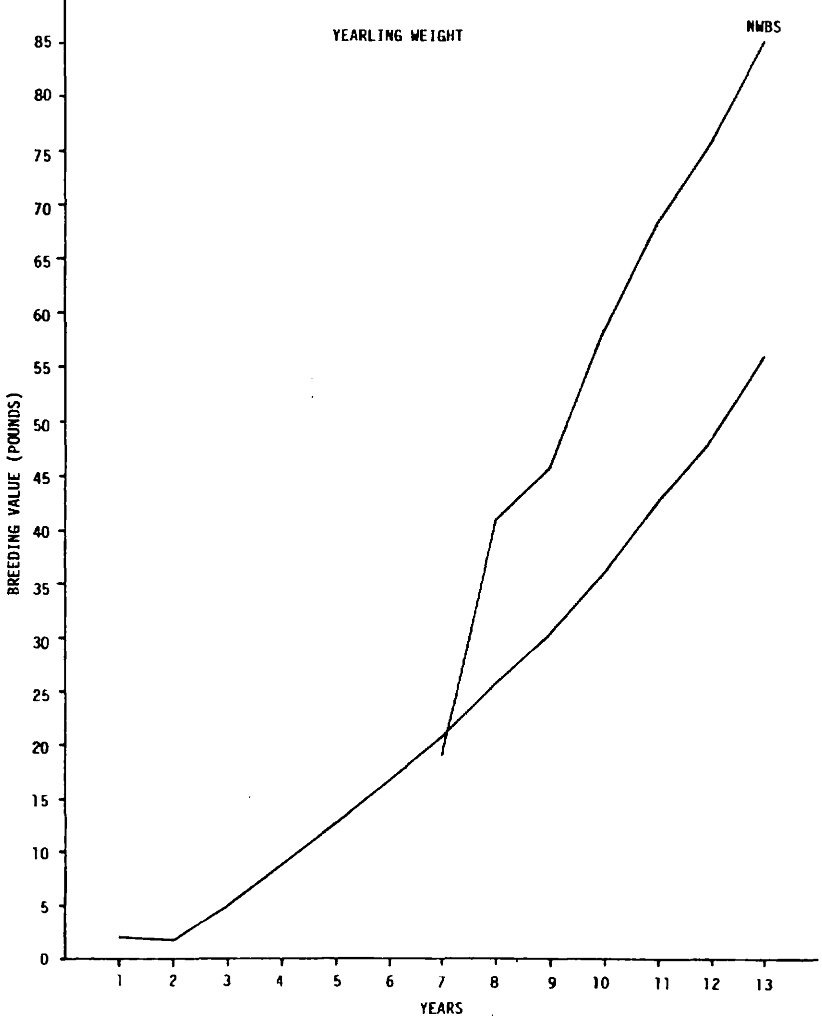


TABLE 1. DIFFERENCES[1] BETWEEN THE SELECTION LINE AND CONTROL LINE

Trait	Years 1978	1979	1980	1981	1982	1983	Genetic change/ year[3]
Birth weight (lb)	3.4	3.6	2.8	4.0	1.5	6.8	.6
Calving ease[2]	.10	-.13	.09	.25	.13	.28	.05
% live calves within 24 hours	-1.1	-.1	1.5	-4.5	-2.5	-.1	-.3
Adjusted weaning wt (lb)	6	19	16	48	43	68	11
Postweaning ADG (lb/day)	.13	.14	.21	.13	.13	.18	.02
Adjusted yearling wt (lb)	30	41	54	67	65	95	14
Yearling hip height (in)	1.4	1.5	1.6	2.4	1.7	2.2	.3
Yearling fat thickness (in)	.02	-.01	---	-.01	-.03	-.01	0
Yearling scrotal circumference (cm)	---	1.0	.2	1.3	.8	2.0	.3
Yearling pelvic area (sq cm)	8	11	13	16	7	13	1.3

Table adapted from Hough et al. (1985).

[1]Selection line least-squares mean - control line least-squares mean.

[2]Score 1 = no assistance, 2 = minor assistance, 3 = major assistance, 4 = cesarean section and 5 = abnormal presentation.

[3]Regression of line differences on years.

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Sire Summary Data—What's New & Why

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The objective of a genetic evaluation program is to condense potentially large volumes of information into a single usable value for each animal. Producers can compare these values and make selection decisions based on the comparisons. Prior to the availability of field records in large enough quantities to make meaningful evaluation programs operative, producers themselves would recall information on the pedigree of an animal, on its own performance and, if available, on its progeny to make decisions regarding the animal's merit. The genetic evaluation systems also combine these varying sources of information, each weighted appropriately, to come up with values that can be compared fairly. The end product of the sire evaluation programs is the sire summary report. The objectives of this presentation are to discuss the information contained within sire reports, to include a discussion of expected progeny differences, accuracies, the published traits and some potential uses of the information within the sire summary.

Expected Progeny Differences (EPD)

The genetic values published for each trait in the national sire summaries are called the expected progeny differences (EPD). The EPD's are usually expressed in the units of the trait being measured. For example, the EPD of a bull for weaning weight would be presented in pounds. However, in surveying any sire summary report, one quickly notices that the EPD's may be either negative or positive. The question often arises as to what the expected progeny difference really tells us.

To appropriately describe an EPD requires considering the physiology of reproduction. Bovine have 30 pairs of chromosomes which carry the genetic code for how the animal looks and performs. The fundamental principle of genetics is that a parent passes on one chromosome for each pair to its progeny. That is, each parent passes 30 individual chromosomes, one from each pair, to the progeny and the remaining 30 come from the other parent. Which chromosome from a pair appears in a gamete (sperm or egg) is completely random. If we were to line up the 30 pairs of chromosomes of a particular bull and randomly sample one chromosome from each pair, the number of different sperm produced by that sampling process is amazingly large. In the bovine, a bull (or cow) can produce through this sampling process 1.073 billion genetically different sperm. The temptation at this point might be to throw up one's hands and consider genetics a hopeless situation. On the contrary, it's quite possible to be successful. Each of the gametes produced by an animal carries genetic material to the progeny and has a value relative to each trait of interest. The EPD estimates the average value of the gametes produced by an animal for a particular trait. Using an animal with a better EPD than another says on average we expect to get better gametes from that animal. Following this policy leads to greater success as we continue to keep the odds in our favor.

Genetic trends in the various breeds show producers have been successful at doing this.

The EPD (average value of an individual's gametes) is presented relative to some base or average parent in the breed. As any one individual can be better or worse than the average parents, the EPD's can be negative and positive. It is important to remember, as will be discussed later, that the definition of a base or average parent is arbitrary and depends exclusively on how the population base is defined. The EPD's can be used correctly regardless of the definition of the base in the breed by simply comparing the EPD's of two animals. For example, a bull with an EPD of +20 is expected to produce progeny which on average weigh 30 lb more at weaning than a bull with an EPD of -10. Regardless of our definition of the base for that breed, this difference between the bulls will remain the same. The term EPD is the EXPECTED PROGENY DIFFERENCE, meaning it predicts the difference in performance of progeny from two different parents.

Let's return to the idea of the base or breed average parent and why it is important relative to the interpretation of an EPD. Assume we are looking at a population that has undergone positive genetic trend. That is, the animals in the population today are on average genetically superior for some trait than those from years past. In this population, what is the base? One could define the base as the average animals at the time the data was first being collected or as the average parent in the population today. Figure 1 shows a population undergoing genetic trend and also shows the implication of two definitions of an average parent. If the base was defined as the average individual at the beginning of data collection, then for a population with a positive trend most of the EPD's computed would be positive. Conversely, if it was defined as an animal in the last year, then most of the EPD's would be negative. Also shown in Figure 1 is a point representing bull A which is 10 lb less than the average animal in the last year. If our base was defined as the last year, that bull's EPD would be -10. However, the population has changed by over 20 lb, and if the definition of the base referred to the average animal in the first year of data collection, our bull would have an EPD of +10. Is he a good bull or not? Bull B in Figure 1 is 10 lb better than the average animal in the last year and 30 lb better than the average in the first year. His EPD would be +10 or +30 depending on the definition of the base.

Figure 1 makes the concept of EPD's seem highly confusing. It is, however, quite simple. First, notice that regardless of our definition of a base, bull B is always 20 lb superior to bull A. That is, as previously stated we would expect the progeny of bull B to weigh 20 lb more at weaning than those for bull A regardless of where we have defined our base population. Second, the EPD does not imply how much additional weight you can expect to see in your herds from using a particular bull. Finally, one cannot look at the EPD's of bulls published in different breed summaries and make a comparison. A +20-lb bull in one sire summary does not mean that bull is equal in genetic merit to a bull with a +20 evaluation in a different breed. The base and average merit of animals to which those two +20 EPD's refer could be quite different across breeds.

To summarize, the EPD of an animal is an estimate of the average genetic value of the gametes produced by that animal. The EPD published is relative to some breed average parent, the definition of which is arbitrary. The difference between two EPD's will always be the same regardless of how we define the base for the breed. And finally, EPD's published for one breed cannot be compared to the EPD's published in another breed's summary.

Accuracy

Expected progeny differences are estimated from available data. The question arises as to how accurately an animal's EPD been estimated. In all sire summaries, a value is reported which indicates the relative degree of accuracy associated with each EPD. Beef producers have been exposed to many different measures of accuracy. The one currently recommended by BIF will be discussed.

The current accuracy figure recommended by BIF is a number between 0 and 1 (or if presented as a percentage, between 0 and 100%). The higher the value, the more accurate the evaluation.

The interpretation of this accuracy is:

> The degree of uncertainly removed by considering the data available on an animal in its evaluation.

There are several components to this interpretation that need to be considered. First, it is an estimate of the uncertainty removed. That is, for a bull with an accuracy of .1 (or 10%), 10% of the uncertainty has been removed by the information available on the animal. An accuracy of .95 (or 95%) means 95% of the uncertainty has been removed by the data available. The question is, 10% or 95% of what uncertainty? If one were to chose an animal randomly without regard to any information available, the level of uncertainty regarding that animal's genetic merit is 100%. Using information about the animal to assess its merit removes some of the uncertainty regarding that animal's potential. Obviously, as information on an animal accumulates, our level of uncertainty decreases. This particular accuracy is conservative by nature. Large amounts of information are necessary to achieve high accuracies which, as we will see, means only bulls with large numbers of progeny achieve high accuracies while pedigree indexed or performance tested bulls and cows (even with progeny) have very low accuracies.

What information contributes to our knowledge about an animal? Perhaps the first information available on an individual comes from its pedigree. An index combining information on known ancestors (usually the sire and dam) can be used to estimate an animal's merit. This index is called the Pedigree Index. The second source of information could be the performance of the individual itself. For a certain portion of the population, information on progeny performance becomes available (and in some cases progeny of the individual's sons and daughters).

Let's examine the contribution of information from each of these sources relative to their impact on accuracy and their importance relative to each other. The pedigree index can be obtained by combining the genetic evaluation of an animal's sire and dam. This index predicts the genetic merit of the average progeny born from the mating of a particular bull to a particular cow, which gives us an advantage in selecting between two animals from different parents but not between full sibs as their pedigree indexes are identical. Now recall the number of possible gametes produced by either a bull or a cow. The number of genetically different progeny produced from a mating is 1.073 billion times 1.073 billion (an unimaginably large number). This tells us not to expect the pedigree index to be accurate relative to using other information.

The pedigree index predicts the EPD of the average progeny born from a mating (what we expect). Performance information helps to determine if the progeny born is above, below, or at the expectation of that mating. Including the performance information in the estimation of the EPD increases the accuracy of the animal's evaluation. Very high accuracies are not achieved, however, until an animal has progeny. For males, where numbers of progeny can be large, the accuracy approaches 1. For females, the progeny numbers are limited (even with the use of embryo transfer) and accuracies as high as those for males are not observed. Intuitively, achieving high accuracies with progeny testing makes sense. We are trying to estimate the average value of an individual's gametes. The more progeny we observe, the more gametes we have observed and the better our ability to estimate the average value. It should be pointed out that once we achieve a relatively large number of progeny per bull (e.g., greater than 50 to 100), that most of the information regarding an animal's EPD is coming from the progeny and the value of its own information or pedigree index is greatly reduced.

A bull's expected progeny difference is published along with a measure of accuracy and often with the number of progeny the bull had or what is called the effective progeny number. In general, the greater the number of progeny, the greater the accuracy. However, the number of progeny itself does not take into account how the progeny are distributed. Bulls with all of their progeny in one herd usually are evaluated less accurately than bulls that have the same number of progeny distributed across many herds.

An alternative representation of the number of progeny for a bull is called the effective progeny number. This is a number that takes into consideration not only the number of progeny the bull had but also the distribution of those progeny across herds (contemporary groups). For bulls with exactly the same number of progeny, the one with the wider distribution will have the higher effective progeny number and consequently the higher accuracy.

Why consider accurcy in a sire summary? The EPD's are estimates based on current information. They are subject to change as more informtaion becomes available. Some bulls will go up, some will go down, and some will not change. Does a higher accuracy mean a bull is less likely to change? The answer is no, but the magnitude of likely changes is greatly reduced for high accuracy bulls. Figures and show the change in bull proofs from two evaluation runs representing three years different in data. Figure is for low accuracy bulls and Figure for higher accuracy bulls. Note the greater spread in low accuracy bulls, 91.5% of high accuracy bulls changed by less than 3 lb (plus or minus) while 64.5% did for low accuracy bulls. Change occurred in both (and is just as likely to occur in both) but at a much smaller magnitude in high accuracy bulls. If one is going to use low accuracy bulls and is concerned about risk, he should use them on a small fraction of cows or many should be used to spread the risk. In EPD's, the components of accuracy are considered in estimation, hence, one need not avoid low accuracy animals in selection programs.

Traits Published

We will not attempt to describe or discuss the different traits published in all the national sire summaries. We do wish, however, to discuss the general concept of the evaluation of bulls both in a direct and maternal role. A bull has several influences in a herd. First is the direct impact on progeny performance and second through the daughters left as replacements. We will use weaning weight as an example. The direct effect of a bull is the genes that he passes to progeny which determine in part their ability to grow through weaning. An evaluation of the bull as a maternal grandsire is an evaluation of his impact on weaning weight through his daughters.

The direct evaluation of a bull is fairly straightforward in interpretation. The evaluations for bulls as maternal grandsires needs further consideration. A bull passes half of his genes to his daughter, which influences her ability to provide a maternal environment for her calf. An evaluation can be obtained for the maternal ability of a bull's daughter. The major influence a daughter has on the weaning weight of her calf reflects her ability in milk production. The EPD's published for these bulls can be thought of as measuring the influence of the milking ability of a daughter in pounds of calf she weans. Hence, the interpretation for a bull with a +10 EPD for maternal ability is; his daughters are expected to produce calves which weigh on average 10 lb more than daughters of another bull with an EPD of 0, the additional weight being achieved mainly through their milking ability.

The EPD for maternal ability answers the question of what impact does the milking ability of this bull's daughter have on weaning weight. This EPD, however, does not address the complete impact a maternal grandsire has on the weaning weight of his grandprogeny. Figure 2 represents a schematic drawing of a calf's record. We see the genes passed directly to the calf by the sire. The impact of these genes represents the direct contribution of that bull. We also see the solid line going from the maternal grandsire to his daughter which represents the genes he passes to her for maternal performance. The third line in Figure 2 (the dotted line) represents the passage of genes for direct growth from the maternal grandsire to his daughter and in turn on to the grandprogeny. On average one-fourth of the genes for direct growth in the calf come from its maternal grandsire. To answer the question, what is the total impact of a bull's daughters as dams, one needs to consider not only the genes he passes to his daughters for maternal ability but also the genes that he passes to his grandprogeny (through his daughter) for direct growth. The total impact of a bull in the role of maternal grandsire is the maternal grandsire effect, which measures both the maternal and direct contribution of that animal. The evaluation for the maternal grandsire effect (called total maternal by some and maternal weaning weight by others) is also published in pounds of weaning weight. These evaluations were those historically published in past summaries for organizations considering the maternal grandsire.

Producers now have three evaluations of a bull to examine when considering selection for weaning weight. The first evaluation is the bull's direct contribution to the calf crop for growth. The second is the bull's potential in milking ability of his daughters, and the third is the total impact of a bull as a maternal grandsire.

Use of the Sire Summaries (Specialization Seed Stock)

The theme of this symposium is supplying specialization seed stock to commercial producers. It is our contention that a comprehensive sire summary contributes greatly to achieving precisely that goal. In examining any of the sire summaries one is immediately struck by the variation in genetic merit of bulls for all traits published. It seems safe to say that one could set up a selection program that would increase (or decrease) any of the weight traits or any of the maternal characteristics of daughters. The variation in sire evaluations is large enough to accommodate either goal.

We strongly advocate that breed organizations publish bull evaluations regardless of the level of performance of those individuals. By doing so, the entire spectrum is available to the producer. He can direct his selection goals to produce the type of animal that his particular commerical customers are interested in purchasing. Perhaps the real question regarding the sire summary and its value in producing specialized seed stock is whether or not all the traits of interest are summarized for bulls.

The information in the sire summaries not only is of value in determining how bulls rank and how their progeny perform for particular traits but also in finding bulls that meet certain requirements across all traits. Producers are well aware of the correlations among various economically important traits and also are aware of the importance of multiple trait selection. Weight traits (e.g, birth weight, weaning weight and yearling weight) are all postively correlated. Any increase in weaning weight or yearling weight, in general, implies a corresponding increase will be observed in birth weight. Where the former may be desirable, the latter may not. However, the correlations among these traits are by no means perfect (i.e., they are less than 1). This implies that exceptions exist. For example, bulls exist that have progeny that grow well postnatally but are below average in birth weight.

The higher the correlation between characteristics, the more difficult it is to find exceptions. Publications of large numbers of bulls with fairly accurate evaluations will increase the probability of finding exceptions for multitrait selection. Multitrait selection against undesireable correlations is possible, but only through accurate evaluations. Some organizations offer a screening service to find identifications of bulls which meet producer's specifications to enhance the multiple trait selection concept and maximize the use of summaries for this purpose.

The final use of the sire summary which we consider to be an important function of publishing such a report is the use of the summary as a management tool. Evaluations are available in several summaries on the birth weight (or calving ease) evaluation of bulls. These evaluations can be used to attempt to reduce calving difficulty problems by choosing bulls with low birth weight (or high calving ease) for use on first calf heifers. The breeding objectives for the young, higher risk portion of the cow population may be to circumvent possible problems rather than to contribute to the overall selection program. Selecting bulls based on information available in the sire summaries allows producers to design selection (or management) breeding goals, and the diversity within any breed essentially guarantees the existance of animals which will meet those goals.

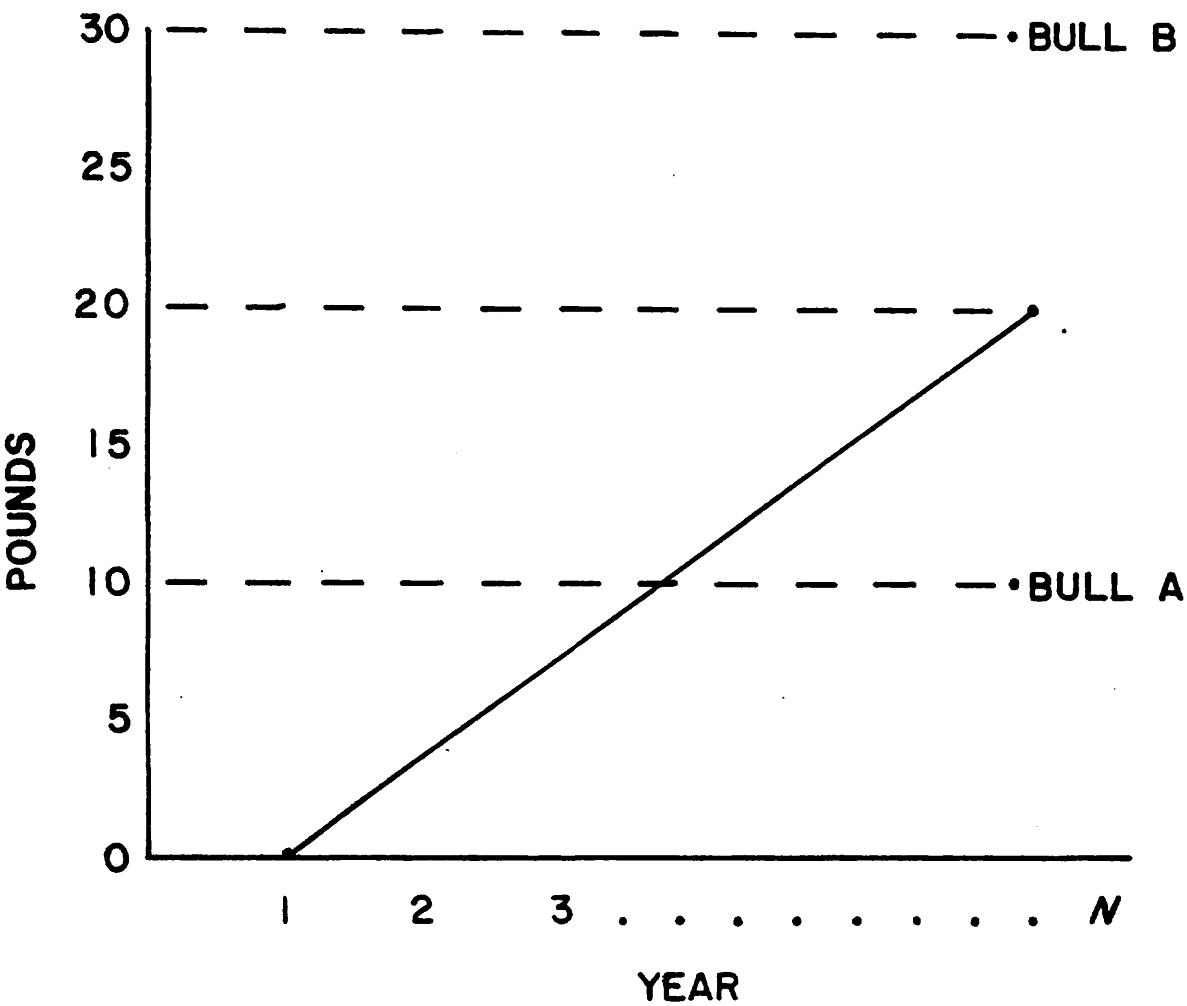


FIGURE 1. A POPULATION UNDER POSITIVE GENETIC TREND.

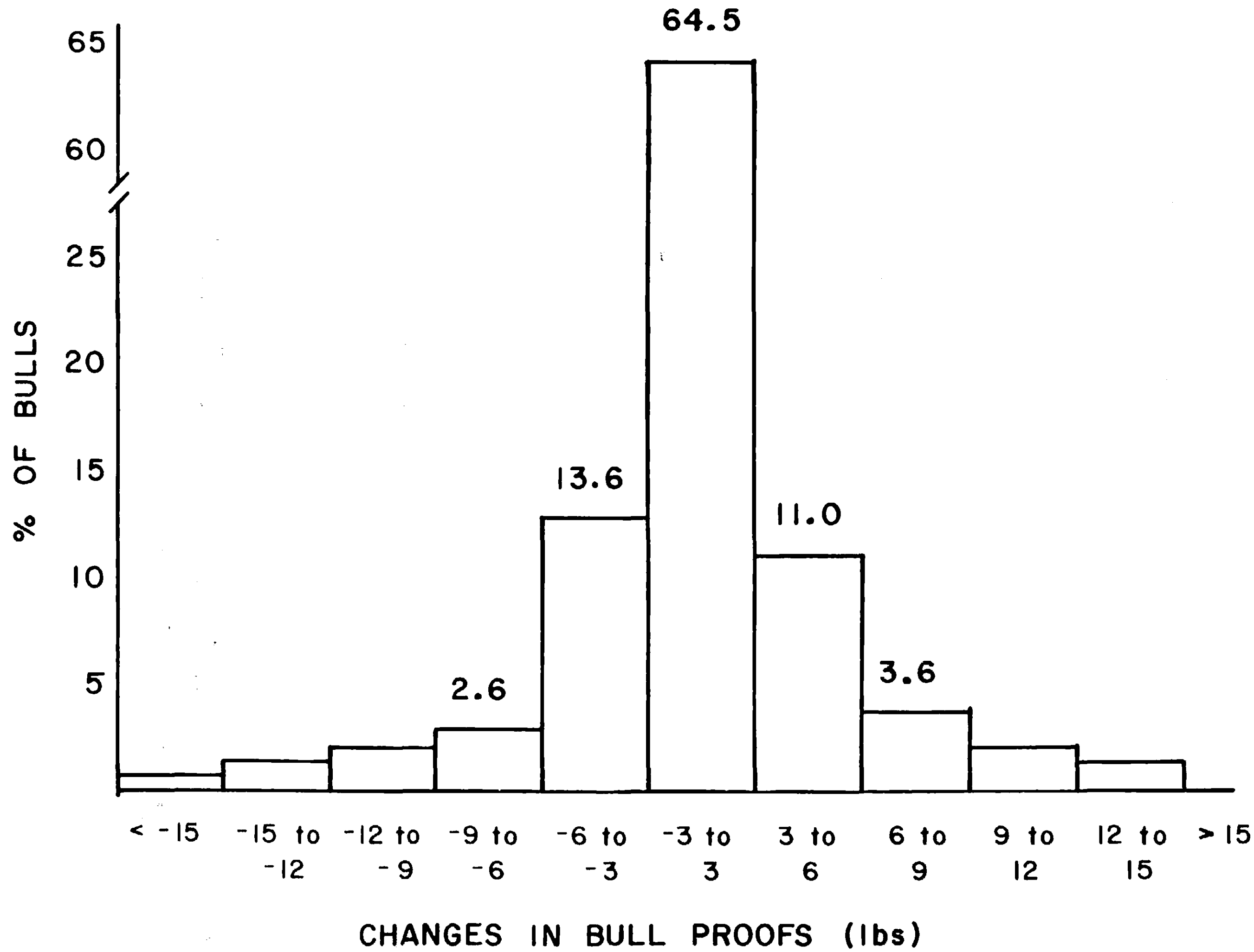


FIGURE 2. HISTOGRAM OF CHANGES IN BULL EVALUATIONS FROM TWO EVALUATIONS 3 YEARS APART FOR LOW ACCURACY BULLS

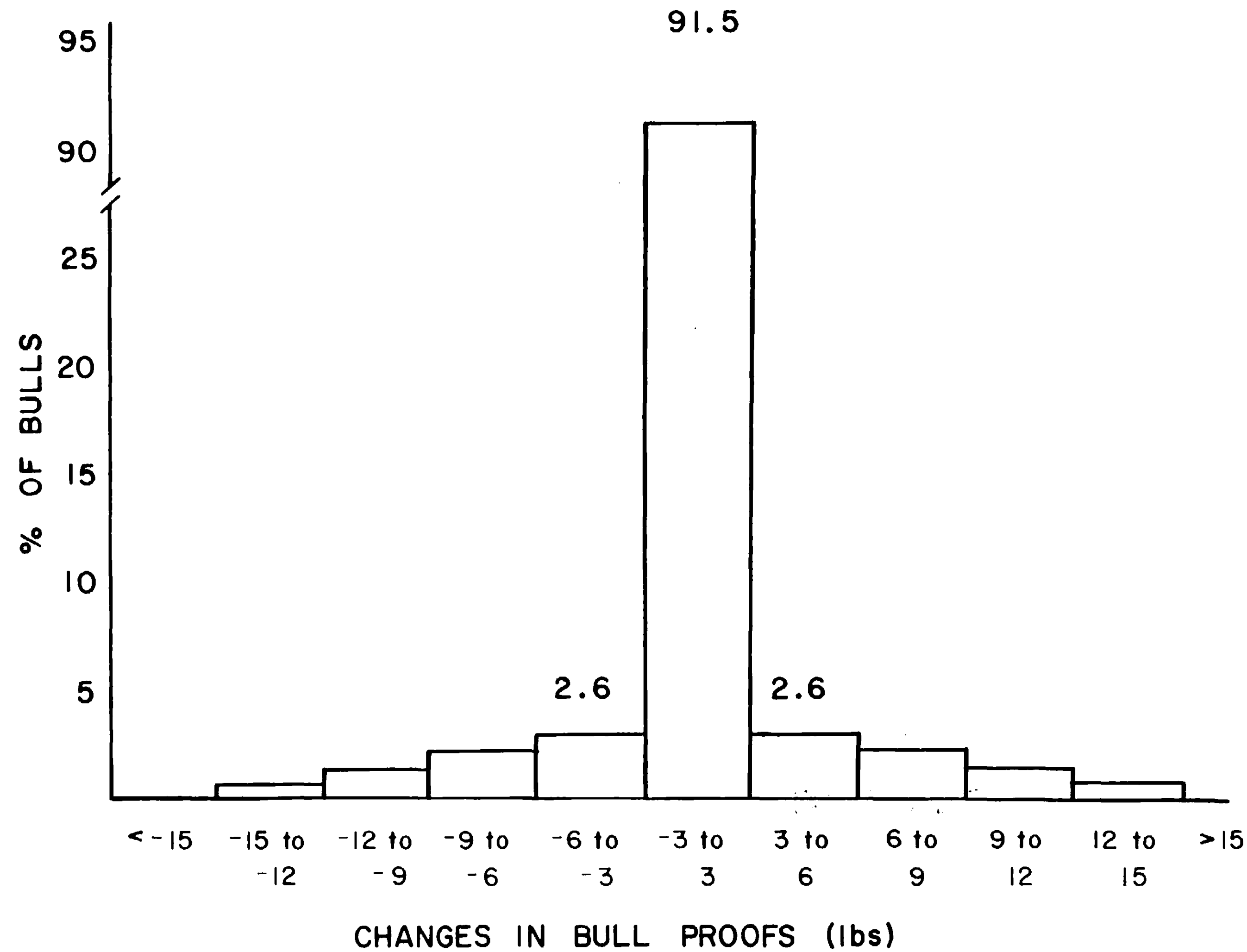
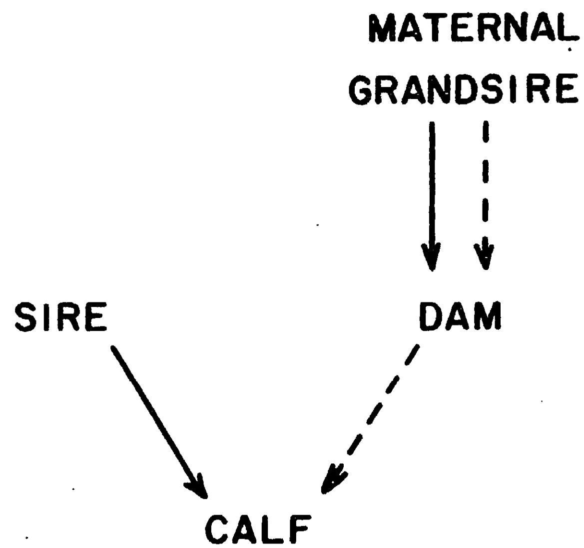


FIGURE 3. HISTOGRAM OF CHANGES IN BULL EVALUATIONS FROM TWO EVALUATIONS 3 YEARS APART FOR HIGH ACCURACY BULLS



——— = GENES PASSED TO DAUGHTER FOR MATERNAL ABILITY

- - - = GENES PASSED TO GRANDPROGENY FOR DIRECT GROWTH

FIGURE 4. PEDIGREE OF CALF WITH RECORD

SIRE SUMMARY DATA - UNSCRAMBLING THE CONFUSION

Roy A. Wallace
Beef Sire Director
Select Sires, Inc.

Many hours have been spent in talking about and planning programs of National Sire Evaluation. Of course since the beginning of domesticated animal breeding, animal breeders have tried to predict the true genetic worth of animals. For many years the animal breeders and stockmen evaluated the animals genetic merit based on its phenotype or how it looked. All of us know that every animal is the result of the combination of his genetic make up and his environment. The biggest problem that all of us had in the past is being able to sort the environment from the genetics. As we have seen throughout the years, we have estimated the heritability of many of these traits to be much higher than they are when we really get them into the field. So because of it I think we have a real big educational job in front of us as far as National Sire Summaries and also the Reduced Animal Model are concerned. The advancements that have been made in the past few years are going to make the job of sorting the environment and sorting the genetics, much easier than we have been in the past. Most of the purebred seedstock has been sold in the United States is a result of phenotypic selection. With the advent of the National Sire Summaries and also the Reduced Animal Models, hopefully we will start getting people to look at the true genetic value of the cattle and not just phenotypic selection alone.

As I look at the problem of implementing and utilizing National Sire Summaries throughout the beef cattle industry, I would like to break it down into three or four different places.

The most important area that I think has to be done is in education. As I look at the educational aspect of educating both the commerical and purebred livestock industry about National Sire Summaries, then I look at three major places that this education is going to be done.

1. Breed Associations
2. Extension & Land Grant Universities
3. Breeders and A.I. Studs.

As we look as the education from a breed association standpoint, I feel that it is extremely important that breed associations put a major emphasis on educating not only their breeders but also their commerical customers on the values and how to interpret the National Sire Summaries and also Reduced Animal Models. I think it is extremely important from the standpoint that people within the industry are starting to demand to know more about the cattle that they have purchased. Much of the purebred livestock industry in the past has been predicated on hipe and environment and I think that people today that are wanting to purchase cattle and are going to want to know the facts and figures and have the ability to make intelligent decisions. I have had the opportunity this past year of working with a number of breeders both commerical and purebred, talking about and discussing the National Sire Summaries. If you get a group of commerical breeders together and talk about the National Sire Summaries along with the Reduced Animal Models, they become extremely interested in it. They also have done a much better job of buying the cattle that will work for them. I think it is extremely important for breed associations if they are going to survive this particular crisis, that they are going to have to offer more than just a registration certificate. I think that the Reduced Animal Model gives them the opportunity of having something in the market place that the only way that you can get this information is to have a registered animal with a registration certificate on it. This will make the registration certificate have real value. I think in the very near future most purebred and commerical breeders are going to demand that there is this kind of availability of data on all of the breeding stock that they buy. Not only just the bulls they put into their program, but also females that they add to their program. Because with the difficult economic times as they are, people cannot afford to make mistakes, and one of the advantages of this particular program is that we do make less mistakes in breeding desicions.

The next area that is going to be very important if we are going to be able to get the concepts of National Sire Evaluation and also the Reduced Animal Model put across, and that area is Extension and Land Grant Universities. Interestingly enough I see some real problems in this area, and I realize I might be stepping on some toes today, but I think we are all among friends and we need to discuss this particular aspect of the program. The majority of the Extension work in so far as cattle breeding is concerned has been in most areas, strictly the utilization of central bull test stations and also some graded bull sales. However, I think it is time for the Extension people in the United States to take a new look at what they are doing from a genetic standpoint as far as their producers are concerned. Granted the central bull test stations probably serve a very useful purpose and I am not belittling those stations, all I am saying is that those stations might have passed their usefulness. Granted there are lost of arguments out there and I am sure people will tell me how much advancement was made with central test stations, etc. I will agree that there probably has been advancements made with utilizing central test stations, however, I think it was probably more of an awareness factor than it was truly sorting the genetics. Of course I have purchased a lot of bulls and probably will continue to purchase bulls from central test stations, however, I do not rely near as much upon the information of the bull himself from the test station, as I do from his pedigree information, because all of us must realize that when we put cattle from 50 to 60 different environments together that the heritabilities of those traits are very low coming out of central test stations. I think these particular test stations can have some real merit in parts of the country that they can be used for the utilizations of small breeders and be used as a marketing tool. But ladies and gentlemen lets not continue to tell everybody that they are the ultimate in beef cattle performance programs, they are a marketing tool and I think after we get past the marketing aspect I question their real usage. I think all of us in the performance programs need to take a long look at central test stations and how they are going to fit into the future of beef cattle programs, because of the utilization of National Sire Summaries and the Reduced Animal Models, you have available to you better information than you ever have before.

I think it is extremely important that the Extension Personnel in the United States start to think about how they are going to teach and also deciminate the knowledge about the Reduced Animal Model. Certainly I think it will inhance the genetic capabilities of the cattle within the particular areas and I think there is a big job waiting us of being able to sell this program to not only purebred but extremely important to the commerical cattle breeders. Because if we can sell this program to the commerical cattlemen, we won't have to worry about selling it to the purebred cattle business because if the commerical cattlemen desire it, and are willing to pay for it, the purebred breeders will therefore have to fall in line or they will not be able to merchandise seedstock.

The other area that I am sure that there will be a lot of education done is in the area of A.I. organizations and also individual breeders. I think it is extremely important for people like us in the A.I. business to educate our customers on the programs on how they work. This last year our particular organization has spent most of its time in the meetings that we have held across the United States in strictly education from the standpoint from the National Sire Summaries. We feel it is extremely important to have a very well educated consumer. Because a well educated consumer is a better buyer, and when you have better buyers you have more satisfied buyers. I think the wise purebred breeders are going to also figure this out shortly because education to their consumers is also going to be very important. I get extremely upset with purebred breeders when they talk about, this guy came to buy some bulls, he didn't even want to look at the performance records, etc. Well why didn't he? Probably the first reason is that the guy didn't understand them, and they have never been explained to him in a good way. I know for certain that if you sit down with most good cattlemen today and talk about the Sire Summaries and the Reduced Animal Models and performance information, those people are ready and willing to listen. One of the problems that many of them have when they go to purebred operations, is that they are afraid to ask questions because they are not knowledgeable enough in the particular areas. I think it is extremely important to use as providers of seedstock to both purebred and commerical breeders to educate these people on the different information that is available to them. You certainly want to have the people buying the right animals from you to do the job. If someone buys a young bull with a Birth Weight EPD of +7 pounds, and takes him home and turns him out on heifers, and he breeds a set of heifers and has difficulty in calving, you are not going to make any friends and you are going to have a very upset customer and your name is going to be spread across the area where the customer lives in as selling hard calving bulls. Where at the same time there might have been a bull available that had a +1.5 to +2 pound EPD that would have worked extremely well on heifers. I think that these are some of the things you are going to have to watch out for, especially in the industry today. As I travel across the country, more people are getting upset at the kind of bulls that they are buying, especially when it pertains to calving difficulty. As we have increased the growth and frame size of these cattle, we have also increased the calving difficulty in all breeds of cattle. There are virtually no easy calving breeds available today. One must go into the population of the breed and find the easy calving bulls. So it becomes extremely important that the consumer or the person buying the bulls knows what he is buying. Because if he takes it home and it does not perform up to his expectations, he is going to be extremely disappointed. Extremely disappointed customers have a way of never coming back and also never having any of their neighbors come back.

The other thing that purebred breeders must understand is that to get the bulls with the right kind of numbers as we say, and that is bulls that have very balanced traits with good yearling weight, good growth, good maternal, and relatively low birth weights within the population. Breeders are going to have to study the summaries and stack the pedigrees together of the bulls that have the right kind of numbers. In my particular situation in buying bulls, I am always scanning the country looking for bulls that have the right pedigrees together. It is extremely disappointing to me today as I travel across the United States and analyze hundreds of bulls, data, and pedigrees, to see what kind of bulls are being put together within the population. As we got printouts on all the top 200 young bulls in many of the different breed associations, we saw what was happening within the population as far as putting together the right kind of bulls. Sure a lot of bulls are sired by the right bulls but the dams are by the wrong bull. I think it is going to be very important to people throughout the industry, that if they want this program to work and if they go out and sell this program, they are going to have to put together the cattle that fit the program. It is not hard to do that particular kind of thing today, as long as you use some prudence in your sire selection. You are going to have to use, yes, some of the older bulls with high accuracies, because you don't want them falling out of bed on you overnight. Yes, you are going to have to give up some growth to get some milk, and you are going to have to give up some growth to get some lower birth weights. But I think it is extremely important that you as individual purebred breeders define your market. Do you want to build a market for light birth weight, high milk cattle? Do you want to build a market of high growth cattle? Do you want to build a market of minimal calving ease cattle, etc.? You as an individual breeder must decide which particular trait you are going to emphasize in your particular operation. Then you must put together the bulls that have the high accuracies, and the high EPD's in those particular traits with their daughters and granddaughters. It is going to be extremely important in the near future that you put these traits together and that you design the kind of cattle that the industry is going to want. But as you travel across the country you see very few people wanting to do this particular thing. It is not glamorous, it is not sensational, all it is is utilizing all of the genetic material that we have available at our hands at no charge really and putting together this material into packages that can be utilized within the purebred and commerical cattle industry. I don't think many of you realize that if you decided you were a commerical breeder, and if you wanted to go into the Angus breed and buy 20 bulls that had Yearling Weight EPD's of +50 pounds, and Maternal EPD's of +5 pounds, I don't think many of you realize how hard it would be to find those particular bulls in the population. Yes, they are in the population. However, you are not going to usually find them in one place and secondly you are going to have to travel across the country quite a bit to find those particular figures put together on a set of bulls. I think those kind of figures are very easy to come up with today, if you stack the right bulls together and certainly you should be able to turn out volumes of bulls with the bulls that are available to you today with that kind of EPD's on them.

I think certainly as we go through the next few years, it is going to be very interesting and exciting in this particular area. We now have the tools available to sort the genetics from the environment. I think it is up to all of the people that are involved in beef cattle breeding, the breed associations, the extension, A.I. organizations, breeders, etc., to be able to mold this information into a program that will produce beef more cheaply, more economically, because lets face it the chicken is always looking over our shoulder.

The Challenge in Producing and Selling Specification Seedstock

by Dr. Greg Martin
Executive Vice President
North American Limousin Foundation

As registered breeders we must first remember that our industry is in the business of taking grass; one of the most abundant, renewable natural resources, and turning it into beef; which is a high quality source of protein for people. The seedstock breeder is the beginning of the beef chain and the consumer is the ultimate end. The real purpose of a seedstock producer is to provide predictable genetics to the commercial man. The seedstock producer must keep in mind the needs of the commercial cow/calf man, the needs of the feedlot operator and the backgrounder, the needs of the packer, the meat wholesalers and retailers, and of the consuming public that provides the demand for our beef product. The seedstock producer and commercial cattlemen have always had goals that have been the target for production. Several years ago we started out with the philosophy that weight equaled profit and the more weight we could produce, the better off we were. Later we moved to the systems approach, which is the beginning of the theroy of balanced production and optimums versus maximums. We talked about total performance, selecting for several traits together versus single trait selection. We Finally came to the realization that profit was more important than production if we were all going to stay in business and survive. To be profit oriented we found out that it was necessary for the seedstock industry to be oriented towards specification, genetics or what I prefer to call predicatable genetics.

I firmly believe that the breed associations are the most important link in predictable genetics. We are in the business of producing registration certificates which documents the ancestry and the ownership, and of producing EPD's, which are the backbone of specification seedstock or predictable genetics today.

The beginning of producing EPD's goes back to our national sire evaluation programs. As you have heard earlier this morning, great strides have been made in the methods by which we can calculate EPD's on sires across a breed. The new evaluations give us an outstanding tool to produce sire summary's which relate the genetics in one herd to that in another. This is a tremendous asset in improving your herd and also in merchandising and selling performance cattle. The new EPD's are much more meaningful than the old 'within herd' ratios, as they are an across the breed comparison and they do solve the problem that we face with half of your calf crop ratios above 100 and half below. Many of the breed associations, including Limousin, now have EPD's available on cows, as well as, younger cattle that would not normally make a sire summary. Currently in the Limousin breed we have concentrated on Expected Progeny Differences for birth weight, weaning and yearling weight, and milking ability. Several of the breeds have additional information available on carcass traits, calving interval, gestation length, calving difficulty, and maternal ability.

It has already been mentioned earlier this morning, but I would like to make a quick comment on milking ability versus maternal value. As all of you know, our old maternal value EPD's were a combination of the direct growth effect and milk production. We have chosen to use milking ability only in our EPD's rather than maternal value or a combination of both. It is the feeling of our association from an educational standpoint, that it is much easier for people to understand the value for pure milking ability and to use the weaning and yearling EPD's for growth. Prior to printing a pure milking ability value, we had several bulls in our breed that were very high in terms of the old maternal EPD's, but when the new Sire Summaries were printed they were quite low in milking ability. This obviously creates a great deal of confusion because the word maternal has so many different meanings to people in the cattle industry. Many assume that maternal is milk when that is not the case. By printing EPD's for birth weight, weaning and yearling growth, and milking ability we feel that our breeders can make better decisions on whether they want to improve growth or milk rather than confusing the issue by combining the two.

The availability of EPD's on both the sires and the dams gives us a tremendous tool in making plan matings. One of the most difficult things to deal with in using EPD's is for breeders to understand that it is very difficult to find animals that are desirable in every trait. As you can see in the typical example shown here Figure 1, most animals will excel in some areas and have deficiencies in others. Part of this is the biological nature of the bovine beast in which it is difficult to get extremely high values for growth rate without also having larger birth weights. There also appears to be a pattern in our breed where animals that exibit extremely high growth rate are normally somewhat negative in milking ability. As the slide indicates, one can compliment cow A by breeding her to bull A, as one can compliment cow B by breeding her to bull B. If one was interested in improving growth rate only, cow A could be bred to bull B, but one must realize the possibility for an extremely large birth weight, as well as, a very negative milking ability. In most cases, we are gearing ourselves more towards a balancing of traits rather then selecting only for growth rate. In the Limousin breed, the new EPD's have been used a great deal to moderate birth weights. Many of our seedstock producers who are selling large number of bulls to commercial cattleman have been working to moderate their birth weights. Too many times a breeder blames heavy birth weight calves only on the sire. In reality if we have a bull calf that has a birth weight over 100 pounds both the sire and the dam have positive EPD's for birth weight. Therefore, the plan matings allow them to breed the high performing, heavy birth weight bulls to cows that are negative for birth weight and vice versa.

In our breed, as well as, in most other associations, we have all been very involved in trying to educate our producers on how to use the new performance programs and the EPD's. Very quickly, I would like to show you the forms that we are now using in our office to encourage breeders to send in all their records on every calf that is born on their operation and to make the paperwork as simple as possible. Most associations have record keeping systems very similar to ours and we borrowed many of the ideas that we are currently using from other associations.

Most producers would agree that a multiple application for entry form where several calves can be listed on one page, is easier to use than the old single applications in which one form was needed for each calf. Many of the associations have gone one step farther by pre-printing the cow inventory on the left-hand side of the page, therefore, reducing the amount of writing the producer needs to do and encouraging him to send in calf information on every cow that he has in his program. We encourage our producers to use the multiple application sheet as the permanent calving record. We suggest that each night they fill in the calves that are born on that day so that there is a permanent record in the house in case something happens to the calving book. They have been known to go through the Maytag, as well as, many other fatalities. After the last calf in the calving season is born and entered, the top copy of the multiple application sheet can be sent to the association office. Calves can be registered at this time or simply processed to get the birth data on file.

The same sheet that is used for the calving information is used to add the weaning data. The second copy of the multiple application form is filled out with the weaning information and then submitted to the association office. If the calving information was submitted after the calving season, the weaning updates are quick and simple. We return to the breeder a weaning summary which has all the adjusted information and ratios on it and room on the right-hand side in which to submit the yearling information. The yearling information can be filled out and the top copy of the form returned to our office. This form works very well for us in helping to convince the breeders to keep the cattle in the same contemporary groups that they were in at weaning time until after the yearling data is collected. After the yearling information has been submitted, a yearling summary is returned to the breeder. If the cattle have already been registered it indicates so on this sheet. If the cattle have not yet been registered the breeder can mark the top copy of this sheet for those animals he wished to register and return it to our office. For the performance program itself and the weaning and yearling summaries, there is absolutely no charge if the cattle are sired by a registered Limousin bull. At any one of the three steps, birth, weaning, or yearling, the breeder can register the cattle on the sheet he uses to sent in his performance data. The important thing is that the performance information is calculated free and returned as promptly as possible whether any or all of the calves are registered. This may be somewhat of a different approach than many breed associations use, but we have found it beneficial in getting the information on all the calves born regardless of whether the individual intends to record them or not.

One thing we have done different than other breed associations have is to develope a separate registration certificate and pedigree that does not have any performance information on it. This allows the registration certificate to be issued at the time the calf is registered regardless of whether or not performance information is available. This works extremely well for cattle that are registered prior to 150 days of age in which very little performance information would be available. Since there is no performance information on this registration certificate, it never needs to be updated or changed. The certificate becomes the permanent possession of the breeder until this calf is transferred to a new owner. All of the performance information goes on the performance record. This sheet includes the same information on the top portion that you find on the top of the registration certificate with the exception of the EPD box. Here we have a young animal in which there are no EPD's yet on this particular individual. The center section of the performance record includes all the available EPD's on the animal's sire and dam and their parents. On young animals in which no EPD's are currently available this can be very useful in building EPD's based on pedigree evaluation only. The bottom portion of the performance record shows all the actual and adjusted data that is calculated on this individual. The first time a performance record is issued is when the calf is registered. An updated copy of the performance record is also created at weaning time and at yearling time if the animal has already been registered. A current updated copy of the performance record also goes with the new registration certificate any time a transfer of ownership takes place. We like this particular form because it is a one way dissemination of data rather than an actual updating of the registration certificate. On our other system, when the data was actually on the registration certificate, the old certificate would have to be returned before weaning or yearling updates could be added. This way, the new performance record can be sent to the breeder without the old one being sent back to the association. This one-way system of disseminating performance information has been more efficient and time saving in our office.

The next form we have is the dam summary. The top half of the dam summary is the same as the certificate and performance record. It does have the EPD box very visible in the center of the certificate for the individual dam in which this summary has been produced. The bottom of the dam summary lists all the calves, the adjusted weights and ratios, and an average at the bottom of the bulls calves, the heifer calves, the average ratios, and an MPPA on this particular cow. These forms all fit into an 8 1/2 x 11 herd notebook, which provides a very simple record keeping system for small breeders. The registration certificates, the performance records, and the dam summaries can all go together to give complete information on any particular individual. The back of the performance record also has room on it for various management information about a cow that has been retained in the herd and can be placed dirrectionly across from her current dam summary. We recommend ordering new dam summaries after you have submitted the weaning weight information on the current calf crop. The dam summaries that come off will have the yearling weights from last spring and the current fall weaning weights on them to update the cows record through weaning time. We do provide binders and notebooks in which all the records can be organized and kept for easy reference. The registration certificates, the performance records and the dam summaries all fit in a standard 8 ½ x 11 three-ring notebook. Special binders are available to keep the weaning and yearling computer printout summary sheets, which are the standard 11 x 14. Performance records and dam summaries are free to owners if the animal is registered. Anyone can order a performance record or dam summary on any cow for a $5 charge.

In selling performance programs and EPD's to our breeders we think it is important that we encourage them to use them in conjunction with visual appraisal. We encourage our people to keep one eye on the cattle and one eye on their records at all times. Whether we like it or not, livestock shows are very traditional in our long-standing part of the purebred industry. They provide an outstanding gathering place for people to get together and visit about the genetics involved in their programs. I can assure you that in this particular crowd at the National Western Stock Show there are some people talking about the performance of these cattle and about the EPD's on their sires and dams. We also must realize that the showring is a tremendous opportunity to get juniors involved in our particular breeds. Once we get them involved through an interest in showing cattle, we have a better opportunity to educate them about the performance aspects and how EPD's should be used. Wayne Vanderwert, on our staff, has developed a new

Limousin Breeding Simulator for use with our junior members. This is really the computer cow game that has been modified to provide those people playing the game with EPD's, as well as, actually weights and ratios. The game is currently set up to run on a Radio Shack mini computer and will be presented at the animal science meetings this summer. We hope to modify the game in the future to run on IBM compatable equipment so it could be used in more areas.

In looking back at the title of my talk, I am sure that it would be appropriate for me to make a few comments in regard to selling specification seedstock. In the registered business I think too many times we are guilty of selling rather then merchandising. Let me quickly refresh your memory on the definition of these two terms. Selling - to give up to another for money or other consideration - to displace by sale. Merchandising - sales promotion as a comprehensive function including market research, development of new products, coordination of manufacturing and marketing, and the effective advertising and selling of a product. The point here is that too many times we are guilty of only trying to sell specification seedstock or total performance programs. What is important is that each one of us needs to be merchandising our specification genetics so that we can maximize the amount the dollars we receive from the genetics we provide. One of the ways in which we are trying to encourage more people to use EPD's and performance values in merchandising their cattle is to provide a standard sale cattle format. As you can see here, it has the basic information on the top and the performance box at the bottom. We are now in the process of setting up our computer to print the information in this format so it can go directly to typesetting. We do have some other variations of the performance box for those people who want to print less information. It is also important for the association to encourage the use of these records whenever possible. If the purebred seedstock producer, who is trying to sell predictable genetics to the commercial man, will assist him in buying the kind of cattle that will work in his program and being sincere and honest in what these cattle will do in the commercial man's program, we could all create a bigger demand for predictable genetics.

Associations must do everything possible to put emphasis on performance programs. In our new Members Manual the largest section in the book is on performance programs. We have developed several worksheets, one of which is entitled "15 Steps to Make It Work" to try to help people understand that performance records can be easy and simple to keep and yet accurate and meaningful. We have also developed a date calculation wheel which has been very beneficial to our breeders. The wheel can be used to calculate age in days, not only for registration fee purposes, but also to find out which days you can weigh the entire group of calves and still have them within the proper age limits for adjusting the weaning and yearling weights.

The way up in the seedstock industry will be with specification seedstock, which are more predictable than anything we have ever produced in the past.

The bottom line for all of us is profitablity regardless of which way you choose to measure it. The thing we must always keep in mind is that merchandising specification seedstock, predictable genetics is not easy. It takes a great deal of effort on the part of the breed association, the breeders and the univeristy and extension people throughout the country. If we all work together, we can provide more predictable genetics to help increase the profit potential of everybody in the beef cattle industry today.

Figure 1

PLANNED MATINGS

	EPD's			
	BW	WW	YW	MA
COW A	+1.0	+9.8	+11.6	-3.2
COW B	0.0	-6.2	- 5.7	+9.3
BULL A	- .8	+3.2	+ 4.1	+5.0
BULL B	+2.1	+9.6	+20.6	-4.8

WHAT IMPACTS ON BREEDING AND RAISING BEEF FOR PROFIT?? -- "SHIFTING PREFERENCES BASED ON CONSUMER ATTITUDES"

This is a time of great excitement for many Animal Scientists associated with the livestock and meat industry. The cause of this excitement certainly is not the economic plight of the industry but rather it stems from the fact that currently shifting preferences and consumer attitudes are triggering changes in livestock production, marketing, processing and meat distribution that no amount of University Research or Extension Education has ever been able to trigger. Why -- We even have packers talking about paying more for higher value cattle and keeping excess fat in the packinghouse -- and retailers are concerned with meeting consumer expectations regarding lean meat!! These are truly revoluntary developments brought on by the impact of shifting preferences and consumer attitudes expressed through choices at the meat case.

As we look at some of these attitudes and preferences and attempt to identify their impact upon the opportunities for beef producers we will be drawing heavily upon research studies and commentaries of other scientists, organizations and industry leaders. It shall be my purpose to focus upon the opportunities and obligations of beef producers and especially seed stock producers.

Consumer Climate For Red Meat

First, let us review some of the facts revealed in the "Consumer Climate For Red Meat" study conducted by Yankelovich, Skelly and White. We are all familiar with that study which has been conducted every other year since 1981. The study asked a series of important questions to determine consumer attitudes. One of the first observations made and in my opinion the most significant one was the fact that there is no such thing as "The Consumer". Rather, there are many, many different consumers. As I have told several audiences over the years, if there was such a thing as "The Consumer" General Motors wouldn't be making so many different automobiles. This is an extremely important concept for seed stock producers. Its recognition should lead us to various criteria for excellence in beef cattle depending upon which consumer is selected as the target.

The 1983 study identified three separate groups of people as pro-meat. They were called meat lovers, creative cooks and price driven consumers. It also identified two other groups as having a negative attitude about meat; active lifestyle and health oriented.

Changing attitudes were revealed when consumers were asked "Do you strongly agree with the following statements".

1. "That in order to really satisfy my appetite a main meal must contain Meat" (MEAT Lovers)

2. "I am considering or have cut down on the amount of meat for health reasons" (Health Oriented)

3. "The main reason I don't eat more meat is because its too expensive" (Price Driven)

4. "I rarely have time to fix meals that take more than a half hour to prepare" (Active Lifestyle)

5. "I make a real effort to avoid foods high in cholesterol" (Health Oriented)

6. "It is important to limit the fat in one's diet, even if not concerned about weight control" (Lifestyle and Health Oriented)

The results of the survey for 1983 and for 1985 revealed some significant shifts that have great implications for the beef industry.

Statement	% That Strongly Agree	
	1983	1985
Main Meal Must Contain Meat	34	28
Cutting Down On Meat For Health	19	26
Meat Is Too Expensive	18	17
Meat Preparation Time	23	36
Avoid Cholesterol, Limit Fat	57	68

In just two years, 1983-1985, there were significant changes in attitudes that impact upon the beef industry; fewer meat lovers, more people concerned about health and an increase in the active lifestyle category.

The National Consumer Retail Beef Study

The National Consumer Retail Beef Study led by Texas A&M and supported by the total industry expanded upon the attitude study and sought to learn some specifics about the beef that consumers would prefer. This study was done in two phases; Phase 1 was a study conducted in 3 cities -- Philadelphia, Kansas City and San Francisco (180 households in each city). The objective was to learn the relationship of quality grade and taste appeal of beef. U.S. Prime, Choice, Good and Standard beef top loin (strip) steaks were compared by the consumers in the home. The Results -- "Over all acceptability decreased as did degree of marbling". The Conclusion -- "Quality as measured by marbling is important to overall acceptability".

Phase 2 of the study was designed to learn more about other major selection criteria such as price and leanness. Remember, the attitudes study suggested a diet/health issue. The study was designed to learn the answers to such questions as (1) "What amount of taste (if any) will be sacrificed by the consumer to obtain the leanness advantage of lower grading beef, and (2) What degree of external fat trim are consumers seeking and are willing to pay for"?

Consumers (750 female shoppers in Philadelphia and in San Francisco were given an opportunity to buy beef of differing quality levels and of differing external fat thickness. A pre-purchase attitude survey confirmed that taste was the single most important factor in their purchases of beef. They expressed concern as dissatisfaction with price and with fatness and cholersterol. Taste, price and leanness are very important in determing how consumers rate beef.

The beef producer can have a dramatic impact upon all of those factors.

Purchase behavior and extended use reactions resulted in many conclusions. I have selected a few that I feel impact strongly upon beef producers and that are under their control.

- Marbling is considered in the context of taste/texture qualities and not as a leanness factor

- Leanness is a key factor in issues of improving the image and increasing the purchase appeal of beef

- The trimmer the beef cut the better the ratings for taste, value, low fat and cholesterol

- Consumers are willing pay a higher price per pound for trimmer cuts

- Consumers are more likely to evaluate beef quality in the context of amount of fat (as determined by appearance) than in the context of industry grade terms

The researchers state that "The lesson to be learned is that consumers are able to discriminate between beef types (though grading per se is not the issue) and choose among available options depending on priority given taste, health and price factors, on a case by case basis".

Implications For Beef Production

Seed stock producers must provide the genetics for high quality (taste) efficient (price) lean (health) beef production.

I have thoroughly studied all of these research reports and I have not found a single indication that consumers are interested in low quality beef regardless of how we define it.

I have associated with the meat processing and retail industry enough to know that trimming fat off to produce lean beef is not an economically feasible alternative to breeding it off.

I am concerned about beef quality and about efficiency if we were to expect feeders alone to be responsible for quality (taste) efficiency (price) and leanness (health). Their first responsibility must be managing resources to maximize profit. Seed stock producers must provide the means for achieving this goal. Feeders must be a part of the effort because history is full of examples of feeder mis-management, but much of that mis-management stems from trying to make big carcasses out of genetically small ones or vice versa. Seed stock producers must design the product and rely upon the feeder to "manufacture" it!! There is no other way!

In conclusion, there are many factors involved in consumer attitudes that impact beef production such things as animal welfare, feed additives, wholesome processing, new products, promotion, advertising and education come to mind. I have selected for this discussion only those factors that are directly related to genetics and can be designed to specification through the selection process. I would challenge every person here to list the current practices of the seed stock industry that will result in the beef industry responding to consumer preference and attitudes. My list is rather short!!

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BEEF IMPROVEMENT FEDERATION
WHAT IMPACTS ON BREEDING AND RAISING BEEF FOR PROFIT?
FRIDAY, MAY 9, 1986

FUTURE MARKETING PRACTICES TO MOVE BEEF AND OTHER RED MEATS

PRESENTED IN LEXINGTON, KENTUCKY

JAMES J. DARAZSDI
ROCCO ENTERPRISES, INC.

I appreciate having the opportunity to speak to the Federation this morning on the subject of meat marketing practices. As many of you know, the company with which I am associated has been involved in the production of poultry products for the past forty years. Very recently, we acquired our first red meat slaughtering facility, the former Shen-Valley Meat Packers plant, which is located in Timberville, Virginia and in August of 1985, we entered the red meat business for the first time. We are currently slaughtering approximately 3,000 head of lambs per week at this plant and we intend to increase our slaughter to 10,000 head per week by 1988. What I would like to do this morning is to begin by sharing with you some of our perceptions of current consumer trends and emerging consumer interests. After that, we will examine the operation of an integrated poultry company in an effort to try to determine the reasons behind the success the poultry industry has experienced in recent years. Finally, in order to tie both issues together, we will discuss how Rocco is trying to apply what we have learned in the poultry business as well as our perception of emerging consumer trends in the design and operation of our lamb plant.

To establish a point of reference, let us begin by examining beef and turkey demand over the past several years. You may recall from your first class in economic theory that price and demand are inversely correlated. Or, to say it another way, as price decreases, demand increases. However, if we examine beef prices in constant dollars during the period 1979 through 1984, we find that just the opposite occurred. We experienced the worst of both worlds, declining price coupled with declining consumption.

If examine turkey demand during the same period, we see a rather interesting situation. Between 1979 and 1981, turkey consumption reacted to price declines in the conventional manner, as price declined in constant dollars at retail from 40 to 35 cents per pound, consumption increased from slightly over 9 to slightly over 10 pounds per capita. However, beginning in 1982, the turkey industry saw the best of all worlds. During the last four years, we have seen rather dramatic increases in both the retail price of our products as well as consumption of them. So, in recent years we have witnessed two economic anomalies. In the beef industry we have seen declining prices coupled with declining consumption while in the turkey industry we have seen increasing prices coupled with increasing consumption.

If we examine turkey and chicken consumption over a longer term, say the past 25 years, we can see that while the increase has been continual, the rate of increase has been anything but constant. On the broiler consumption graph, I draw your attention to the rate of increase since 1975. On the turkey consumption graph, although sheer number of pounds consumed is substantially less, the growth pattern is virtually identical. Again, I draw your attention to 1975 and the very significant increases which have occurred since that time. I will come back to this point again, but I feel compelled to point out that in 1975, the poultry industry made a substantial commitment to further processed products. In this time frame, the boneless breaded chicken nugget and chicken strip were being seriously promoted and the turkey industry was making a conscious effort to move out of whole bodied, frozen turkeys and into fresh parts.

The last slide in this series tracks aggregate meat consumption, that is both red meat and poultry products, during the period 1955 through 1985. In order to say anything meaningful about this information, we almost need to cut the slide in half. During the fifteen year period between 1955 and 1970, the meat industry experienced both increasing per capita consumption and a positive growth in the population. Not only were there more people around to eat meat, but in addition, generally speaking, every person was eating more of it. However, during the most recent fifteen year period, per capita meat consumption has fundamentally stabilized and this occurred in tandem with a significant decline in the rate of population growth. Thus, it becomes rather apparent that any increase in beef consumption will occur only at the expense of a competing product.

Let's move away from this area for a few moments and take a look at the significant demographic changes which are occurring in our population. The major purchasing segment in our population today is the 35 to 54 year old age group. They represent approximately 25% of the population. They are also the most highly educated and affluent consumer group this country has ever seen. They were in school during the period of campus unrest in the 1960's. Upon graduation they did social work but after a few years of that they decided to join the establishment. Today, they are married and live in the suburbs with one and one-half children. They are accustomed to two incomes and they live very active life-styles. But, in the longer term, perhaps the important thing to remember is that they are getting older. As a group, they will reach their full potential in the year 2000 when they will comprise almost 30% of the U.S. population. But then they will begin to leave the ranks of the 35 to 54 year old age group and join the 55 and up group. And, as you can see, around the year 2015, so many of them will have left the 35 to 54 year old bracket that the 55 and up group will actually take over as the largest percentage of consumers in the country. This represents a tremendous marketing opportunity for the astute company positioned to take advantage of the change.

There are other emerging demographic trends which we need to consider as we plan our marketing strategy. The seven most important emerging trends in our opinion are as follows:

1. The population in whole is becoming older. This aging population profile has significant marketing ramifications.

2. There has been and will continue to be an increase in the nnumber of two income families.

3. The active life-style of the two income household has given rise to an increase in the number of microwave ovens in U.S. homes. Today, about 50% of all homes have microwave ovens and the number is growing at a rate of between 5 and 8% percent per year.

4. The active life-style and increase in the number of microwaves gives rise to an increasing demand for convenience type of foods. Drawing again on our experiences in the turkey industry, we have seen a marked decline in the number of large, whole bodied, bone-in turkeys which we sell while we are experiencing significant increases in demand for our boneless cutlets and fully cooked products.

5. This new group of informed consumers is more aware of nutrition and they demand products which are low in fats and cholesterols and high in nutrition.

6. Concerns about high blood pressure have given rise to an increase in the demand for low salt products.

7. The demands placed on the household where both parents work have broken down many old family traditions. The dinner meal where everyone sits around the table to discuss the events of the day has largely gone by the wayside. But, this has given rise to an increasing awareness of our ancestry. This increasing sensitivity to family heritage has become the surrogate for some of the traditions we have been forced to abandon. This has given rise to an increasing popularity of ethnic foods.

During the past several years, the American Meat Institute working through the Yanklovich Research Firm has been conducting attitude surveys. I want to just touch on them briefly because I think they add a measure of credibility to the theories we have just examined. On the subjects of attitudes toward meat, nutrition and health issues, economizing in food purchase decisions and attitudes toward meal preparation the following data was gathered. When asked if a meal must contain meat in order to be satisfying, 34% of consumers agreed with that statement in 1983. By 1985, the percentage was down to 28%. Alternately stated, almost three-fourths of the people in this country don't feel that a meal must contain meat in order to be satisfying. When asked if they had cut down on their consumption of meat for health reasons, 19% said they had in 1983; the percentage was up to 26% in 1985.

When asked if they were cutting down on the amount of fat, salt and cholesterol in their diets, roughly half said they were in 1983. By 1985, the number of affirmative responses increased by about 15%.

On the subject of price sensitivity, the consumers were asked if they agreed with the statement, "I really don't let price govern my purchase decisions when it comes to food." While the percentage remained relatively constant, you will see that only about one-quarter of the population is essentially insensitive to price when it comes to grocery purchases.

Finally, when we examine attitudes towards meal preparation, the demand for convenience comes through loud and clear. In 1983, only 23% of the people surveyed indicated that they rarely have time to fix meals that take a half hour or more to prepare. By 1985, that percentage increased to 36% for an increase of almost 50% in two years. The number of people who rated speed and ease of preparation as the two primary factors considered when deciding what foods to buy increased 20 to 25% between 1983 and 1985. Finally, the traditional American housewife who enjoys spending time in the kitchen preparing foods is largely a thing of the past. Only 32% of the people surveyed indicated that they truly enjoyed the time they spent in meal preparation.

There are several other general consumer attitudes which we must bear in mind as we plan our marketing strategy for the years ahead. Consistently high quality and value for the money are important for the American consumer. Unless they perceive what we are offering is both good for them and a true value for their money, they are not likely to purchase it. In addition, past experiences will largely influence buying habits. Almost 65% of the people surveyed indicated that they are more disposed to buy a product from a manufacturer in whom they have confidence rather than one with whom they are unfamiliar.

As we indicated earlier, there are probably a variety of reasons for the popularity that poultry currently enjoys. Certainly, price is a consideration which cannot be overlooked. In 1970, the price for a pound of chicken meat at retail was 41 cents as compared with beef at $1.02. This gave us a spread of 61 cents per pound. Between 1970 and 1980, this spread increased from 61 cents to $1.66 and has remained relatively stable since that time.

But price alone, in my opinion, does not tell the whole story. There are a number of other very significant factors which must be considered. Frankly, beef has been victimized by an awful lot of bad publicity. This article appeared in the January, 1986 edition of Discovery Magazine. The headlines read "Darling, Now It is Official, Your Steak May Give You Cancer". This article deals in general with food additives, but is specifically directed at a growth stimulant called DES and is indicative of the type of media coverage which is damaging the entire meat complex. Certainly, most of the negative press has been directed at the red meat sector.

In addition to price and publicity, there are still other factors which must be considered. I believe that the poultry industry has generally been more in tune to portion control. Also, branded poultry products have given rise to the value perception which we previously discussed. But let's not forget that all major poultry producers in this country are today fully integrated. There are many advantages associated with integration which have given the poultry industry a competitive edge. I thought it might be appropriate to examine some of these issues briefly.

Integration leads to production control and the ability to quickly respond to changing consumer demands. The poultry industry begins its integrated operation through breed selection. This is followed by control of hatchery and grow-out facilities and processing plant operations. Products are then generally further processed and moved into distribution centers. In the years ahead, I would look for the poultry industry to be involved in the production of heat and serve meals such as Armour Classics and Lean Cuisine.

In addressing the question "Why is beef in trouble?", I would offer the following list of considerations. I think that largely you have been unable to address the issue of portion control since a boxed beef program leaves the matter of portion control in the hands of the retail chain. This loss of control has resulted in a very slow evolution from carcass to boxed to boneless products as well as slow progress in the area of new product development. Beef continues to be marketed as a commodity and not as a product. Further processing opportunities have not been fully exploited. Beef continues to require extensive store level handling in the areas of cutting, wrapping and weighing which can compromise quality. Beef continues to have a very high priced image and beef can be fatty looking in retail cases. Because of loss of control at retail, the quality of beef is inconsistent. Great variation in portion and fat and bone content still exist. Finally, because of adverse publicity, consumers generally feel that they should limit beef consumption.

Many of the problems which I associate with beef are equally applicable to lamb. When we decided to enter the red meat business, we went out and talked to major retail chains in the metropolitan areas on the East Coast. The folks who run the A & P's, the Krogers, the Giants and the Safeways told us that if we intended to be successful with our lamb operation, there were certain attributes of our program which we must achieve. They indicated that they wanted consistently high quality at every level. Everything from the racks down to the cheapest cut must be of consistently high quality. They wanted good shelf life and smaller portions. They wanted case ready and further processed products. They insisted on year round availability. This was a particularly sensitive area since many of their current suppliers were capable of providing product only on a seasonal basis. They wanted leaner looking carcasses and they wanted competitive prices. Simply stated, they wanted value for their money. They felt that the consumers wanted greater convenience in preparation and they suggested we pay close attention to institutional markets since this was an area where many people tried products such as lamb for the first time. Finally, they warned us of foreign competition and the presence of fresh lamb products which were arriving daily by plane from Australia and New Zealand.

After much reflection we felt that most, if not all, of the things we needed to accomplish could be done through an integrated production process. Integration, in our opinion, results in production control and that, in turn, gives us the ability to react quickly to changing consumer demands. We wanted to first get involved in genetic and breed selection. We felt that by doing this we could assist with multiple births, offseason lambing, good carcass conformation, better feed conversions, lower mortalities and morbidity, increased rates of gain and smaller deviations in body weights among animals of the same age. Through nutritional control, we felt that we could best achieve least cost formulation, reduce fat to muscle ratio, achieve better conversions and generally improve the health of the animal. By providing veterinary services, we felt that we could lower mortality and morbidity, achieve a greater rate of disease prevention and standardize health maintenance programs. Through control of growing operations, we felt that we could produce products of standard size, move lambs at rates called for by our marketing department, minimize capital investment through standardized confinement feeding programs and maximize confinement feeding efficiency. Finally, by being responsible for the processing plants, we could design a production operation which would mesh nicely with our live production practices and coordinate our marketing efforts to respond to the dictates of the marketplace. Stated another way, marketing will pull the train and quality control will keep it on the track.

To achieve our objective, we designed five contracts. The first one is a breeding contract and its objective is the production of feeder lambs. In the contract, we attempt to achieve control through the selection of breeding stock and direction of the medication program. We establish target weights which enable us to schedule slaughter well in advance, we direct the basic nutritional guidelines for the ewes and rams and generally require that the animals be in good condition at the time they are surrendered to us.

Our second contract is an open market forward price feeder lamb contract. It also has the objective of the production of feeder lambs. It is designed for the more experienced producer. Through it, we again control weights enabling us to schedule slaughter well in advance and we require that the animals be in generally good condition at the time they are surrendered to us.

Our third contract is a stocker contract. It has the objective of intermediate weight gains. The controls built into the contract provide that Rocco directs the worming and vaccination program, provides the veterinary care and it also requires that the lambs be in generally good condition at the time of surrender.

Our fourth contract is our finisher contract. It has as its objective the production of slaughter lambs. In it, Rocco provides the general nutritional specifications, we direct the mediation program, target weights are established which give us the ability to produce animals of uniform carcass size, we pay premiums for lean carcasses (yield grades of 1 and 2) while we penalize producers who send us fatty carcasses; finally, carcasses are expected to grade prime or choice and a penalty is imposed if they do not.

Our fifth and final contract is an open market forward price contract. Again, it has the objective of the production of finished lambs but it is intended to accommodate established producers. Controls are again built into the agreement. Again, target weights are established in order to give us uniform carcass size, premiums are paid for lean carcasses and, again, carcasses are expected to grade prime or choice.

The challenge which lies ahead was well articulated by Roger Berglan, the Vice President of Communication for the Cattlemen's Association, when he recently said in a speech, "If individuals and businesses in the beef industry don't become more market oriented, beef's share of available food dollars will shrink further." The beef industry has some positive purchase influences on which they can build. Ground beef is already perceived by the consumer as the product having the greatest variety of ways in which it can be served. It is seen as a product which is easier to prepare than either pork or chicken and it has greater appeal to children. Further, the taste appeal of fresh beef is not exceeded by any other meat group. As with anything else, you must capitalize on your strengths and attempt to mitigate your weaknesses. The specific recommendations which I would propose today for the beef industry are as follows. New processed and precooked beef products are needed. You must place more emphasis on research and development. You must somehow assure that visible fat is removed before the product is displayed at retail. You must overcome your cost disadvantage through portion control. Through the control of the production process, you must achieve quality and uniformity, afterwards, you need to brand the product. Finally, you must capitalize on the ease of preparation perception through value added techniques such as boning and sizing.

I appreciate having the opportunity to visit with you this morning and I hope I was able to impart some useful suggestions.

THE EFFECT OF FUTURE DEMAND ON PRODUCTION PROGRAMS - BIOLOGICAL VS. PRODUCT ANTAGONISMS

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Introduction

For many years most stockmen have believed that 'there is more variation within breeds than between breeds'. As Lush (1945) pointed out, stockmen were misled by this attitude into believing that genetic differences between breeds were 'not real after all' or at least not very important. Data from the Germ Plasm Evaluation (GPE) Program at the Roman L. Hruska U.S. Meat Animal Research Center (MARC) will be reviewed to examine the relative amount of genetic variation between and within breeds for biological traits associated with value of beef carcasses. Relationships between output of retail product and other characteristics associated with efficiency of beef production will be examined.

The GPE program is presently in the fourth cycle (table 1). Topcross performance of 26 different sire breeds have been or are being evaluated in calves out of Hereford and Angus dams or calves out of F_1 cross dams (Devon and Holstein sires in Cycle I; Santa Gertrudis and Brangus sires in Cycle II). To date, complete data are available only from cycles I, II and III. Thus, this review will include data from twenty sire breeds involved in the first three cycles of the program. In all three cycles, Hereford-Angus reciprocal crosses have been produced using semen from the same sires throughout. Data presented were pooled over Cycles I, II and III by adding the average differences between Hereford-Angus reciprocal crosses (HAx) and other breed groups (2-way and 3-way F_1 crosses) within each cycle to the average of Hereford-Angus reciprocal crosses (HAx) over the three cycles. Data will be presented for nineteen F_1 crosses (2-way and 3-way) grouped into seven biological types based on relative differences (X lowest, XXXXXX highest) in growth rate and mature size, lean to fat ratio, age at puberty and milk production (table 2). The carcass and meat data, obtained in cooperation with Kansas State University under the direction of Dr. Michael E. Dikeman, are presented for 15 F_1 crosses out of Hereford and Angus dams.

Genetic Variation Between and Within Breeds

Breed group means and the range (R) for differences between breed group means is shown in table 3 for carcass and meat composition traits. Since topcross comparisons estimate half of the difference between breeds, estimates of R are doubled and divided by the standard deviation in breeding values within breeds ($2\,R/\sigma g$, where $\sigma g = \sqrt{\sigma p^2 h^2}$) to assess genetic variation between relative to that within breeds. The range in breeding values within a breed is expected

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TABLE 1. SIRE BREEDS USED IN GERM PLASM EVALUATION PROGRAM AT ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER

	Cycle I (1970-72)	Cycle II (1973-74)	Cycle III (1975-76)	Cycle IV (1986-90)
	F1 crosses from Hereford or Angus dams (Phase 2)			
Hereford (H)	X[a]	X[a]	X[a]	X[a,b]
Angus (A)	X[a]	X[a]	X[a]	X[a,b]
Jersey (J)	X			
South Devon (Sd)	X			
Limousin (L)	X			
Simmental (S)	X			
Charolais (C)	X			X[b]
Red Poll (Rp)		X		
Brown Swiss (B)		X		
Gelbvieh		X		X[b]
Maine Anjou (M)		X		
Chianina (Ci)		X		
Brahman (Bm)			X	
Sahiwal (Sw)			X	
Pinzgauer (P)			X	X[b]
Tarentaise (T)			X	
Longhorn (Lh)				X
Salers (Sa)				X
Piemontese (Pt)				X
Galloway (Gw)				X
Nellore (N)				X
Shorthorn (Sh)				X
	3-way crosses out of F1 cows (Phase 3)			
Brahman (Bm)	X			
Devon (D)	X			
Holstein (Ho)	X			
Brangus (Bn)		X		
Santa Gertrudis (Sg)		X		
Hereford (H)	X[a]	X[a]		
Angus (A)	X[a]	X[a]		

[a] Hereford and Angus sires, originally sampled in 1969, 1970 and 1971 have been used throughout the program.

[b] Hereford, Angus, Charolais, Gelbvieh and Pinzgauer sires produced after January, 1982 are used in Cycle IV in addition to the original Hereford and Angus sires.

TABLE 2. BREED CROSSES GROUPED IN BIOLOGICAL TYPES ON BASIS OF FOUR MAJOR CRITERIA[a]

Breed group	Growth Rate & Mature Size	Lean to Fat Ratio	Age at Puberty	Milk Production
Jersey	X	X	X	XXXXX
Hereford-Angus	XX	XX	XXX	XX
Red Poll	XX	XX	XX	XXX
Devon	XX	XX	XXX	XX
South Devon	XXX	XXX	XX	XXX
Tarentaise	XXX	XXX	XX	XXX
Pinzgauer	XXX	XXX	XX	XXX
Brangus	XXX	XX	XXXX	XX
Santa Gertrudis	XXX	XX	XXXX	XX
Sahiwal	XX	XXX	XXXXX	XXX
Brahman	XXXXX	XXX	XXXXX	XXX
Brown Swiss	XXXX	XXXX	XX	XXXX
Gelbvieh	XXXX	XXXX	XX	XXXX
Holstein	XXXX	XXXX	XX	XXXXXX
Simmental	XXXXX	XXXX	XXX	XXXX
Maine Anjou	XXXXX	XXXX	XXX	XXX
Limousin	XXX	XXXXX	XXXX	X
Charolais	XXXXX	XXXXX	XXXX	X
Chianina	XXXXX	XXXXX	XXXX	X

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

to be about 6 σg. Most estimates of $2R/\sigma g$ are about 6 indicating that genetic variation between breeds is comparable to that within breeds for carcass and meat composition traits.

Results for retail product growth to 458 days of age are summarized in figure 1. Retail product is closely trimmed-boneless (trimmed to .3 inch external fat and boneless except for dorsal and transverse spinous processes and rib bones in rib roasts) steaks, roasts and lean trim. In figure 1, F_1 cross means for weight of retail product at 458 days of age are shown on the lower horizontal axis. The spacing on the vertical axis is arbitrary but the ranking from the bottom to top reflects increasing increments of mature size. Steers sired by bulls of breeds with large mature size produced significantly more retail product than steers sired by breeds of small mature size. Differences are

TABLE 3. BREED GROUP MEANS FOR CARCASS AND MEAT COMPOSITION TRAITS

Breed group	Marb. score[a]	l. dorsi fat[b] %	Percentage of carcass weight, %: Ret. prod.[c]	Fat trim[d]	Bone[e]	Total fat[f]
Jersey-X	13.3	7.5	65.5	22.1	12.4	40.8
Hereford-Angus-X	11.3	6.7	66.3	21.7	12.0	39.6
Red Poll-X	11.2	6.4	66.6	21.0	12.4	39.2
South Devon-X	11.3	6.2	67.7	20.0	12.3	37.6
Tarentaise-X	10.1	5.2	69.8	17.7	12.5	34.6
Pinzgauer-X	10.8	6.2	69.4	17.5	13.1	34.9
Sahiwal-X	9.7	4.8	69.1	18.4	12.4	35.0
Brahman-X	9.3	4.8	69.4	18.0	12.6	35.0
Brown Swiss-X	10.4	5.2	69.1	17.6	13.3	34.8
Gelbvieh-X	9.7	5.2	69.8	17.4	12.8	34.4
Simmental-X	9.9	5.3	71.0	15.6	13.4	32.6
Maine Anjou-X	10.2	5.2	70.2	16.5	13.3	34.0
Limousin-X	8.9	4.2	72.4	15.1	12.5	31.6
Charolais-X	10.3	5.2	71.8	15.2	13.0	32.4
Chianina-X	8.5	3.9	73.0	13.0	14.0	29.6
Range (R)	4.8	3.6	7.5	9.1	2.0	11.2
2 R/σg	5.3	6.0	5.8	6.5	3.3	6.0

[a] 8 = slight, 9 = slight+, 10 = small-, 11 = small, 12 = small+, etc.

[b] l. dorsi fat, % is based on chemical analysis of l. dorsi muscle from the 12th rib: (Chemical fat %)/(.85) to express fat on an adipose tissue basis (i.e., adipose tissue is 85% ether extract, 12% water, 3% other; Allen et al., 1976).

[c] Retail product is closely trimmed (.3 in) boneless (except for small amount of bone left in short loin and rib roasts) steaks, roasts and lean trim (adjusted to 25% chemical fat) from the carcass.

[d] Fat in excess of .3 in separated from retail product (adipose tissue).

[e] All bone in the carcass except for small amount left in short loin and rib roasts.

[f] Total carcass fat was estimated using a prediction equation (r^2 = 95.8%) developed from chemical analysis of a sample of 27 carcasses (Crouse and Dikeman, 1974):

Soft tissue fat, % = 90.69 + .36 (Marb. score) + .12 (Rib eye area, cm^2) + 2.8 (Adj. fat thickness, cm) + .60 (Est. Kidney-pelvic-heart fat, %) -1.08 (Retail product, %).

Since carcass fat tissue is only 85% chemical fat (Allen et al., 1976), soft tissue (bone is not included in soft tissue) fat was divided by .85 to estimate adipose soft tissue fat. Adipose tissue fat, % carcass weight = (adipose soft tissue fat)(Retail product, % + Fat trim, %)

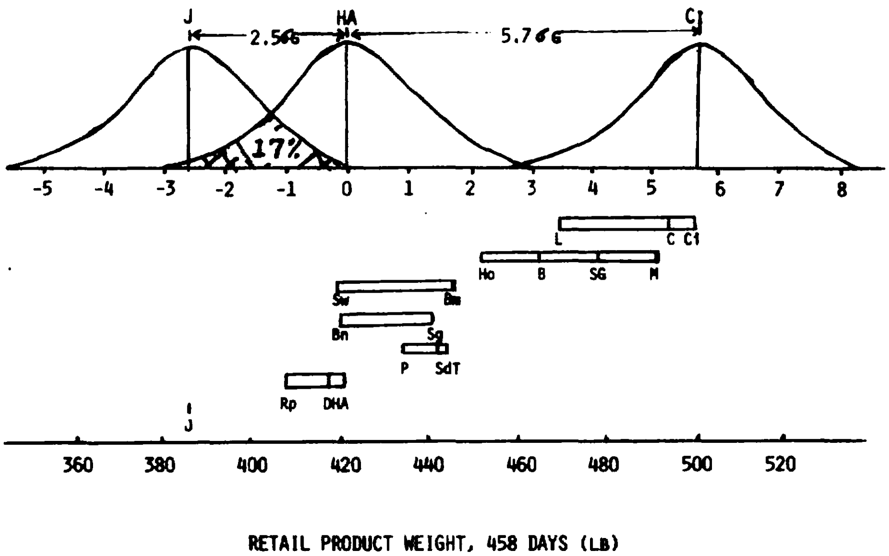

Figure 1. Breed group means (lower axis) and genetic variation between and within breeds (upper axis) for weight of retail product at 458 days.

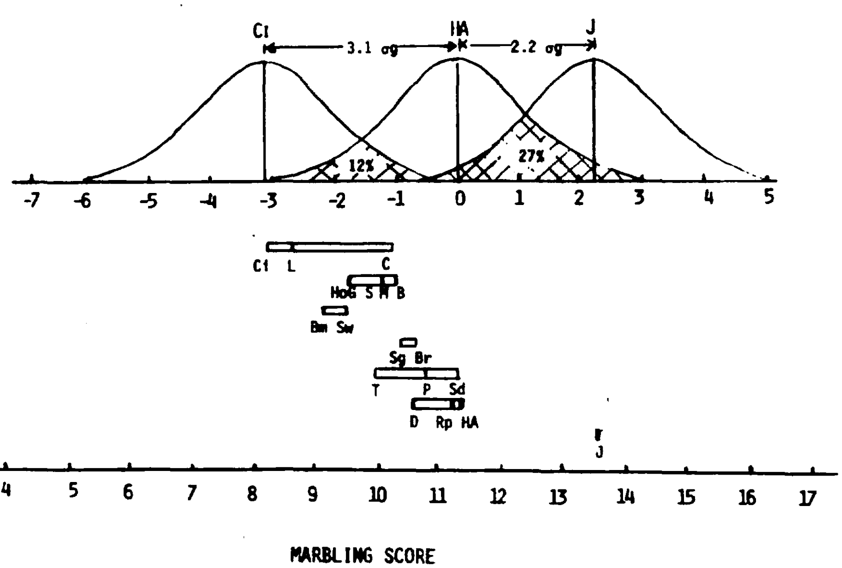

Figure 2. Breed group means (lower axis) and genetic variation between and within breeds (upper axis) for marbling score.

doubled in the upper horizontal scale to reflect variation among pure breeds relative to a standard deviation change in breeding value $[\sigma g = \sqrt{(\sigma^2 p)(h^2)}]$ within pure breeds. Frequency curves, shown for Jersey, the average of Hereford and Angus, and Chianina, reflect the distribution expected for breeding values of individual animals within pure breeds. The breeding value of the heaviest Jersey is not expected to equal that of the lightest Chianina and the heaviest Hereford and Angus would only equal the lightest Chianina in genetic potential for retail product growth to 458 days.

With so much genetic variation both between and within breeds for retail product growth and other carcass traits, why hasn't more been done to exploit this variation? In U.S. dairy production, Holsteins have replaced the vast majority of cows of other breeds which had lower genetic potential for fluid milk yield. It is estimated that 90% of the cows presently used for dairy production are Holsteins. Further increases in milk yield have been realized by intensive intrapopulation selection, involving extensive progeny testing and artificial insemination. Why haven't breeds that excel in lean tissue growth rate been substituted for breeds with lower lean tissue growth potential? Should intense intrapopulation selection be applied for lean tissue growth rate in all breeds? In answering these questions it is important to consider genetic relationships among retail product growth rate and other traits that are important to efficiency of beef production.

Trade offs

Breeds that excel in retail product growth have not totally replaced breeds with less genetic potential for output because of trade offs resulting from antagonistic genetic relationships with other traits important to efficient production or marketing of beef. Although intense intrapopulation selection for lean tissue growth rate would be very effective in changing lean tissue growth potential, if carried to an extreme, it would lead to problems because of antagonistic genetic correlations among traits within breeds.

Retail Product Versus Marbling

Degree of marbling (small deposits of fat interspersed in muscle) in the twelfth rib cross-section of the rib eye muscle is currently the primary determinant of USDA carcass quality grade. Significant genetic variation exists between and within breeds for propensity to deposit marbling (figure 2).

Carcass yield grade, reflecting variation in retail product as a percentage of carcass weight, is also considered in the USDA dual grading system. Significant genetic variation exists between and within breeds for retail product percentage when comparisons are made at the same age (figure 3) or weight.

However, breeds that rank highest for retail product percentage rank lowest for marbling (figures 2, 3 and 4). Similarly, negative genetic correlations have been found within breeds between marbling and retail product percentage (-.80, Cundiff et al., 1964; -.85, Swiger et al., 1965; -.89, Cundiff et al., 1971; -.37, Koch et al., 1982a). Thus, only limited opportunity exists from between breed selection or from within breed selection for genetically increasing marbling without increasing fat trim and reducing retail product percentage.

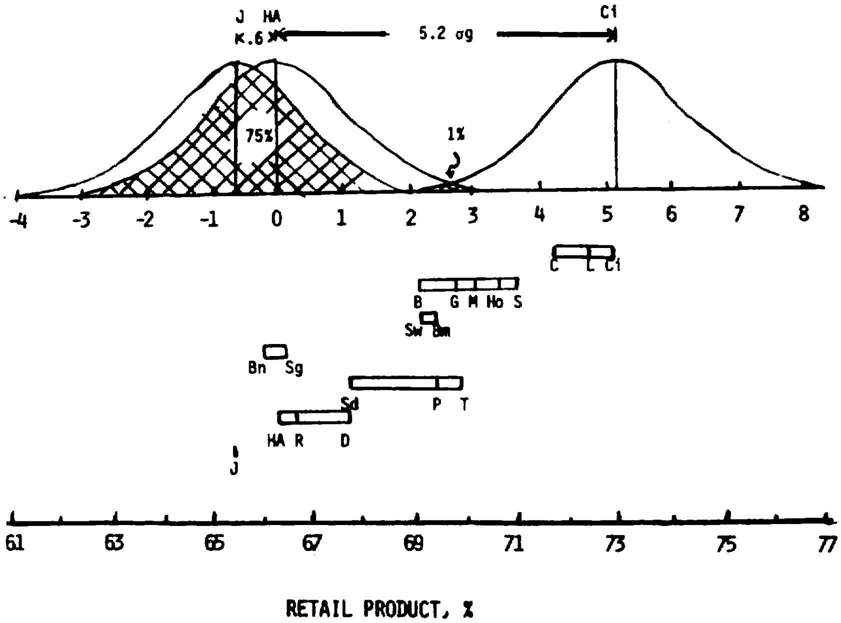

Figure 3. Breed group means (lower axis) and genetic variation between and within breeds (upper axis) for retail product percentage at 458 days.

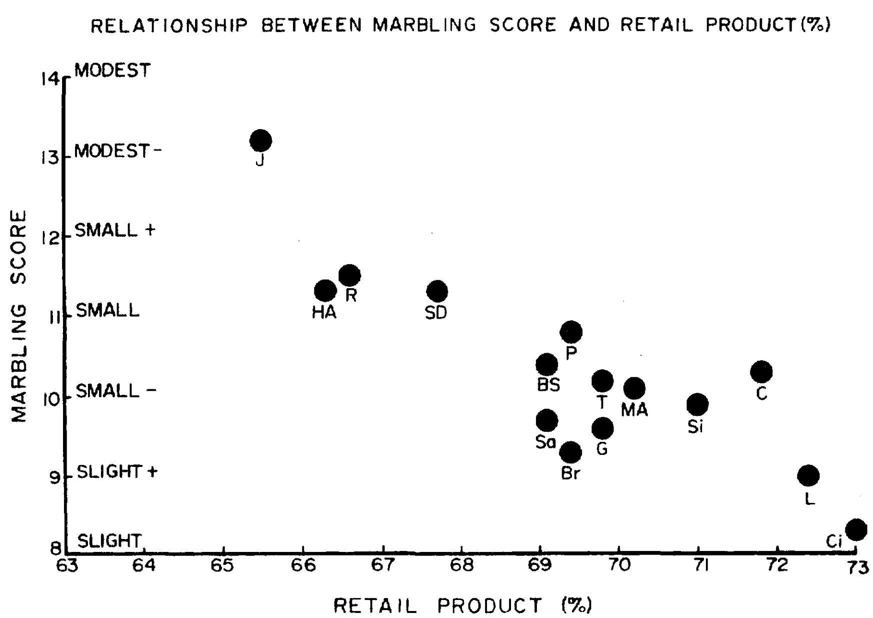

Figure 4. Breed group means for retail product percentage versus marbling score at 458 days.

Marbling and palatability. Concern with the antagonism between marbling and retail product percentage is justified to the extent that high levels of marbling are required to ensure palatability of the retail product. Some studies have shown a positive relationship between marbling and palatability characteristics, especially sensory panel ratings for tenderness or Warner-Bratzler shear force (e.g., see Smith et al., 1984), while others have shown a very low or nonexistent relationship (e.g., Campion et al., 1975).

Sensory panel evaluations of uniformly cooked 10th rib steaks from about 1,230 steers produced in the GPE program are summarized in table 4. One of the most significant findings was the generally high level of acceptance of meat from all breed groups when they were fed and managed alike and slaughtered at 14 to 16 months of age. Although, breed groups differed significantly in average marbling scores and in percentage of carcasses that had adequate marbling to grade USDA Choice or better, sensory panel evaluations of flavor and juiciness were very acceptable for all breed groups. Average taste panel scores and Warner-Bratzler shear determinations for tenderness did tend to increase as marbling increased when comparisons were at the same age, but the change was slight.

TABLE 4. BREED GROUP MEANS FOR FACTORS IDENTIFIED WITH MEAT QUALITY

Breed crosses	Marbling[a]	Percent choice	Warner-Bratzler shear (lb)	Sensory panel scores[b]		
				Flavor	Juiciness	Tenderness
Chianina-X	8.3	24	7.9	7.3	7.2	6.9
Limousin-X	9.0	37	7.7	7.4	7.3	6.9
Brahman-X	9.3	40	8.4	7.2	6.9	6.5
Gelbvieh-X	9.6	43	7.8	7.4	7.2	6.9
Sahiwal-X	9.7	44	9.1	7.1	7.0	5.8
Simmental-X	9.9	60	7.8	7.3	7.3	6.8
Maine-Anjou-X	10.1	54	7.5	7.3	7.2	7.1
Tarentaise-X	10.2	60	8.1	7.3	7.0	6.7
Charolais-X	10.3	63	7.2	7.4	7.3	7.3
Brown Swiss-X	10.4	61	7.7	7.4	7.2	7.2
Pinzgauer-X	10.8	60	7.4	7.4	7.2	7.1
South Devon-X	11.3	76	6.8	7.3	7.4	7.4
Hereford-Angus-X	11.3	76	7.3	7.3	7.3	7.3
Red Poll-X	11.5	68	7.4	7.4	7.1	7.3
Jersey-X	13.2	85	6.8	7.5	7.5	7.4

[a] Marbling: 5 = traces, 8 = slight, 11 = small, 14 = modest, 17 = moderate.

[b] Taste panel scores: 2 = undesirable, 5 = acceptable, 7 = moderately desirable,9 = extremely desirable.

Marbling and Caloric Density. Historically, when steers were finished on pasture, propensity to fatten at a young age was important, particularly when market requirements for fatness were great. However, propensity to fatten has become a handicap as we have shifted to increased use of grain in growing-finishing diets. Consequently, yield grades have been added to the USDA grading system to reflect variation in carcass value associated with differences in yield of retail product. Consumer pressure to reduce caloric and fat content of red meats in human diets continues to mount because coronary heart disease is believed to be associated with elevated blood cholesterol levels (e.g., CAST, 1985; ASAS, 1986). Dietary control of the type and amount of fat consumed is often recommended by medical doctors in an attempt to regulate blood cholesterol levels.

Data from the GPE program can be used to examine genetic variation among and within breeds in intra-muscular (marbling) and inter-muscular (subcutaneous and seam fat) fat composition of the carcass (table 3) and of the retail product (table 5). These data can, in turn, be used to estimate grams of protein and grams of fat from both intra-muscular and inter-muscular fat depots in an average 100 gram (3.5 oz) uncooked portion of retail product (table 6). Caloric content of an average 100 gram (3.5 oz) uncooked portion of retail product can be estimated also (table 7).

Percentage l. dorsi fat differed widely among breeds and was strongly associated with breed differences in marbling score (table 3). Breeds with the highest levels of l. dorsi fat also had higher percentages of fat trim and lower percentages of retail product and bone in the carcass (table 3). Breeds with higher levels of l. dorsi fat not only had higher percentages of intra-muscular fat but also higher percentages of inter-muscular fat in the retail product (tables 5 and 6). Inter-muscular fat (averaging 20.6% over all breeds) accounted for a much greater proportion of total fat in the retail product than intra-muscular fat (averaging 4.0%). Variation among breeds was important for both, percentage intra-muscular fat (range 2.6%) and for percentage inter-muscular fat (range 3.2%).

Breed group means for Calories originating from the lean, intra-muscular fat, and inter-muscular fat components of 100 gram (3.5 oz) uncooked portions of retail product are presented in table 8. In the average, 100 gram portion of uncooked retail product containing a total of 280 kcal, 83 kcal originate from protein (29.7%), 34 kcal originate from intra-muscular fat (12.2%) and 163 kcal originate from inter-muscular fat (58.3%). As is often recommended (e.g., ASAS, 1986), fat content of retail product is markedly reduced by total trimming of visible fat. Caloric content of totally trimmed portions (lean and intra-muscular fat only) contained an average of 117 kcal.

For totally trimmed retail product, the range among F_1 breed groups was 14 kcal (111 for Chianina crosses to 125 kcal for Jersey crosses). Since topcross comparisons estimate only half of the difference between breeds, estimates of the range between F_1 crosses can be doubled to estimate the range between pure breeds, 28 kcal (about 99 kcal for Chianina to 127 kcal for Jersey steers). The dairy processing and brewery industries have developed and effectively marketed products with a range in caloric content, similar to that for 4 oz portions of retail product, ranging from 111 kcal for Chianinas to 143

TABLE 5. BREED GROUP MEANS FOR COMPOSITION OF RETAIL PRODUCT

Breed group	Percentage fat,% Total	intra-muscle	inter-muscle	Lean, fat free %
Jersey-X	28.5	5.8	22.7	71.5
Hereford-Angus-X	27.0	5.3	21.7	73.0
Red Poll-X	27.3	5.0	22.4	72.6
South Devon-X	26.0	4.9	21.1	74.0
Tarentaise-X	24.2	4.2	20.1	75.8
Pinzgauer-X	25.0	4.9	20.2	74.9
Sahiwal-X	24.0	3.8	20.3	76.0
Brahman-X	24.4	3.7	20.7	75.5
Brown Swiss-X	24.9	4.1	20.8	75.1
Gelbvieh-X	24.4	4.2	20.2	75.6
Simmental-X	23.9	4.2	19.7	76.1
Maine Anjou-X	24.9	4.1	20.8	75.1
Limousin-X	22.8	3.3	19.5	77.2
Charolais-X	24.0	4.2	19.8	76.0
Chianina-X	22.7	3.2	19.5	77.3
Range (R)	5.8	2.6	3.2	5.7

[a] Total fat, % of retail product = (total fat, % carcass wt - Fat trim, % of carcass wt)/(Retail product, % of carcass wt).
[b] Intra-muscular fat = (l. dorsi fat, %)(1.0 + l. dorsi fat, %)([Retail Prod., % carcass wt]-[(Total fat, % carcass wt)-(Fat trim, % carcass wt)])/retail product, % carcass wt).
[c] Inter-muscular fat = (Total fat, % of retail product - Intra-muscular fat, % of retail product).
[d] Lean, fat free, % of retail product = (Retail product, % of carcass wt - Retail product fat, % of carcass wt)/(Retail product, % of carcass wt).

kcal for Jerseys. Caloric content of one cup (3.5 fluid oz.) servings of milk range from 100 kcal for low fat milk (1.0 fat, or 120 kcal for 2.0% fat) to 150 kcal for regular milk (3.5% fat). Caloric content of beers (12 fluid oz.) range from about 110 kcal for light beers to about 150 kcal for regular beers.

Because there is considerable variation within breeds and because age, time on feed, diet energy density and other environmental effects add to the phenotypic variation observed in carcass and meat composition, it is not appropriate for any specific breed to label all of their products as either low fat or high

TABLE 6. BREED GROUP MEANS FOR COMPONENTS OF RETAIL PRODUCT, 100 g UNCOOKED PORTION (3.5 oz)

Breed group	Lean protein g	intra-muscle g	inter-muscle g	Other (water) g
Jersey-X	19.3	4.9	19.3	56.5
Hereford-Angus-X	19.7	4.5	18.4	57.3
Red Poll-X	19.6	4.2	19.0	57.1
South Devon-X	20.0	4.2	17.9	57.9
Tarentaise-X	20.5	3.6	17.1	58.9
Pinzgauer-X	20.2	4.2	17.2	58.4
Sahiwal-X	20.5	3.2	17.3	59.0
Brahman-X	20.4	3.1	17.6	58.9
Brown Swiss-X	20.3	3.5	17.7	58.6
Gelbvieh-X	20.4	3.6	17.2	58.8
Simmental-X	20.6	3.6	16.7	59.1
Maine Anjou-X	20.3	3.5	17.7	58.6
Limousin-X	20.8	2.8	16.6	59.8
Charolais-X	20.5	3.6	16.8	59.1
Chianina-X	20.9	2.7	16.7	59.8
Range (R)	1.6	2.2	2.7	3.3

[a] Lean protein = .27 (retail product lean, %) since lean tissue is 27% protein (NAS, 1967).

[b] Intra-muscular fat = .85 (intra-muscular fat, % retail product) since adipose tissue is 85% chemical fat (Allen et al., 1976).

[c] Inter-muscular fat = .85 (inter-muscular fat, % retail product) since adipose tissue is 85% chemical fat (Allen et al., 1976).

[d] Other (water) = 100 - [(lean protein, g) + (intra-musc. fat, g) + (inter-musc. fat, g)].

fat. The leanest steers from relatively fat breed groups will be leaner than the fattest steers from the leanest breed groups due to overlapping phenotypic frequency distributions. However, considerable opportunity exists to breed and produce cattle which will provide for a wide array of beef products in terms of caloric and fat content (e.g., table 7).

A range of 40 kcal in caloric content of 100 gram portions of retail product, comparable to that in low fat versus regular milk or light versus regular beer,

TABLE 7. BREED GROUP MEANS FOR CALORIC CONTENT OF RETAIL PRODUCT, 100 g UNCOOKED PORTION

Breed group	Lean protein kcal[a]	Intra-musc. fat kcal[b]	Inter-musc. fat kcal[b]	Retail trimmed total kcal[c]	Totally trimmed ret. prod. kcal[d]
Jersey-X	79	46	180	305	125
Hereford-Angus-X	81	42	172	294	123
Red Poll-X	80	40	177	297	120
South Devon-X	82	39	167	287	121
Tarentaise-X	84	33	159	276	117
Pinzgauer-X	83	39	160	281	122
Sahiwal-X	84	30	161	275	114
Brahman-X	84	29	164	276	113
Brown Swiss-X	83	32	164	280	116
Gelbvieh-X	84	33	160	277	117
Simmental-X	84	33	156	273	117
Maine Anjou-X	83	32	164	280	115
Limousin-X	86	26	154	266	111
Charolais-X	84	33	156	274	117
Chianina-X	86	25	155	265	111
Range (R)	7	21	26	40	14

[a] 4.1 kcal per gram of protein (Ganong, 1977).
[b] 9.3 kcal per gram of chemical fat (Ganong, 1977).
[c] Retail trimmed total = Lean protein, kcal + intra-muscular fat, kcal + inter-muscular fat, kcal.
[d] Totally trimmed retail product = Lean protein, kcal + intra-musc. fat, kcal.

can easily be achieved. Or by total trimming of visible fat from the retail product, it is possible to have both your favorite beverage and a 100 gram portion of beef retail product (table 8). The fat content of 100 gram portions of low fat retail product can be 3 grams or less. At this level, only 25% of the calories from the retail product originate from fat, 75% originate from protein. Restriction of caloric intake originating from fats to 30% of the total caloric intake is recommended by dieticians.

TABLE 8. BEEF RETAIL PRODUCT CLASSES,
100 GRAM (3.5 OZ) PORTION
(NO ALLOWANCE FOR COOKING LOSS)

Item	Regular	Intermediate	Low fat
Retail trimmed:			
Calories	300	280	260
Fat, grams	23	21	19
Protein, grams	20	20.5	21
Cal. from fat, %	72	70	67
Totally trimmed:			
Calories	128	121	114
Fat, grams	5	4	3
Protein, grams	20	20.5	21
Cal. from fat, %	36	31	25

With normal consumption of vegetables, fruits and other low fat foods, it would not be difficult to restrict caloric consumption from animal fat to 30% or less and at the same time consume relatively generous portions (e.g., 263 gram or 9.2 oz.) of totally trimmed retail product (table 9). A retail trimmed 100 gram uncooked portion of "regular" retail product contains the same amount of calories as a 234 gram uncooked portion of totally trimmed "regular" retail product or better still, quantitatively, a 263 gram uncooked portion of totally trimmed "low fat" retail product. Perhaps even more significant is the opportunity to reduce fat intake from 23 grams in a retail trimmed 100 gram uncooked portion of "regular" retail product to just 12 grams in a 234 gram uncooked portion of totally trimmed "regular" retail product or to only 8 grams in 263 gram uncooked portion of "low fat" retail product.

TABLE 9. CALORICALLY EQUIVALENT PORTIONS (300 CALORIES)

Item	Regular	Intermediate	Low fat
Retail trimmed:			
grams	100	107	115
ounces	3.5	3.7	4.0
Totally trimmed:			
grams	234	248	263
ounces	8.2	8.7	9.2

Market potential appears to be great for labeled beef products showing caloric, protein and fat content of the product. Fat content of beef products can be predicted with reasonable accuracy from measures of fat thickness, rib-eye area, kidney-pelvic-heart fat percentage and marbling score (components of current USDA quality and yield grades). It should be easy to educate the public to identify and appreciate these products because in beef, unlike many other meat and nonmeat products, fat is white and lean is red. This advantage and the reputation for flavor enjoyed by beef products provide for extraordinary market opportunities. The genetic variation available between and within breeds can easily be used to synchronize genetic potential with shifts in market requirements to provide for low fat beef products.

All of this is not to say that we should just consider size and leanness in selection of beef cattle. There are other trade offs resulting from antagonistic genetic correlations between breeds which need to be recognized and considered.

Retail Product Growth Versus Birth Weight and Calving Difficulty

An important trade off results from antagonistic genetic relationships among retail product growth rate and birth weight and calving difficulty. Breeds siring the heaviest calves at birth experience more calving difficulty than breeds siring calves with lighter birth weights (figure 4). The association between calving difficulty and birth weight was greater in 2-yr-old and 3-yr-old cows than in 4-yr-old or older cows. Calving difficulty is associated with increased calf mortality and reduced rebreeding performance of dams (Laster and Gregory, 1973; Laster et al., 1973). This is not just a between breed phenomenon, caused by mating females from breeds or crosses of small size

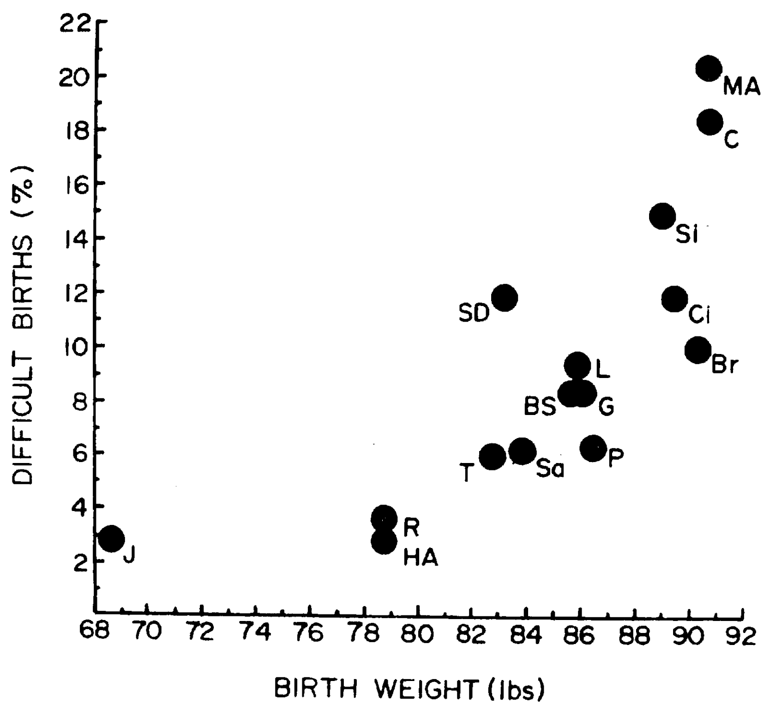

Figure 4. Breed of sire of calf means for calving difficulty versus birth weight for Hereford and Angus females calving at 4 years of age or older.

to sires of a different breed of larger size. Similar relationships exist within breeds. Koch et al. (1982b) have shown that calving difficulty and calf mortality have increased significantly relative to unselected controls in offspring of 2-yr-old heifers in three lines of Hereford cattle selected for: (1) weaning weight, (2) yearling weight, or (3) and index of yearling weight and muscling score.

Retail Product Growth Versus Age at Puberty

Breeds that excel in retail product growth potential tended to be older at puberty (figure 5). Similar relationships exist within breeds (genetic correlation = .30 MacNeil et al., 1984). Breeds that have been selected for milk production as well as size reach puberty earlier than breeds of similar mature size and retail product growth potential that have not been selected for milk production.

Retail Product Growth Versus Mature Size

Breeds that excel in retail product growth are also large in mature size (figure 6). Within breeds, high genetic correlations have been found among weights at weaning, yearling and mature ages (Brinks et al., 1964; Smith et al., 1976) and between retail product growth and mature weight (MacNeil et al., 1984). Heavier cow weight increases output per head from the production system when cows are sold; however, heavier cow weight also increases nutrient requirements per head for maintenance of the cow herd. Ferrell and Jenkins (1984) have estimated daily maintenance requirements of 130, 129, 145, and 160 kcal/$kg^{.75}$ for mature Angus or Hereford, Charolais, Jersey, and Simmental sired F_1 cows out of Hereford and Angus dams. Thus, increases in output associated with increased size tend to be offset by increases in feed requirements for maintenance, so that differences in efficiency are small (Marshall et al., 1976; Bowden et al., 1980; Jenkins and Ferrell 1983; Cundiff et al., 1983). Increases in output of progeny weight associated with increasing increments of milk production of dams appear to be more than offset by increased feed requirements for lactation (Holloway et al., 1975; Cundiff et al., 1983; Jenkins and Ferrell, 1983). Efficiency of cows with smaller output potential for retail product is especially favored if, by mating to sires with greater genetic potential for growth, they produce calves with greater genetic potential for retail product growth than they themselves possess and transmit to their offspring.

Conclusions

The variation that exists in biological traits important to beef production is vast and under a high degree of genetic control. Genetic variation found between breeds is of comparable magnitude to that found within breeds for most growth and carcass traits. Thus, significant genetic change can result from selection between and within breeds.

Breeds with the greatest retail product growth potential excel in feed efficiency from weaning to slaughter at age and weight end points. They also produce carcasses with a higher percentage retail product, less fat trim and lower levels of marbling but very acceptable meat palatability characteristics including meat tenderness. Retail trimmed (.3 in) and totally trimmed steaks,

Figure 5. Breed group means for age at puberty.

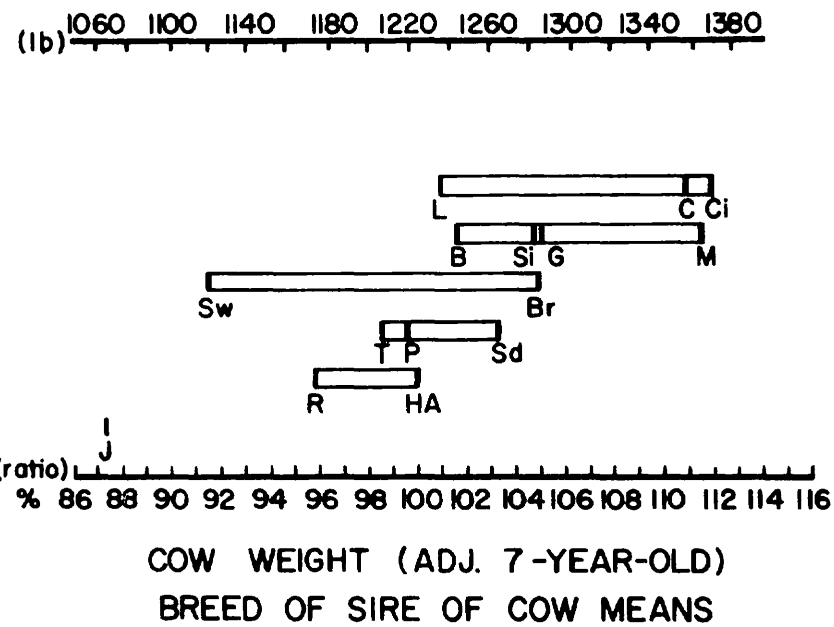

Figure 6. Breed group means for mature weight of F_1 cows.

roasts and lean trim from breeds with greatest retail product growth potential have lower levels of intra-muscular (marbling) and inter-muscular fat content, which are well suited to marketing opportunities for low fat and low caloric beef products.

Unfortunately, breeds (and sires within breeds) that excel in retail product growth potential from birth to market ages also 1) sire progeny with heavier birth weights, increased calving difficulty, reduced calf survival and reduced rebreeding in dams; 2) tend to be older at puberty; and 3) have heavier mature weight increasing nutrient requirements for maintenance. Thus, differences in output/input tend to be small.

Because of trade-offs such as time, it is not possible for any one breed to excel in all traits important to beef production. Nor is it appropriate to select intensely within breeds excluding emphasis on other important traits. Use of crossbreeding systems that exploit complementarity, heterosis and opportunity to match genetic potential with feed resources, and market opportunities provide the most effective means of managing trade-offs that result from genetic antagonisms.

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WHAT CAN AND IS BEING DONE THROUGH BIF

A. L. Eller, Jr.
BIF Executive Director
&
Extension Animal Scientist
Virginia Polytechnic Institute & State University, Blacksburg, VA

My task this morning is to discuss with you the work that has been accomplished through BIF since BIF was founded in 1968. I must tell you that a great deal has been accomplished through BIF, but very little has been accomplished by BIF. This is because the real work that is accomplished in beef cattle improvement is accomplished by the member organizations with BIF simply pulling together the best thinking of those member organizations, the research community, and the beef industry to formulate progressive uniform guidelines for beef improvement programs carried out by those member organizations.

BIF has been fortunate to have had some extremely strong leadership over the years. There certainly is a long list of these outstanding leaders that would include Dr. Frank Baker, Ferry Carpenter, Clarence Burch, Dixon Hubbard, Bob deBaca, Art Linton, and an extremely strong group of individuals who have served as president of BIF across its history, who have caused BIF to be a true catalyst for beef cattle improvement through the use of performance records.

I particularly wish to call to your attention some of the very important things that have been accomplished by the BIF board during the past few years. Several of the more important ones are as follows:

1. Activated Standing Committees - The real modern activation of standing committees, who do most of the work accomplished through BIF, was brought about under the leadership of Bill Borror in 1982. From that time forward, committees have been extremely strong and active and have been chaired by BIF board members.
2. Initiated a Budget Process - For the last four years BIF has laid out a budget and, in my opinion, have done a super job in utilizing funds from membership dues in carrying out programs and causing things to happen.
3. Data Banks Study - This study done in 1984 through Winrock International pulled together and quantified the data banks on beef cattle improvement information in every member organization and every research entity in the country.
4. Expanded Services - For the last four years, considerably more effort has gone into communications and information from the BIF office. This has happened because the board decided to spend some dollars very well in employing a part-time office secretary.

PRESENTED 1986 BIF CONVENTION, MAY 9, 1986, LEXINGTON, KENTUCKY

5. Annual Survey of Member Organizations & Central Bull Test Stations - Dixon Hubbard has done this work for BIF. Each year up-to-date information is published in the convention proceedings. This has helped communications and knowledge of performance testing activity in the country.
6. Membership - At present there are some 60 member organizations including 32 state beef improvement associations, 17 national breed associations including two in Canada and one in South Africa, and 11 other organizations such as National Cattlemen's Association, National Association of Animal Breeders, A.I. studs and others. There has been considerable interest in BIF from a number of foreign countries including Australia, New Zealand, and South Africa.
7. Annual Conventions - The annual conventions have been the focal point of the activities through BIF. The proceedings have become valued resource pieces for not only member organizations but researchers and industry groups because the annual convention symposia have brought forth technical and thought-provoking knowledge that has been well utilized. The 1987 convention will be held in Wichita, Kansas on April 29 through May 1. The 1988 convention will be in New Mexico.
8. Publicity - For the last 3½ years, BIF UPDATE has been created in the BIF national office and mailed on a monthly basis to every member organization, to state extension specialists in every state in charge of beef improvement, and to some 100 beef cattle and livestock publications throughout the country. This activity has raised the level of knowledge about BIF, beef improvement, and the workings of member organizations.
9. Executive Director Position - It has been my privilege to serve in this capacity since fall of 1982. Roger McCraw at North Carolina State University is taking over as Executive Director as of now and will be a definite asset to the cause of beef cattle improvement. Regional directors have been very active and are extremely important. Ken Ellis from California has served long and well and is now being replaced by Doug Hixon, Extension Beef Cattle Specialist at Wyoming. Roger McCraw has served well in the Eastern Region and is now being replaced in that capacity by Ron Bolze, Extension Beef Cattle Specialist at Ohio State. Daryl Strohbehn has done an outstanding job in the Central Region and continues to serve in that capacity.
10. BIF Guidelines - The standing committees working with Dr. Frank Baker have done an outstanding job pulling together the information for the new guidelines which have just been printed and are ready to be mailed to every member organization. This is the first time the guidelines have been printed and paid for by BIF. On each of the other printings, USDA has paid the printing bill. The guidelines are put together in sections that can be updated and replaced anytime the need arises. This is new and an improvement.
11. The Hanging of Frank Baker - The BIF board has strongly supported the honoring of Dr. Frank Baker by having his portrait hung in the Saddle & Sirloin Club in Kentucky which will occur November 16, 1986.
12. Awards Program - The annual Awards Program has brought honor to individuals each year at the annual convention and includes these awards: Seedstock Producer of the Year; Commercial Producer of the Year; Pioneer; Continuing Service; and the new award called the Ambassador Award.

13. Performance Records in National Judging Contests - The BIF board has caused the recent implementation of performance classes in the national contests for major universitites, minor universities, and 4-H.

We now need to look at the most important work that has been done by the various standing committees:

SIRE EVALUATION

The Sire Evaluation Committee has, perhaps, been BIF's most valuable committee. An extreme amount of work has been done over the years under the leadership of Everett Warwick, Richard Willham, and Larry Cundiff. In addition to these individuals, breed association and research people have made a tremendous contribution.

Sire Evaluation came about because of the leadership furnished through BIF and breed associations have embraced the national sire evaluation philosophy and have moved rapidly in utilizing extremely contemporary programs. These important points should be noted:

1. Guidelines - the BIF Guidelines have carried the necessary information for breed associations to utilize in putting their sire evaluation programs together.
2. Content of Convention Symposia - Down through the years, a great deal of the effort and new information have been brought to light in annual conventions.
3. Modern Sire Evaluation Procedures - Sire evaluation programs have moved rapidly to embrace the Best Linear Unbiased Prediction (BLUP) concept and recently the Animal Model. The BIF Sire Evaluation Committee sponsored a workshop on the potential to use the Animal Model in computations at Winrock at Morrilton, Arkansas in December, 1983. This workshop was the catalyst to cause breed associations to quickly adopt this technology.
4. Future - The committee is considering the needs and methodology to include measures of fertility in sire evaluation including scrotal circumference, gestation length, mature weight, pelvic measures and others. Traits of female reproduction are being studied with the thought of adding them to sire summaries. Work in the area of calving ease as it relates to sire summaries continues.

LIVE ANIMAL EVALUATION

This committee under the present leadership of John Crouch has been very active with the following points:

1. Frame Size Chart - This was a hard birth, but finally a BIF recommended frame size chart has gone into the new guidelines.
2. Scrotal Circumference Adjustments to a Common Age - Both Live Animal and Reproduction Committees have grappled with this one and have as yet have not made recommendations because research to date has not been conclusive but certainly will lead to proper adjustments in this area at sometime in the near future.
3. Future - The committee is currently looking at linear trait scoring; the assessment and scoring of behavior and temperment. A current subcommittee will, no doubt, make recommendations to the board relative to the adoption of an udder scoring system.

GROWTH

1. Adjustment Factors - This committee did a gigantic amount of work in working out adjustment factors for the various growth traits that have been embraced by the industry.
2. Calving Ease - The committee continues to work in the area of quantifying and recording calving ease.

REPRODUCTION

The Reproduction Committee under the able current direction of Roy Wallace has worked extremely closely with the Sire Evaluation Committee and are currently interested in two major points:

1. Scrotal Size Adjustments in Bulls to a Common Age.
2. Investigation of Reproductive Measures that can be used in Sire Evaluation.

CENTRAL TEST

Roger McCraw has provided current leadership for this committee as its chairman and the committee has been active in these areas:

1. Developed guidelines for forage testing of bulls.
2. Brought about a uniform yearling weight adjustment formula for test station bulls that is currently in the guidelines.
3. Current work involving length of test recommended for central test stations. The committee will bring forth a recommendation to the BIF board to allow 112 day tests as well as 140 day tests with proper constraints.
4. Other - Guidelines for presentation of data in sale catalogs; micro computer programs for test station use; and utilization of video auctions are some of the current concerns.

UTILIZATION

This committee has been chaired by Steve Wolfe. The new chairman will be Al Smith. This has been one of the most active and productive of the standing committees. Their work includes:

1. BIF Guidelines - The new guidelines must fall into the category of utilization and have been printed after being brought up-to-date. They are ready for distribution.
2. Fact Sheets - Camera-ready copies of nine fact sheets have made a tremendous impact on the utilization of records and performance programs. Daryl Strohbehn, Central BIF Secretary at Iowa State, has chaired this responsibility. There will be more fact sheets in the future.
3. Slide Sets - Two slide sets basically for junior audiences, one entitled, "Understanding Genetic Principles" and the other entitled, "Selecting the Beef Heifer", are currently ready for distribution from the University of California, thanks to the work of Ken Ellis at the University of California, Davis, and Larry Corah at Kansas State University.

4. Commercial Performance Testing Software Package - This software for use with micro computers is in the testing phase and is an excellent program. Roger McCraw has chaired the activity with the help of Dennis Lamm, J. D. Mankin, Curly Cook, and others.
5. Performance Records in Judging Contests - Jim Gibbs spearheaded this work that has been successful in getting performance classes in national collegiate and 4-H contests.
6. Electronic Data Systems - At some point, BIF Guidelines and perhaps sire summaries will be available across the country on electronic data networks.
7. Convention Proceedings in Libraries - The committee is working to, for the first time, make BIF convention proceedings available to landgrant university and other libraries.
8. Current Work - How to utilize and sell the EPD concept to commercial producers; how to get sire summary data and EPD's more ingrained into the educational process; continued work on slide sets; continued work on the commercial software package; continued work on fact sheets; a look at what extension and landgrant universities should be doing to get the educational job done at all levels.

SYSTEMS

Jim Gibb has provided excellent leadership as chairman of this committee which is one of the newer BIF standing committees. Important work includes:

1. For the first time a section on Systems has been written for the BIF Guidelines and is included in the 1986 printing.
2. A fact sheet on the Systems Approach to Cattle Breeding is coming out camera-ready to all member organizations and state extension specialists.
3. A Systems Workshop was sponsored by the committee in November, 1984 at Winrock. A set of proceedings of this workshop were printed.
4. Currently the Systems Committee is looking for a computerized method of bringing about integrated cattle breeding and management. Danny Simms from Kansas State has made an excellent presentation on their work in this area at this convention.

EMBRYO TRANSFER

Craig Ludwig has served as the chairman for this newest BIF committee. The committee has explored methods for utilizing growth records on embryo transfer produced calves and have suggested guidelines for including records on ET calves that would be utilizable in sire summary data.

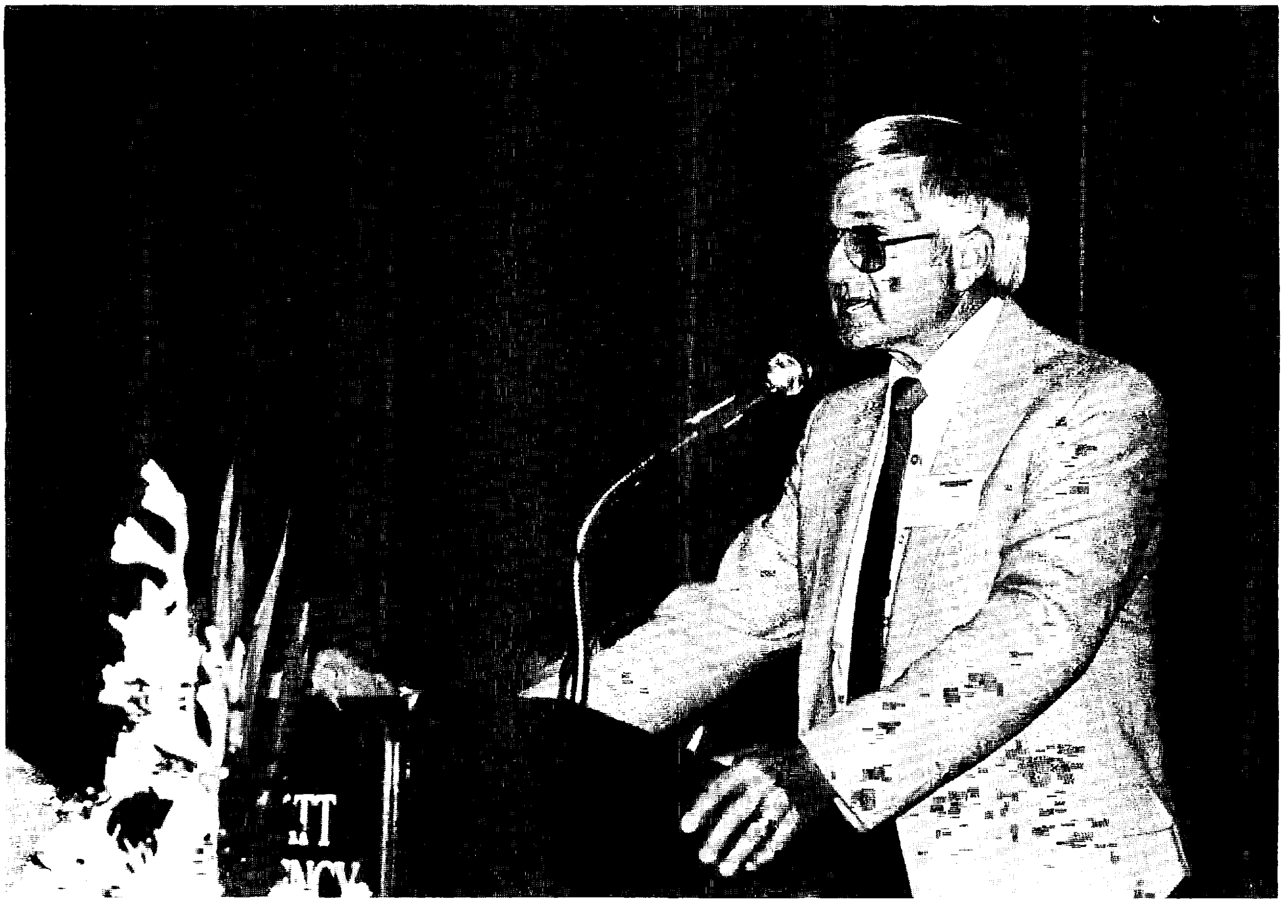
The above does not fully capture all the work of the board or the committees. At this point, I think we need to turn our attention to the future and think about some of the things that BIF and its member organizations will need to address in the near future. Some of these are:

1. Serving Capacity of Bulls - There is no question but that the measurement and recordation of libido and serving capacity is of extreme importance to the commercial beef industry. How to get the procedure simplified and quantified for records is the task.

2. Sire Evaluation - Today sire evaluation appears very sophisticated. I think we have only seen the tip of the iceberg. As we move into specification seedstock at all levels of the seedstock industry, many modifications and improvements will need to come about in sire evalution.
3. Whole Herd Analysis - This is a brand new concept that has been only introduced by breed associations using the Animal Model or Reduced Animal Model in the last one to two years. A tremendous educational job is yet to be done to get utilization of this advanced technology.
4. Scoring and Utilizing Auxiliary or Functional Traits - Little has been done in beef cattle relative to soundness traits, traits that lend themselves to longevity, traits that better quantify eventual size and better quantify reproduction. Just a few of these traits are frame size, scrotal circumference, pelvic area, udders, teats, feet, and legs. The more valuable of these traits certainly will find their way into sire summaries in the future.
5. Performance and Profitability - These two need to tied together closely. Much more work needs to be done on systems that are economics-driven.
6. Predictable Seedstock - The industry has only gotten a glimmer of this concept that has been so well enunciated by speakers in this convention. Much more can and will be done.
7. Crossbreeding Systems - Much research has been done but the application of crossbreeding systems and the utilization of specification seedstock is still in its infancy.
8. The beef industry must figure out how to produce beef more efficiently and reduce the maintenance cost that the industry bears in our rather inefficient system.

In summary, I would quote Henry Wadsworth Longfellow who said, "We judge ourselves by our capacity of doing. Others judge us by what we've done." We are collectively capable of great things. We, no doubt, will be judged in history by what we actually accomplish. In my opinion, BIF and its entire complement of member organizations will be judged well because much has been accomplished. The talents of many individuals and groups have been brought together for a common cause. The beef industry is much better off because you collectively have done so much.

We all will agree that BIF has done much -- but wait! BIF has done nothing, nothing but be a catalyst. The member organizations have done much. There is much more to be done.



CHARGING THE BIF COMMITTEES - Dixon Hubbard

NATIONAL SIRE EVALUATION AND REPRODUCTION COMMITTEE REPORT

May 8, 1986

Chairman: Larry Cundiff and Roy Wallace

Meeting was called to order by Cundiff at 2:40. Joint meeting was held today with reproduction to explore reproduction traits for use in sire evaluation. This is spin-off from reproduction symposium.

Don Lunstra, U.S. MARC, discussed scrotal circumference as a criterion of selection. He considered factors affecting the fertility of beef bulls. Scrotal circumference a simple and accurate method of determining puberty (r = -.85). Heritability of scrotal circumference is .41. Used paired testicular volume. Low correlation of SC with body weight. Found age of dam effects for SC. Have large range of SC within breeds. SC correlated with heifer age at puberty (-.98) using breed means. Adjustment factors were presented for SC. Discussion centered on the effect of management level on puberty and the adjustments.

Jim Brinks, CSU, discussed adj. SC, using Hereford data. The genetic correlations with other traits were presented for SC. Suggest committee recommended an EPD for SC. Pelvic measures were presented. SC is age at puberty in coded form. Problems exist to measure female puberty but score being developed for palpation. Suggested traits for EPD are gestation length, mature weight, pelvic measures, scrotal circumference, and puberty score.

Dave Notter, VPI, involved in study of traits to be used for female reproduction. Two problems are theoretical and practical. The theoretical are categorical traits, non-normal distribution, and multi-stage responses. The practical are no information on heifer fertility, no breeding data, incomplete data and inventory reporting and indistinct breeding seasons. Simulation used to generate underlying distribution and 0 or 1 measures and used to estimate heritability on 0 or 1 data. Number of services estimated h^2 well but other measures less. Data on 1st calving data gave h^2 = .17. The first two calvings may be extent of information available. Multiple stage problems were discussed. With breeding information breeders can measure reproduction. Calving data is complex function of underlying distribution. Y = ln (C+1) normalized calving data distribution. Must have full reproductive information in field data. Must have open female data.

Ron Green, U. of Nebraska, reported on Garst data using calving data in a fixed breeding season. For gestation length and birth date, estimated direct and maternal effect. Simulation work used to predict genetic change. Big year-season effects. Maternal grandsire important as was service sire. For birth date direct h^2 = .09 and maternal h^2 = .03 with a correlation of -.38 in first parity data. Index was developed to look at response to selection. Responses for birth date .76 days/year.

John Pollak discussed calving ease work using gestation length. Talked on gestation length analysis. The heritability of gestation length was .37 and maternal grand sire .09. There is information available on gestation length. They will do non-linear calving ease with linear other trait analysis if it can be done.

Larry Benyshek discussed problem of accuracy and how to get approximate lead diagonal inverse for Reduced Animal Model. Looking at the use of embryo transfer data for SE analysis. Trying to make BV more useful by getting them to breeders updated. Had request for more than one sire evaluation per year.

Willham suggested the need to update sire evaluations or RAMs as data were added.

Larry Cundiff summarized the meeting. Reproduction needs to be included in sire evaluation. Larry introduced Everett Warwick who was first chairman of the Sire Evaluation Committee.

LIVE ANIMAL EVALUATION COMMITTEE REPORT
1986 BIF CONVENTION
LEXINGTON, KENTUCKY

John Crouch, America Angus Association, presiding.

Chairman Crouch reported on the activities of the committee since the last convention. The frame score charts were published in April in the fifth edition of the BIF Program Guidelines.

The areas of temperament and udder soundness in beef cattle were the primary discussion topics for this years program. Chairman Crouch introduced Harold Gonyou, University of Ill. for a presentation of his research in the assessment of temperament in beef cattle. A summary of his presentation is listed below:

Two distinctions of Temperament
- A. Genetic Analysis
- B. Behavior Assessment

Differences in Temperament Types
- A. Herd dominance
- B. Aggression
- C. Fearfulness
- D. Excitability

Methods of Assessment
- A. General Impression (by herdsman)
- B. Open field test (separation from herdmates)
- C. Handling situation (headchute score)
  5-10 second assessment

  Classification
  1. no pull on headchute
  2. pulls back
  3. repeated push and pull
  4. some jumping
  5. continous movement including jumping

Previous research on temperament has been conducted by:
- Tulloh - Australia
- Heisher - Sask.
- Fordyce - Australia

Reasons for Selection of Temperament

- A. Production Traits (tame = more efficient?)
- B. Effect on Pen Mates (chicken featherpecking)
- C. Independent Value

Conclusions
1. Establishment of a scoring system must be uniform.
2. Multiple observers should be used.

QUESTIONS FROM THE FLOOR:

Does chute score at weaning or yearling reflect the same score assigned later in life and/or on progeny?

Gonyou was requested to keep the committee informed on his research findings.

Chairman Crouch introduced Ike Eller to discuss udder scoring of dairy females. He presented the scoring systems that the Holstein and Jersey breeds utilize in their performance programs. No recommendations were made to the committee.

QUESTION FROM THE FLOOR:

What is the economic value of udder scoring?

Chairman Crouch introduced Jim Gibb to present the APHA udder scoring system. He discussed the reasons for a scoring system:

1. Labor Requirements caused by problem udders.
2. Calf unable to get necessary colostrum
3. Safety of the herdsmen when treating problem udders.

The APHA system scores for two traits approximetely 24 hours after calving:

1. Teat Size (0 - 50 pts)
2. Udder Structure (0 - 50 pts)

QUESTIONS FROM THE FLOOR:

- are scores reported in the APHA sire summary?
- at what score is labor required?
- does age of cow effect scoring system?
- how are scores for rear and front udder suspension separated?
- where is the trade-off made between udder scores and high producing cows

A committee of Jim Gibb, Dave Notter and John Crouch are to arrive at a udder scoring system prior to the midyear board meeting. As there was no other business the committee adjourned.

Minutes submitted by Russ Danielson

ASSESSMENT OF TEMPERAMENT IN BEEF CATTLE

by

Dr. Harold W. Gonyou
Department of Animal Sciences
University of Illinois

There are several aspects of cattle behavior that we would like to improve. Our reasons for this may be to facilitate handling or management, or to improve production in our enterprises. Three areas in which there is considerable interest and some attempt at assessment has been made are serving capacity in bulls, maternal behavior in cows and temperament in feedlot cattle. Serving capacity tests have been developed and are expected to play a more important role in selecting bulls and determining the number of cows to be exposed to each bull. Research has been conducted in Australia by Blockey (1981) and Chenoweth (1983), and in the United States by Mader and Price (1984) and Lunstra (1986). Maternal behavior is an important consideration of cow-calf operations but there is little documentation of a potential to improve this behavior by selection (Buddenberg et al., 1986). Assessing maternal behavior, particularly aggression toward intruders, will be difficult in that it must occur during a limited period of time and under range conditions to be of value to a producer. The third area of behavioral assessment that has received some attention has been temperament.

The term temperament is not clearly defined but in the research conducted has usually referred to the reaction of animals to restraint or handling. Thus, it is not a measure of social dominance among the animals, or even the aggressiveness of animals in relation to each other. It probably most accurately reflects the animals excitability and fearfulness when handled. Fear may lead to aggression towards the handler but this is considered to be a class of aggression separate from social interations.

Several methods have been used to assess temperament in both beef and dairy cattle. Dairy producers have rated their cows' temperament by giving a general impression developed over weeks or years of milking. These values have been included in herd records but appear to be too subjective to be of much use. Heritabilities of these scores are generally low (Agyemang et al., 1982). A second method used was the open field test which was developed for laboratory species. This method involves releasing the cows in a large, specially designed arena and recording their behavior. It is time consuming and had little relationship to scores given in the milking parlor (Kilgour, 1975). A third general method is to score the animals in a specific handling situation. In dairy cattle this has usually been the milking parlor (Kilgour, 1975), while in beef cattle this has been in a scale or headgate (Tulloh, 1961).

"Chute scores," as developed by Tulloh and used with some modification by Heisler (1979), Fordyce et al. (1982) and others is a simple technique. The reaction of the animal to being held on the scale or a headgate is assessed using a scoring system such as that in Table 1. Scoring can be accomplished in a matter of seconds and interferes very little with other procedures performed on the animal. The facilities to score an animal are available on most operations. Unlike general assessments of temperament, there is a high degree of agreement between observers scoring the same animal. Heisler (1979) reported between-observer repeatabilities of .73 and Goddard et al. (1983) of .90. Animals receive similar scores if they are tested several times. Repeatabilities for multiple scores range from .45 for Fordyce et al. (1982) to .78 for Gonyou (unpublished data). Repeatabilities of this magnitude indicate that if an animal is scored 4 or 5 times the average score is an accurate assessment of the behavior.

The two questions most often addressed concerning the genetics of temperament are those of breed differences and heritability. Heisler (1979) evaluated the temperament of purebred bulls during their feedlot performance test. Maine Anjou and Hereford bulls were the quietest followed by Angus and Shorthorn. Charolais were somewhat more temperamental and Simmental scored highest. These ranks are in general agreement with other studies although minor differences may be found. In general, cattle with Brahman breeding in them are more excitable than other breeds (Fordyce et al., 1982, Gonyou, unpublished data).

Heritabilities based on paternal half-sib comparisons are moderate to high (.22, Gonyou, unpublished data; .48, Heisler, 1979; .67, Fordyce et al., 1982). However, both Heisler (1979) and Fordyce and Goddard (1984) reported parent-offspring correlations of less than .10. This is likely due to the fact that the parent (the dam) was scored at a greater age than the offspring when the effects of the experience would be greater. When animals are tested at a uniform age, the heritabilities are great enough to indicate that a reasonable response should be obtained by selection.

The final product of the beef industry is meat, not quiet cattle. This means that the value of improved temperament is indirect rather than direct. Quiet cattle tend to grow faster than their temperamental pen-mates (Stricklin, et al., 1979), but the relationship is not strong enough to attempt to improve growth by improving temperament. Little is know about the relationship of temperament to meat quality in terms of bruising and dark cutting but one could speculate that temperamental cattle may result in poorer quality meat. The real value of temperament assessment may relate to how much trouble a rancher is willing to put up with in handling his cattle.

The tolerance of a producer should be related to the number of times an animal is handled and the quality of the handling facilities. Putting this into dollar terms is a difficult problem. One approach, used by Wickham (1979) in a study with dairy cattle, is to examine the culling rates of cows in terms of both production and temperament. Cattle with poor temperament were often culled even though their productivity was higher than many quiet cows retained in the herds studied. Quiet cows were more valuable because they and their daughters would stay in the herd longer. Including temperament in the selection criteria of the herds was estimated to increase the rate of improvement in the herd by 15%. As beef cattle are handled much less frequently than dairy, the value of temperament is probably lower, but still important enough for a producer to consider avoiding certain breeds or bulls and to occasionally cull a cow.

Questions that remain to be answered about temperament include the following:

1. The economic value of the trait. This should take into account culling rates among cows, extra time and precautions necessary during handling, and the frequency of injuries to both the animals and stockmen during handling.
2. Is chute score indicative of other important behavioral traits such as maternal behavior?
3. Are the estimated heritabilities realized in selection response trials?
4. Does heterosis play a major role when crossbred cattle are involved?

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Table 1. Scoring system for "Chute Scores."

Score	Description
1	Does not pull on head gate
2	Pulls back on head gate
3	Repeated push and pull
4	Some jumping
5	Continuous movement including jumping

SYSTEMS COMMITTEE REPORT

The committee meeting was called to order by Chairman Jim Gibb. After briefly reviewing the activities of the Systems Committee during the last three years, Jim introduced Danny Simms who gave a presentation on the BEEFpro Integrated Cattle Management Program being developed at Kansas State University. This presentation was in response to inquiries made at previous Systems Committee meetings regarding microcomputer applications of beef cattle simulation models. BEEFpro, when completed, will assist producers in analyzing available information for more accurate decision-making regarding all aspects of their operations. Included will be a means of preparing a cost return budget for the beef enterprise, evaluation of current management and recommendations for changes in management that should have a positive economic impact. In addition to being a decision-making model, it will also be very effective in disseminating educational information.

A question and answer period followed the presentation. A more detailed description of BEEFpro is included on the pages that follow. Questions regarding BEEFpro should be directed to Danny Simms, Northeast Area Extension Office, 1515 College Ave., Manhattan, Kan. 66502, phone (913) 532-5833.

Respectfully submitted,

Jim Gibb, Chairman

BEEFpro
An Integrated Cattle Management Program For Microcomputers

Danny D. Simms, Terry B. Goehring, and Don D. Pretzer
Kansas State University

What is BEEFpro?

BEEFpro is a computer program being developed for use on microcomputers with the following goals:

1. Provide a means of preparing a cost/return budget for the beef enterprise.
2. Evaluate current management.
3. Provide recommendations for changes in management.
4. Provide a means of rapidly evaluating the economic impact of management changes including the major interactions between production factors.
5. Provide a resource base for producers, county agents, bankers, etc.

BEEFpro will be written utilizing the "SHELL" developed at Kansas State University. The "SHELL" has capabilities which make it useful in developing expert systems type decision aids. Several of these characteristics include:

1. Excellent user interface and ease of use.
2. Modular format which allows easy updating and modification to fit a variety of production systems and geographical areas.
3. Interaction between modules so that calculations and variables can be shared between numerous modules. This integration overcomes one of the weaknesses of prior software development projects in that cattle management decision aids didn't share common variables, and thus they didn't communicate.
4. Ability to present technical information to "back up" the recommendations and economic analysis. This capability gives the program tremendous potential as a reference source for producers, county agents, bankers, etc.

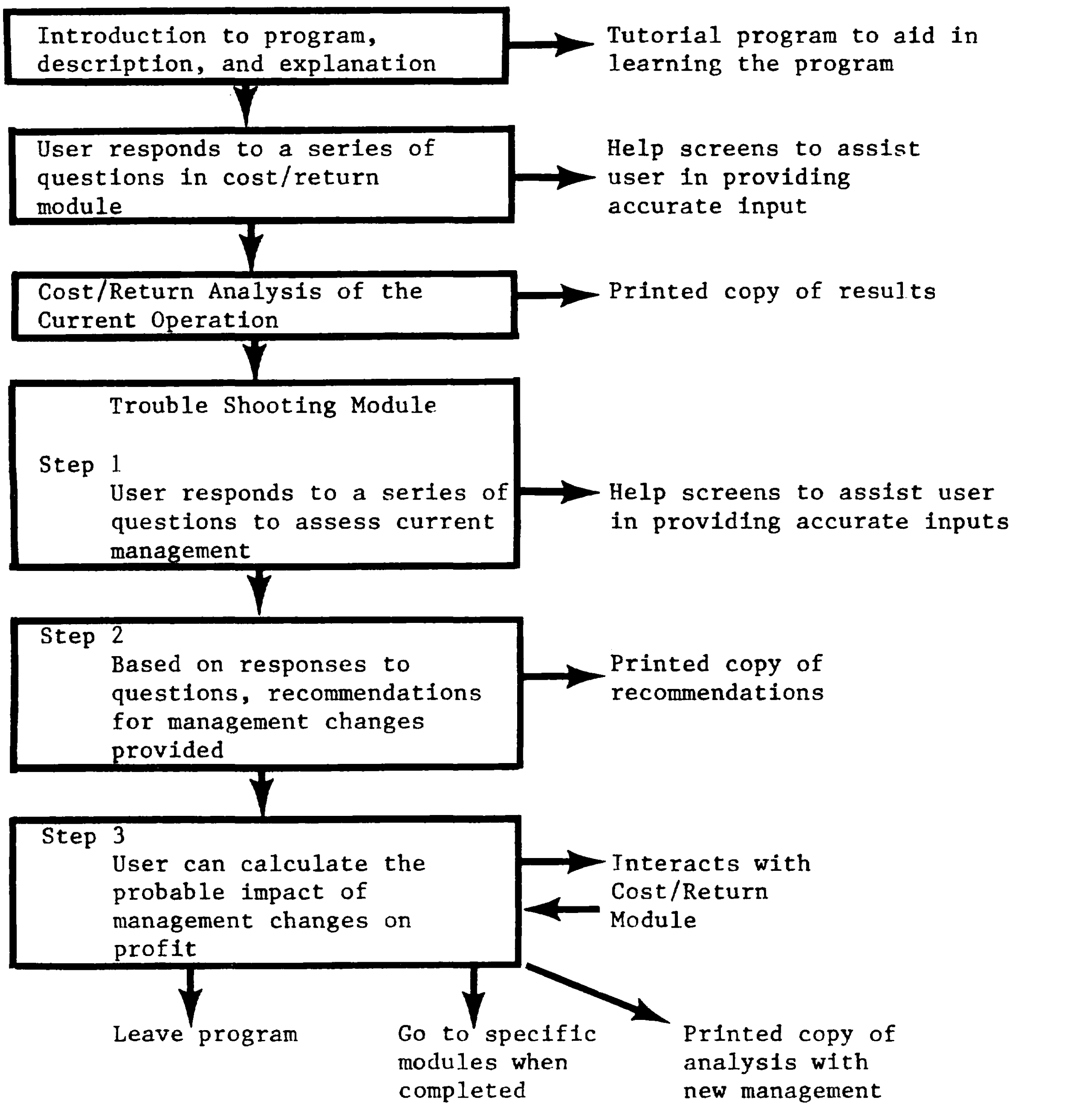
BEEFpro will attempt to take a total approach by considering all of the economic ramifications of alternatives. This approach is greatly preferable to making decisions on individual facets of the operation without adequate considerations of the overall impact. Obviously, this approach is already being utilized by producers; however, the increasing complexity of modern agriculture has made it more difficult to evaluate the total impact of management changes. Therefore, the time appears to be ripe for the computer to assist producers in analyzing the available information and assist in profitable decision making.

Current Status of BEEFpro

At the present time, two modules for BEEFpro are in development--the cost/return module and a trouble shooting module. The cost/return module is a key part of the program since all other modules will interact with it through the SHELL to show the economic impact of management changes. The trouble shooting module is being designed to evaluate the overall management of the operation and indicate areas of potential improvement. Under the current schedule, these two modules will be ready for field testing with producers by the summer of 1986.

Diagram 1 illustrates the operation of BEEFpro once both modules have been developed.

Diagram 1. A Flow Chart of BEEFpro in Action



In addition to the attributes shown in Diagram 1, BEEFpro will have the ability to present educational information at the user's request. For example, summaries of research trials or results of field demonstrations could be presented to aid the user in assessing the probable impact of a management change. Additionally, help screens will be available to assist the user in providing accurate input and in obtaining output as desired. Furthermore, for each input value requested from the user, the program provides a default value which will be an average value for the state or area based on farm management association records, test farms, etc.

Future Development of BEEFpro

While only two modules are in development at the current time, many more modules are planned for future development. For example, modules covering cow herd nutrition, breeding programs, reproduction, marketing, health, and stocker programs, as well as many others, will be included in the final version of BEEFpro. Also, because of the modular design of the program, it can be updated easily as new technology is developed.

BEEFpro will be a Multi-State Project

Modules for BEEFpro will be developed at several universities to take advantage of the best expertise from across the country. It must be pointed out that a multi-state effort of this type will take longer and cost more than development at a single university; however, the final product should have wider appeal since many universities participated in its development.

How will the "SHELL" be Shared?

The "SHELL" will be shared with other universities via a "Sharing Agreement" developed at Kansas State University. Basically, this agreement says that Kansas State University will give the "SHELL" to cooperating universities at minimal cost if they agree to the following conditions:

1. They will not modify the "SHELL." This will maintain the compatibility which is probably the most valuable feature of this project.

2. They will share the source code, documentation, etc., to all software developed utilizing the "SHELL" with all cooperating universities. This sharing should maximize the impact of software throughout the cattle industry.

Function of National Cattlemen's Association in BEEFpro Development

The National Cattlemen's Association, and more specifically the Research and Education Committee, will assist in the development of BEEFpro in the following ways:

1. Providing leadership and guidance on prioritizing modules.

2. Promoting BEEFpro within the cattle industry.

3. Helping secure funds to support BEEFpro development.

CENTRAL TEST STATION COMMITTEE

Beef Improvement Federation

May 8, 1986

Chairman Roger McCraw called the meeting to order at 2:10 pm.

The first item on the agenda was discussion concerning the possibility of conducting 112-day tests rather than having tests of 140-days in length. Dr. Keith Zoellner presented a review of research on length of test for central test stations. Summary material from his review follows this report. Much discussion followed his presentation. The committee recommends to the board that the minimum length of central gain tests be 112 days. However, test supervisors need to consider the objectives of their tests in deciding the appropriate length of the testing period.

Next on the agenda was a proposed format for test station sale catalogs. A committee consisting of Drs. Larry Nelson, Bob McGuire and Charles McPeake reported on their study of this topic. Their report indicated that they had reviewed catalogs from several states and found them to be quite complete and reasonably uniform in terms of the data presented. They did stress that perhaps more effort should be directed toward including EPD's in the catalogues; however, they acknowledged the difficulties involved in obtaining them in time for inclusion.

Dr. Curly Cook, University of Georgia, reported on a microcomputer program they have developed for processing records and printing reports for central bull tests. Copies of the output generated were shared with committee members. He agreed to make the program available to BIF and to send a copy of it to Dr. McCraw, N.C. State University, for distribution. The committee recommends to the board that BIF consider distributing this program to those who are interested in using it.

The fourth item was a report from Dr. Larry Nelson, Purdue University, on the use of video sales for test stations in Indiana. He reported that the method of merchandising has been used successfully in Indiana for six years. They use the videotapes at two remote locations with ringmen at each. They are now selling 30 to 35% of their bulls to buyers at the remote locations. The total video cost for 1985 and 1986 was $10 and $9 per bull in the sale, respectively. Results of surveys presented by Dr. Nelson indicated general acceptance and satisfaction among the video audiences.

Due to time constraints on the committee meetings, the remaining two items on the agenda -- 1) alternative testing schemes for bulls in central tests (Dr. Keith Zoellner, Discussion Leader) and 2) criteria for determining eligibility of bulls for sale at test stations -- were not discussed. It was concluded that these two items should be included on the agenda for the meeting next year.

Dr. Charles McPeake, Oklahoma State University, was elected as Chairman and Dr. Ronnie Silcox, University of Georgia, was elected as Secretary for the next year.

The committee meeting was adjourned at 5:15 pm.

Respectfully submitted,

Dr. Larry Olson, Acting Secretary

A REVIEW EVALUATING LENGTH OF TEST FOR CENTRAL TEST STATIONS

BY KEITH O. ZOELLNER
EXTENSION SPECIALIST
KANSAS STATE UNIVERSITY
MANHATTAN, KS

BIF
LEXINGTON, KENTUCKY
1986

CENTRAL TESTING STATIONS

USES:

1. COMPARING INDIVIDUAL PERFORMANCE OF POTENTIAL SEED STOCK HERD SIRES TO SIMILAR ANIMALS FROM OTHER HERDS
2. COMPARING BULLS BEING READIED FOR SALE
3. FINISHING STEERS OR HEIFERS SCHEDULED FOR SLAUGHTER AS PART OF PROGENY TEST
4. ACQUAINT BREEDERS WITH RECORD OF PERFORMANCE
5. ESTIMATING GENETIC DIFFERENCES BETWEEN HERDS OR BETWEEN SIRE PROGENIES IN GAINING ABILITY, FEED CONVERSION, AND CARCASS CHARACTERISTICS

HERITABILITIES BY GAIN PERIODS[1]

	HERITABILITY
BIRTH WT.	.22
WEANING WT.	.25
PERIOD: 1	.18
2	.28
3	.18
4	.08
5	.04
140-DAY FEEDLOT	.40
FINAL WT.	.47

[1]SWIGER; JAS: VOL 20, NO. 1, 1961
832 HEREFORD PROGENY OF 23 SIRES, 1950-1958

CORRELATIONS BETWEEN FINAL WEIGHT AND GAIN PERIODS PLUS WEANING WEIGHT[1]

	CORRELATION
WEANING WEIGHT PLUS	
PERIOD: 1	.64
2	.75
3	.79
4	.80
5	.81

[1]ADOPTED FROM SWIGER AND HAZEL
JAS: VOL 20, NO. 1, 1961

POOLED ESTIMATES OF HERITABILITY[1]

TRAIT	BULLS	HEIFERS	STEERS
200-D. WT	.47	.42	-.06
284-D. WT	.57		
396-D. WT	.73	.47	.18
452-D. WT	.44		
508-D. WT	.71		
550-D. WT	.63	.55	.37

[1]SWIGER ETAL. JAS: VOL 22, NO. 5 (1963)
1671 CALVES, 240 SIRES
543 BULLS, 840 HEIFERS, 288 STEERS

HERITABILITIES OF GAINS FROM 28 TO 224 DAYS[1]

	LENGTH OF POSTWEANING INTERVAL (DAYS)							
SOURCE	28	56	84	112	140	168	196	224
GPE[2]	.12	.27	.35	.40	.46	.49	.52	.55
SEL. EXP.[3]	.09	.13	.16	.19	.21	.21	.21	.24

[1]KOCH, ETAL, JAS: VOL. 55, NO. 6, 1982

[2]2,410 CROSSBRED STEERS - 313 SIRES, 16 BREEDS

[3]3,088 HEREFORD BULLS - 180 SIRES

HERITABILITY ESTIMATES FOR GAIN FOR DIFFERENT TIME INTERVALS WITHIN TEST[1]

DATA PERIODS[2]	HEREFORD	ANGUS
1, 2, 3, 4, 5	.62	.49
1, 2, 3, 4	.78	.55
2, 3, 4	.80	.43
2, 3, 4, 5	.57	.37

[1]MEYERS, ETAL, UNIV. OF ARK., 1985
573 HEREFORD, 694 ANGUS, 31 TESTS, 42 HEREFORD SIRES AND 38 ANGUS SIRES

[2]28 DAY PERIODS

140 DAY VS SHORTER TEST PERIODS[1]

TRAITS	CORRELATION
84 ADG. 140 ADG	.82
112 ADG. 140 ADG	.91

[1]MCPEAKE AND BUCHANAN. OKLAHOMA STATE UNIVERSITY 1986 ABSTRACT
655 BULLS, SIX BREEDS, 1983-1985

HERITABILITIES OF POSTWEANING PERFORMANCE TRAITS[1]

TRAIT	H^2
FIN. WT	.49
ADG	.23
WT 2 - 10D	.12
WT 3 - 24D	.10
WT 4 - 38D	.18
WT 5 - 52D	.16
WT 6 - 66D	.24
WT 7 - 80D	.24
WT 8 - 94	.23
WT 9 - 108	.28
WT 10 - 122	.28

[1]MAUROGENIS, ETAL. JAS: VOL. 47, NO. 5 (1978)
NORTH CAROLINA STATE.

695 HEREFORD BULLS, 72 SIRES, 1967-1975

CORRELATIONS POST WEANING PERFORMANCE WITHIN FRAME[1]

	FRAME		
	4	4, 5 & 6	7 OR
NO. BULLS	2982	6404	545
AVG. FR.	3.1	5.5	7.4
AVG. ADJ 365 WT	912	1051	1193
112 ADG 140 ADG	.89	.89	.72
LAST 28D ADG 140 ADG	.32	.47	.55
140 ADG ADJ 365 WT	.65	.61	.57
FR. 140 ADG	.29	.34	-.04
FR. ADJ 365 WT	.37	.56	.30

[1]SCHALLES AND ZOELLNER, KANSAS STATE UNIVERSITY 1986.
9946 BULLS, 732 HERDS, 32 BREEDS, 2195 SIRES, 43 TESTS
1971-1985.

BIF Utilization Committee Meeting

May 8, 1986

Chairman - Dixon Hubbard

Secretary - Doug Hixon

Chairman Hubbard reminded those in attendance that the purpose of the Utilization Committee was to develop means of improving and increasing the use of performance testing.

Several items on the agenda were discussed in considerable detail. These included:

1. How to Sell Sire Summary and, the EPD Concept to Commercial Producers. This discussion was led by H. H. "Hop" Dickenson of the American Hereford Association (AHA). The AHA is trying to "sell" the EPD concept. He indicated that it would be difficult to get wide use until more dollars are received for those cattle with high EPD's. A video tape entitled "Utilizing Superior Bulls" has been developed as a cooperative project by the AHA and the University of Georgia. This tape can be acquired for a minimal reproduction cost ($5-$15) from the AHA. This demonstrates the genetic progress that can be made by using results from the National Sire Evaluation Program. Sire selection based on yearling weight EPD yielded an 11 pound/calf/year increase in weaning weight and a 14 pound/calf/year increase in yearling weight over the period of 6 calf crops.

   An example of a producer using the National Sire Summary data to "sell" the EPD concept as well as his bulls, was also discussed. This purebred producer used the data to explain to bull buyers how his bulls ranked with other Hereford bulls across the country. He effectively put the information in commercial producers' language.

2. How A.I. Studs use Data for Educational Programs on Sire Selection. Discussion was led by Norm Vincel, Virginia - North Carolina Select Sires. Select Sires has developed a slide-tape presentation entitled "Evaluation of Beef Bull Sire Summaries". This presentation discusses the evaluation of EPD's for the economically important traits. Partitioning of the maternal trait into growth and milk production components is discussed. Accuracy figures are also explained. This production is available for distribution for the cost of reproducing.

3. Report on BIF Slide Sets. Ken Ellis, University of California, presented the two slide-tape programs which were developed at the request of BIF. These were designed for a broad audience including new adult breeders and youth.

a) "Genetics and Animal Breeding" - Contents include discussions of genetic progress, mating systems, estimated breeding values, sire selection and EPD's.

b) "Selecting a Beef Breeding Heifer" - Contents include discussion of choosing a breed, preferred pedigrees, goals and objectives, performance, costs and various other aspects involved in this process.

These slide-tape sets are available from the University of California Cooperative Extension Service for $35/set.

4. Performance Testing Software Report. "Ike" Eller discussed the program that has developed under the leadership of Roger McCraw over the last 3 years. This is now available for CPM machines with a minimum of 64K. Auburn University is changing this over to MS DOS. New version should be available the first part of June. It should be more "user friendly" with an easier to understand manual. It appears to also have more flexibility in terms of printing different sorts. This software package currently sells for $50. States may distribute as they see fit. McCraw will notify state groups when update is available.

5. BIF Fact Sheets Report and Plans. Daryl Strohbehn described the six factsheets of which camera-ready copies have been distributed to each Land-Grant University. These include:

a) Beef Production Glossary by Dave Notter, VPI & SU.

b) Understanding Performance Pedigrees by Jim Gibb, American Polled Hereford Association.

c) Understanding and Using Sire Summaries by Wayne Wagner, West Virginia University.

d) Utilizing Performance Records in Commercial Beef Herds by J. D. Mankin, University of Idaho.

e) Utilizing Performance Records with Judging Classes by John Crouch, Steve Radokovich, Carla Nichols and Brad Skaar.

f) Calving Difficulty in Beef Cattle by Harlan Ritchie, Michigan State University.

Camera-ready copies of these factsheets are still available.

Presently, three additional factsheets are at the typesetters. These include:

a) The Systems Concept of Beef Production by Rick Bourdon, Colorado State University.

b) Culling the Commercial Cowherd by Dennis Lamm, Doug Hixon and J. D. Mankin.

c) Modern Commercial Beef Sire Selection by Roger McCraw, Jim Gosey and Roy Wallace.

Camera-ready copies of these three should be out by mid-June.

Additional factsheet needs should be brought to the attention of Strohbehn or other board members.

6. <u>What Extension and the Land-Grant University System Should Do to Get the Educational Job Done</u>. Charles McPeake challenged Extension personnel to work with industry and breed associations to promote the use of EPD's. He suggested the EPD concept should be sold on the basis of economics. It is not improvement if it's not economically feasible. The need for breed associations to standardize informaton and the form of reporting was also stressed.

Committee recommendations:

1. A need exists for a list of available educational materials. This list should include cost and means of obtaining.

2. There is need for the development of teaching materials that illustrate the various available sire summaries and their particular methods of presenting data.

3. Factsheet entitled "Understanding and Using Sire Summaries" needs to be revised with more emphasis on EPD's.

MINUTES OF BEEF IMPROVEMENT FEDERATION
BOARD OF DIRECTORS MEETING
MAY 7 & 9th
HYATT REGENCY LEXINGTON
LEXINGTON, KENTUCKY

The BIF Board of Directors held two directors' meetings in conjunction with the 1986 Annual Convention at the Hyatt Regency Lexington in Lexington, Kentucky. The first meeting was held on Wednesday, May 7th 2:30 - 7:00 p.m. with dinner. The second meeting was held May 9th 6:00 - 7:00 a.m. Attending the board meeting were Henry Gardiner, President; Harvey Lemmon, Vice-President; A. L. Eller, Jr., Executive Director; Roger McCraw; Daryl Strohbehn; and Ken Ellis, Regional Directors; Doug Hixon and Ron Bolze, New Regional Directors; Bill Borror; Bill Warren; John Crouch; Bob Dickinson; Roy Wallace; Wayne Vanderwert; Jim Gibb; Richard Whitman; Bruce Howard; Larry Cundiff; Dixon Hubbard; Frank Baker; and new directors, Leonard Wulf and Jack Chase. The directors not in attendance were Craig Ludwig, Steve Radakovich, Al Smith, Steve Wolfe, Glenn Butts, and Keith Vandervelde.

The following items of business were transacted:

1. Call to order and clear the agenda. The meeting was called to order at 2:45 p.m. by President Henry Gardiner who ask if there were other agenda items, in addition to those listed. There were none.

2. The minutes of the mid-year board meeting held in fall 1985 at Kansas City were read by Executive Director Eller who moved acceptance of the minutes as read. Seconded by Roy Wallace. Carried.

3. Treasurer's Report - A. L. Eller, Jr. provided copies of the treasurer's report for the calendar year 1985 and for 1986 from January 1 to April 22, 1986. Copies of these reports are attached. For the year 1985 total cash in checking account and money market accounts January 1, 1985 was $49,442.72. Total cash in checking account, money markets,and certificates of deposits December 31, 1985 was $48,639.04. The report showed income for 1985 of $17,696.88 and disbursements of $18,500.56. As of April 22, 1986, the report showed total cash in checking account, money market account, and certificates of deposits to be $56,561.23. For the year 1986 to date total income of $9,757.98, total expenses $1,835.79. Eller moved acceptance of the treasurer's report which was properly seconded and carried.

4. BIF Membership Report - Eller passed out a complete membership report as of April 25, 1986 which showed 29 state organizations, 17 national breed associations, and 11 other category members which have paid dues to date for 1986. For a total of 57 members. A copy of the membership report is attached.

5. Future BIF Conventions - President Gardiner announced that the 1987 convention would be at the Airport Hilton in Wichita, Kansas April 29, 30 and May 1, 1987. He indicated that the Kansas people are making plans to tour feedlots and a packing plant which is a boxed beef facility. Preliminary plans call for video taping of steers on feed in the fall and slaughtering them before the BIF meeting. He says there will be a woman's program included. President Gardiner will appoint a program committee at the board meeting Friday morning. President Gardiner indicated that the board needed to act on the invitation from New Mexico for the 1988 Convention. Eller shared a letter with the board from Ron Parker indicating that New Mexico is definitely serious about inviting BIF Convention to New Mexico in 1988. Bill Borror moved that the 1988 BIF Convention be held in New Mexico with preference for Albuquerque. Seconded by John Crouch and carried.

6. BIF Guidelines - Executive Director Eller reported that 5,000 copies of the new guidelines were printed in Blacksburg at a total cost of $5,618 or a per copy cost of $1.13 ea. He thanked Frank Baker for his editorial work and Dixon Hubbard's office and his secretary Agnes Lamar for putting the entire text of the new guidelins on the computer which produced the camera-ready copy. He indicated that the camera-ready copy will go to Animal Science Dept. in every state such that they can print the needs for classroom work at their university. Eller covered planned distribution which calls for 50 copies per member organization with no charge and regular charge for additional copies. He indicated that in addition 20 or 25 copies were slated to go to state extension specialists in charge of performance testing programs and that BIF members in the other category would get a number of Guidelines up to 50 based on their request. The matter of what to charge for individual copies of the Guideline was discussed. Crouch moved that a charge of $3.00 per copy post-paid be made. Seconded by Dickinson, carried. Roger McCraw will have any reprinting done that is necessary. The question was asked as to whether sections of the Guidelines could be reprinted and the answer is yes. That was the intent for printing the Guidelines in the form the new Guidelines are printed in. Eller will send copies to libraries at land-grant universities and to other places as the general mailing is made. Eller mentioned the cost of shipping and stated that he did not know what the cost would be, but he felt like it would nominal.

7. Executive Director Position - Henry Gardiner indicated that the transition from Eller to Roger McCraw was being made, and Roger indicated that he is ready to begin his work as Executive Director. Eller talked of several items that he has initiated and carried out through his office and particularly talked about the work of the part-time secretary and how essential she has been at a cost of less than $300 per month. Roger McCraw stated that he has a part-time secretary lined up.

8. Regional Directors - A committee composed of Dixon Hubbard and Roy Wallace was appointed at the fall mid-year meeting to come up with a recommendation of a Western Regional Director to replace Ken Ellis and an Eastern Regional Director to replace Roger McCraw. Hubbard reported for the committee and recommended Doug Hixon, Extension Animal Scientist and the University of Wyoming at Larmie for the Western Regional Director and Dr. Ron Bolze, Extension Animal Scientist at Ohio State University at Columbus for the Eastern Regional Director. Bob Dickinson moved the approval of those recommended as new regional directors, seconded by Jim Gibb, carried. Dixon Hubbard made a motion that the minutes show that the service of McCraw and Ellis as Regional Directors is appreciated and that the President write a letter to their institutions thanking them for the work of these two men. Seconded by John Crouch and carried.

9. BIF Slide Sets - Ken Ellis, Western Regional Director, thanked the board for allowing him to serve as Western Regional Director and expressed his pleasure in having served for a number of years. He reported that the two slide sets and tapes have been completed and that the University of California can handle the distribution of the slide sets. He indicated also that the slide sets would be shown in the Utilization Committee on Thursday, May 8th. He indicated that the University of California's cost is about $35.00 per set, but does not know what the mailing charge would be. Frank Baker moved that the board authorize the University of California to sell the two slide sets and tapes for the Beef Improvement Federation. Seconded by Roger McCraw. In the discussion, there was a question as to whether the University of California needed to make any profit. The answer was no. Ken Ellis suggested that there is a catalog that carries slide sets and the like from the University of California at Davis. When asked how widely it was circulated, he did not know.

The two slide sets are entitled "Selecting the Beef Project Heifer" and "Basic Genetics in Cattle Breeding Programs." The motion was voted on and carried. In discussing the charge for the slide sets, Bill Borror made a motion to have the University of California charge an amount near $35.00 to cover cost and that BIF would not expect any income from the project. Seconded by Frank Baker. The motion carried. Ken Ellis said that several people hade contributed material for the slide sets and this material would be returned.

10. <u>BIF Fact Sheets</u> - Daryl Strohbehn, Central Regional Director, reported that the first six slide sets have been gotten out and camera-ready copy had been sent to all member organizations and to all state extension services and that the use has been extremely good. He reported that he has sent three Fact Sheets to the typesetters who are a bit slow in getting them out. These three are entitled "Cow Selection and Culling" by John Crouch, Dennis Lamm, J. D. Mankin, and Doug Hixon. The "Systems Concept" by Rick Bourdon and "Modern Commercial Beef Sire Selection" by Roy Wallace and Roger McCraw. Strohbehn reported that he will have camera-ready copy out by June 1 and will send 100 copies of the camera-ready copies to new Executive Director, Roger McCraw and that a bill to BIF will follow. Eller reported that he had brought copies of the first six Fact Sheets printed in Virginia with him to the convention for those attending to pick up. Eller suggested that committee chairman should get ideas developed for new fact sheet topics.

11. <u>Commercial Herd Performance Testing Software Package</u> - Roger McCraw who has chaired this effort made a report giving the complete background on the project and indicating he has sent copies of the program to Extension Specialists in 40 states and to a fair number of individuals particularly after the Farm Journal article that came out on the Software Package. He indicated that there was need to update the program and put it in MS DOS language for IBM capatible hardware. He reported that personnel at Auburn University are now working on the program to do revisions to MS DOS. He said the Auburn people were planning to have their work done by April 1st, but that the Auburn version now would probably not be out until June. McCraw stated that the original objective of his work with the software package had been achieved and that several states have utilized the program and modified it to suit their needs. Roger suggested he would get information out to member organizations and Extension Specialists as soon as the new version from Auburn is completed. Eller ask about handling and sale and maintenance and whether or not anything had been done to secure a vendor. Dixon Hubbard had been ask to check if there was any monetary report for maintaining such a program from federal sources. He reported that there are none. President Gardiner ask McCraw to report on the progress of the software at the mid-year board meeting in Kansas City in fall 1986.

12. <u>Standing Committee Plans for the Convention</u> - Eller reported that he had put together a mimeograph of the program planned for each of the 5 committees which will meet during the convention. These to be picked up by individuals attending the convention so they will know the agenda is for each committee meeting. He passed out copies of this outline. Since Al Smith nor Steve Wolfe will be in attendance, Dixon Hubbard agreed to chair the Utilization Committee. Bill Borror suggested that the schedule of committee activities should go in the program in the future. Each of the committees was reviewed in the standpoint of the committee secretary. Ike Eller ask that each committee chairman get a report of their activities during the committee meeting to him by Thursday evening, May 8th so he could include their work in his report at breakfast, May 9th.

13. Member Organization and Test Station Report - Dixon Hubbard is in charge of getting the survey material out to every member organization and test station and getting the report put together in time for the proceedings. He indicated that he had instructed his secretary to get the material out and is in the process of getting the work accomplished.

14. Mid-Year Board Meeting - Richard Willham reported that Frank Baker will be hung in the Saddle and Sirloin Club in Louisville, Kentucky Sunday, November 16th. He passed out material and indicated that he had made preliminary plans to put on a symposium on Saturday and Sunday, November 15th and 16th and invited the BIF board to tie in their mid-year board meeting. He indicated too that there is a need to raise considerable funds for having the portraits painted and other expenses. He indicated too that he needs the names of people to invite to the various functions. He suggested that he has two news articles ready to go. He ask the board's input on the symposium program. Eller commented that it would be difficult to put together as long a symposium as he has in mind with all the other things going on at Louisville. After considerable discussion, Eller suggested that a one-half day symposium on Sunday afternoon,previous to the banquet honoring Dr. Baker, might be appropriate. There was considerable discussion, after which the consensus of the board was that a one-half day symposium held on Sunday afternoon November 16th prior to the banquet would be quite appropriate. Eller ask the board if there was any reason he should not send mailing labels of the BIF member organization and individuals to Dick Willham. There being no problem, he stated that he will send the labels to Dr. Willham.

15. Mid-Year Board Meeting - There was a consensus of the board that it would be necessary to have a separate mid-year board meeting away from Louisville. Daryl Strohbehn moved that the board meet in Kansas City October 30 and 31. The motion was seconded by Hubbard and carried. The program committee will meet the morning of October 30. The board meeting will begin at noon October 30th.

16. Sponsorship of Third World Congress on Genetics Applied to Animal Production Eller indicated that he had received a letter asking for monetary support for the World Conference and that Larry Cundiff could speak relative to details. Larry Cundiff ask the board to contribute $500. Harvey Lemmon moved that BIF contribute $500, seconded by Ellis. John Crouch moved to ammend the motion to make the amount $1000. Seconded by Strohbehn and carried. The main motion as ammended was voted on and carried unanimously.

17. Nominating Committee for Officers - Bill Borror, Chairman of the committee, suggested that Ludwig and Radakovich are not in attendance and ask President Gardiner to appoint additional help for him in formulating his report before the Friday morning board meeting. Henry Gardiner appointed John Crouch and Daryl Strohbehn to serve with Bill Borror.

18. 1987 Convention Program Committee - President Gardiner appointed the following committee: Bob Dickinson, Chairman; Henry Gardiner, Larry Corah, Scott Laudert, Roger McCraw, Jack Chase. That committee will meet in Kansas City on October 30th in the morning prior to the board meeting.

19. Election of Officers - Bill Borror, Chairman of the nominating committee, placed the names of Harvey Lemmon, President and Bob Dickinson, Vice President in nomination. He moved acceptance of the nominating committee report and that an unanimous ballot be cast for these two individuals. Motion was seconded by Strohbehn and carried unanimously. So the new president is Harvey Lemmon and the new vice-president is Bob Dickinson

20. New Directors to the Board - President Gardiner welcomed new board of directors' members who were in attendance at the May 9th board meeting. They are Leonard Wulf from Morris, Minnesota, the At-Large Director replacing Steve Radakovich and Jack Chase from Wyoming, the Western BCIA Director, replacing Bill Borror. Henry Gardiner was re-elected representing Central BCIA's, Harvey Lemmon was re-elected representing Eastern BCIA's, and Craig Ludwig was re-elected representing Breed Associations. President Gardiner also welcomed Ron Bolze, Eastern Regional Director, replacing Roger McCraw and Doug Hixon, Western Regional Director, replacing Ken Ellis.

21. Catalog of BIF Materials - Daryl Strohbehn suggested that in the Utilization Committee there was an expressed need for a catalog of materials that are available through BIF. He ask that the board authorize putting together a catalog for distribution and suggested that it shouldn't cost over $50 to $100 to print. Frank Baker moved that BIF approve such a catalog. Bill Warren seconded the motion and it was carried.

22. Convention Improvement - The board took just a few moments to visit about ideas that might improve future conventions including early work by the host organization in getting sponsorships, making plans early to hold cost as low as possible.

23. Status of PRI Directorship - The question was ask whether Performance Registry International was still functioning and was due a board member on the BIF Board. No one seemed to have the correct information, but Eller did indicate in recent letter to him from Glenn Butts, Mr. Butts indicated that the name had been changed to Performance Records International and that it appeared that organization had been reincorporated. It was the concensus that the appropriate information be gathered prior to the fall mid-year board meeting.

24. BIF Constitution and By-Laws - Eller indicated that there is a need to have the Constitution and By-Laws of BIF looked at with the idea that some changes may be necessary. Since many BIF directors do not have a copy of the Constitution and By-Laws, Eller volunteered to send a copy of the present Constitution and By-Laws to all board members.

25. Local Organizations Sponsoring 1986 BIF Convention - The Kentucky Beef Cattle Association was that organization for the 1986 Convention and will be thanked appropriately by a letter from the Executive Director.

26. Awards at 1986 Convention - The following awards were presented:
Seedstock Producer of the Year - Leonard Lodoen, North Dakota
Commercial Producer of the Year - Charles Fariss, Virginia
Continuing Service Awards - Larry Benyshek, University of Georgia
Earl Peterson, American Simmental Association
Ken Ellis, University of California Davis
Ambassador Award - Warren Kester, Beef Magazine
Pioneer Awards - Charles R. Henderson, Cornell University (Retired) and Everette Warwick, USDA ARS (Retired)

Respectfully submitted,

A. L. Eller, Jr.
BIF Executive Director

BEEF IMPROVEMENT FEDERATION

FINANCIAL STATUS - CALENDAR YEAR 1985

by

A. L. Eller, Jr.

	1-1-85	12-31-85
Checking Account	$ 336.41	$ 252.38
Money Market Account	49,106.31	8,386.66
Certificates of Deposit	--	40,000.00
	$49,442.72	$48,639.04

1985 BIF INCOME

Interest	$ 4,978.69
Proceedings	109.36
Guidelines	1.00
Dues	9,120.15
*1985 BIF Conv.	3,487.68
TOTAL INCOME	$17,696.88

*Includes - Wisconsin BIA, 4 Coffee Breaks $131.32 ea., and NC St. Univ. reimbursement for James Innes

1985 BIF EXPENSES

Postage	1,899.78
Printing (Conv. Prog. $241.00, Proceedings $1,635.70)	1,876.70
Am. Polled Hereford Assn. (Proceedings Systems Workshop)	1,162.69
1985 Conv. Speakers Travel	4,380.12
Exec.Dir. Travel Conv. & Mid-Yr. Board Mtg.	1,098.50
Supplies	144.46
Salary & Taxes (Office Sec.)	3,357.33
Plaques & Engraving	265.77
Certificate Lettering	16.25
Mid-Yr. Bd. Meeting Dir. Travel Lemmon (1984) Borror (1985) Lemmon (1985)	1,404.00
Holiday Inn (Mid-Yr. Board Meeting)	614.88
Iowa St.Univ.Fact Sheets	211.30
Colorado St. Univ. Computer Software	1,500.00
Ray Kimsey (NCSU Computer Consultant) (1985 Conv. Expense)	470.93
Plaques (Nat'l. Livestock Judging Contests - Louisville)	97.85
TOTAL EXPENSES	$18,500.56

BEEF IMPROVEMENT FEDERATION

FINANCIAL STATUS - January 1, 1986 - April 22, 1986

BY

A. L. Eller, Jr.

Checking Account	$ 1,377.16
Money Market	15,184.07
Certificates of Deposit	40,000.00
	$56,561.23

1986 BIF INCOME

Dues	$ 8,140.44
Proceedings	40.00
Interest (Checking)	8.13
Interest (Money Market)	202.74
Interest (Certificates of Deposit)	1,366.67
TOTAL INCOME	$ 9,757.98

1986 BIF EXPENSES

Salary & Taxes (Office Sec.)	$ 791.03
Supplies (Envelopes, Mail bags, Ribbons, Print Shop for env.)	52.30
Postage	627.46
Corporation Registration	5.00
Legal Fees (Colorado law firm)	45.00
BIF Programs	315.00
TOTAL EXPENSES	$ 1,835.79

PAID

BIF MEMBER ORGANIZATIONS AND AMOUNT FOR DUES - 1986

April 25, 1986

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

Breed Associations	
American Angus	$600.00
American Brahman Breeders	$300.00
American Gelbvieh Assoc.	$200.00
American Hereford Assoc.	$600.00
Am.-International Charolais	$300.00
American Red Poll	$100.00
American Salers Assoc.	$200.00
American Shorthorn Assoc.	$300.00
American Polled Hereford	$600.00
American Tarentaise	$ 50.00
International Brangus Breeders	$200.00
North American Limousin	$300.00
Red Angus Assoc.	$200.00
Santa Gertrudis Breeders Intern.	$300.00
Beefmaster Breeders Universal	$300.00
Canadian Charolais Assoc.	$200.00
Canadian Hereford Assoc.	$ 70.54 ($100.00)

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Missouri	$100.00
Montana	$100.00
New Mexico	$100.00
New York	$ 50.00
North Carolina	$100.00
North Dakota	$ 50.00
Ohio	$100.00
Oklahoma	$100.00
Oregon	$100.00
Pennsylvania	$ 50.00
South Carolina	$100.00
South Dakota	$100.00
Tennessee	$100.00
Texas	$ 50.00
Virginia	$100.00
Washington	$ 50.00
West Virginia	$100.00
Wisconsin	$100.00
Wyoming	$ 50.00

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Beefmaster Breeders Universal	$300.00
Canadian Charolais Assoc.	$200.00
Canadian Hereford Assoc.	$ 70.54 ($100.00)

Others	Dues	
Nat'l. Assoc. of An. Breeders	$100.00	
Performance Records Int'l., Inc.	$ 50.00	
Nat'l. Cattlemen's Assoc.	$100.00	
Am. Breeders Service	$100.00	
Midwest Breeders Coop.	$100.00	
NOBA, Inc.	$100.00	
Select Sires, Inc.	$100.00	
Manitoba Agriculture/Beef Program of An. Industry Branch	$100.00	
Beefbooster Cattle Limited	$ 69.90	($100.00)
Agricultural Canada, Regional Development Branch	$100.00	
Northeast Kentucky BIF	$ 50.00	

BIF MEMBERS WHO HAVE NOT PAID MEMBERSHIP DUES FOR 1986
(As of April 20, 1986)

Georgia BCIA - $100.00
Hawaii BCIA - $50.00
Idaho BCIA - $50.00

American Simmental Assoc. - $300.00
The Simmentaler Cattle Breeders
Society of Southern Africa - $100.00
American Chianina Assoc. - $200.00

1986 AWARDS BANQUET
John Crouch - M.C., Mr. and Mrs. Henry Gardiner, and Larry Cundiff

BIF AWARDS PROGRAM

The Commercial Producer Honor Roll of Excellence

Chan Cooper	MT	1972
Alfred B. Cobb, Jr.	MT	1972
Lyle Eivens	IA	1972
Broadbent Brothers	KY	1972
Jess Kilgore	MT	1972
Clifford Ouse	MN	1973
Pat Wilson	FL	1973
John Glaus	SD	1973
Sig Peterson	ND	1973
Max Kiner	WA	1973
Donald Schott	MT	1973
Stephen Garst	IA	1973
J. K. Sexton	CA	1973
Elmer Maddox	OK	1973
Marshall McGregor	MO	1974
Lloyd Mygard	ND	1974
Dave Matti	MT	1974
Eldon Wiese	MN	1974
Lloyd DeBruycker	MT	1974
Gene Rambo	CA	1974
Jim Wolf	NE	1974
Henry Gardiner	KS	1974
Johnson Brothers	SD	1974
John Blankers	MN	1975
Paul Burdett	MT	1975
Oscar Burroughs	CA	1975
John R. Dahl	ND	1975
Eugene Duckworth	MO	1975
Gene Gates	KS	1975
V. A. Hills	KS	1975
Robert D. Keefer	MT	1975
Kenneth E. Leistritz	NE	1975
Ron Baker	OR	1976
Dick Boyle	ID	1976
James D. Hackworth	MO	1976
John Hilgendorf	MN	1976
Kahua Ranch	HI	1976
Milton Mallery	CA	1976
Robert Rawson	IA	1976
Wm. A. Stegner	ND	1976
U. S. Range Experiment Station	MT	1976
John Blankers	MN	1977
Maynard Crees	KS	1977
Ray Franz	MT	1977
Forrest H. Ireland	SD	1977
John A. Jameson	IL	1977
Leo Knoblauch	MN	1977
Jack Pierce	ID	1977
Mary & Stephen Garst	IA	1977
Odd Osteroos	ND	1978
Charles M. Jarecki	MT	1978
Jimmy G. McDonnal	NC	1978
Victor Arnaud	MO	1978
Ron & Malcolm McGregor	IA	1978
Otto Uhrig	NE	1978
Arnold Wyffels	MN	1978
Bert Hawkins	OR	1978
Mose Tucker	AL	1978
Dean Haddock	KS	1978
Myron Hoeckle	ND	1979
Harold & Wesley Arnold	SD	1979
Ralph Neill	IA	1979
Morris Kuschel	MN	1979
Bert Hawkins	OR	1979
Dick Coon	WA	1979
Jerry Northcutt	MO	1979
Steve McDonnell	MT	1979
Doug Vandermyde	IL	1979
Norman, Denton & Calvin Thompson	SD	1979
Jess Kilgore	MT	1980
Robert & Lloyd Simon	IL	1980
Lee Eaton	MT	1980
Leo & Eddie Grubl	SD	1980
Roger Winn, Jr.	VA	1980
Gordon McLean	ND	1980
Ed Disterhaupt	MN	1980
Thad Snow	CAN	1980
Oren & Jerry Raburn	OR	1980
Bill Lee	KS	1980
Paul Moyer	MO	1980
G. W. Campbell	IL	1981
J. J. Feldmann	IA	1981
Henry Gardiner	KS	1981
Dan L. Weppler	MT	1981
Harvey P. Wehri	ND	1981
Dannie O'Connell	SD	1981
Wesley & Harold Arnold	SD	1981
Jim Russel & Rick Turner	MO	1981
Oren & Jerry Raburn	OR	1981
Orin Lamport	SD	1981
Leonard Wulf	MN	1981
Wm. H. Romersberger	IL	1982
Marvin & Donald Stoker	IA	1982
Sam Hands	KS	1982
Larry Campbell	KY	1982
Lloyd Atchison	CAN	1982
Earl Schmidt	MN	1982

Milton Krueger	MO	1982
Carl Odegard	MT	1982
Raymond Josephson	ND	1982
Clarence Reutter	SD	1982
Leonard Bergen	CAN	1983
Kent Brunner	KS	1983
Tom Chrystal	IA	1983
John Freitag	WI	1983
Eddie Hamilton	KY	1983
Bill Jones	MT	1983
Harry & Rick Kline	IL	1983
Charlie Kopp	OR	1983
Duwayne Olson	SD	1983
Ralph Pederson	SD	1983
Ernest & Helen Schaller	MO	1983
Al Smith	VA	1983
John Spencer	CA	1983
Bud Wishard	MN	1983
Bob & Sharon Beck	OR	1984
Norman Coyner & Sons	VA	1984
Franklyn Esser	MO	1984
Leonard Fawcett	SD	1984
Fred & Lee Kummerfeld	WY	1984
Edgar Lewis	MT	1984
Boyd Mahrt	CA	1984
Don Moch	ND	1984
Neil Moffat	CAN	1984
William H. Moss, Jr.	GA	1984
Dennis P. Solvie	MN	1984
Robert P. Stewart	KS	1984
Charlie Stokes	NC	1984
Milton Wendland	AL	1985
Bob & Sheri Schmidt	MN	1985
Delmer & Joyce Nelson	IL	1985
Harley Brockel	SD	1985
Kent Brunner	KS	1985
Glenn Harvey	OR	1985
John Maino	CA	1985
Ernie Reeves	VA	1985
John E. Rouse	WY	1985
George & Thelma Boucher	CAN	1985

1986

Kenneth Bentz	OR	1986
Dennis and Nancy Daly	WY	1986
Carl and Fran Dobitz	SD	1986
Charles Fariss	VA	1986
David J. Forster	CA	1986
Danny Geersen	SD	1986
Gary Johnson	KS	1986
Ralph G. Lovelady	AL	1986
Ramon H. Oliver	KY	1986
Kay Richardson	FL	1986
Mr. & Mrs. Clyde Watts	NC	1986
David and Bev Lischka	CAN	1986

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 Crame	CA	1974
Burwell M. Bates	OK	1974
Maurice Mitchell	MN	1974
Robert Arbuthnot	KS	1975
Glenn Burrows	NM	1975
Louis Chesnut	WA	1975
George Chiga	OK	1975
Howard Collins	MO	1975
Jack Cooper	MT	1975
Joseph P. Dittmer	IA	1975
Dale Engler	KS	1975
Leslie J. Holden	MT	1975
Robert D. Keefer	MT	1975
Frank Kubik, Jr.	ND	1975
Licking Angus Ranch	NE	1975
Walter S. Markham	CA	1975
Gerhard Mittness	KS	1976
Ancel Armstrong	VA	1976
Jackie Davis	CA	1976
Sam Friend	MO	1976
Healy Brothers	OK	1976
Stan Lund	MT	1976
Jay Pearson	ID	1976
L. Dale Porter	IA	1976
Robert Sallstrom	MN	1976
M. D. Shepherd	ND	1976
Lowellyn Tewksbury	ND	1976
Harold Anderson	SD	1977
William Borror	CA	1977
Rob Brown, Simmental	TX	1977
Glenn Burrows, PRI	NM	1977
Henry & Jeanette Chitty	FL	1977
Tom Dashiell, Hereford	WA	1977
Lloyd DeBruycker, Charolais	MT	1977
Wayne Eshelman	WA	1977
Hubert R. Freise	ND	1977
Floyd Hawkins	MO	1977
Marshall A. Mohler	IN	1977
Clair Percel	KS	1977
Frank Ramackers, Jr.	NE	1977
Loren Schlipf	IL	1977
Tom & Mary Shaw	ID	1977
Bob Sitz	MT	1977
Bill Wolfe	OR	1977
James Volz	MN	1977
A. L. 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
Roy Hunt	PA	1978
Del Krumwied	ND	1979
Jim Wolf	NE	1979
Rex & Joann James	IA	1979
Leo Schuster Family	MN	1979
Bill Wolfe	OR	1979
Jack Ragsdale	KY	1979
Floyd Mette	MO	1979
Glenn & David Gibb	IL	1979
Peg Allen	MT	1979
Frank & Jim Willson	SD	1979
Donald Barton	UT	1980
Frank Felton	MO	1980
Frank Hay	CAN	1980
Mark Keffeler	SD	1980
Bob Laflin	KS	1980
Paul Mydland	MT	1980
Richard Tokach	ND	1980
Roy & Don Udelhoven	WI	1980
Bill Wolfe	OR	1980
John Masters	KY	1980
Floyd Dominy	VA	1980
James Bryan	MN	1980
Blythe Gardner	UT	1980
Richard McLaughlin	IL	1980

Charlie Richards	IA	1980
Bob Dickinson	KS	1981
Clarence Burch	OK	1981
Lynn Frey	ND	1981
Harold Thompson	WA	1981
James Leachman	MT	1981
J. Morgan Donelson	MO	1981
Clayton Canning	CAN	1981
Russ Denown	MT	1981
Dwight Houff	VA	1981
G. W. Cornwell	IA	1981
Bob & Gloria Thomas	OR	1981
Roy Beeby	OK	1981
Herman Schaefer	IL	1981
Myron Aultfather	MN	1981
Jack Ragsdale	KY	1981
W. B. Williams	IL	1982
Garold Parks	IA	1982
David A. Breiner	KS	1982
Joseph S. Bray	KY	1982
Clare Geddes	CAN	1982
Howard Krog	MN	1982
Harlin Hecht	MN	1982
Willard Kottwitz	MO	1982
Larry Leonhardt	MT	1982
Frankie Flint	NM	1982
Gary & Gerald Carlson	ND	1982
Bob Thomas	OR	1982
Orville Stangl	SD	1982
C. Ancel Armstrong	KS	1983
Bill Borror	CA	1983
Charles E. Boyd	KY	1983
John Bruner	SD	1983
Leness Hall	WA	1983
Ric Hoyt	OR	1983
E. A. Keithley	MO	1983
J. Earl Kindig	VA	1983
Jake Larson	ND	1983
Harvey Lemmon	GA	1983
Frank Myatt	IA	1983
Stanley Nesemeier	IL	1983
Russ Pepper	MT	1983
Robert H. Schafer	MN	1983
Alex Stauffer	WI	1983
D. John & Lebert Shultz	MO	1983
Philip A. Abrahamson	MN	1984
Rob Bieber	SD	1984
Jerry Chappell	VA	1984
Charles W. Druin	KY	1984
Jack Farmer	CA	1984
John B. Green	LA	1984
Ric Hoyt	OR	1984
Fred H. Johnson	OH	1984
Earl Kindig	VA	1984
Glen Klippenstein	MO	1984
A. Harvey Lemmon	GA	1984
Lawrence Meyer	IL	1984
Donn & Sylvia Mitchell	CAN	1984
Lee Nichols	IA	1984
Clair K. Parcel	KS	1984
Joe C. Powell	NC	1984
Floyd Richard	ND	1984
Robert L. Sitz	MT	1984
Ric Hoyt	OR	1985
J. Newbill Miller	VA	1985
George B. Halterman	WV	1985
Davis McGehee	KY	1985
Glenn L. Brinkman	TX	1985
Gordon Booth	WY	1985
Earl Schafer	MN	1985
Marvin Knowles	CA	1985
Fred Killam	IL	1985
Tom Perrier	KS	1985
Don W. Schoene	MO	1985
Everett & Ron Batho & Families	CAN	1985
Bernard F. Pedretti	WI	1985
Arnold Wienk	SD	1985
R. C. Price	AL	1985

1986

Clifford & Bruce Betzold	IL	1986
Glenn L. Brinkman	KS	1986
Jack & Gini Chase	WY	1986
Henry & Jeannette Chitty	FL	1986
Lawrence H. Graham	KY	1986
A. Lloyd Grau	NM	1986
Mathew Warren Hall	AL	1986
Richard J. Putnam	NC	1986
Clarence Van Dyke	MT	1986
John H. Wood	SC	1986
Evin & Verne Dunn	CAN	1986
Gerald E. Hoffman	SD	1986
Delton W. Hubert	KS	1986
Dick & Ellie Larson	WI	1986
Leonard Lodden	ND	1986
Ralph McDanolds	VA	1986
Roy D. McPhee	CA	1986
W. D. Morris & James Pipkin	MO	1986
Robert J. Steward & Patrick C. Morrissey	OR	1986
Leonard Wulf	MN	1986

Commercial Producer of the Year

Chan Cooper	MT	1972	Bert Hawkins	OR	1979
Pat Wilson	FL	1973	Jess Kilgore	MT	1980
Lloyd Nygard	ND	1974	Henry Gardiner	KS1	1981
Gene Gates	KS1	1975	Sam Hands	KS	1982
Ron Baker	OR	1976	Al Smith	VA	1983
Steve & Mary Garst	IA	1977	Bob & Sharon Beck	OR	1984
Mose Tucker	AL	1978	Glenn Harvey	OR	1985

1986

Charles Fariss VA 1986

Seedstock Breeder of the Year

John Crowe	CA	1972	Jim Wolf	NE	1979
Mrs. R. W. Jones	GA	1973	Bill Wolfe	OR	1980
Carlton Corbin	OK	1974	Bob Dickinson	KS	1981
Leslie J. Holden	MR	1975	A. F. "Frankie" Flint	NM	1982
Jack Cooper	MT	1975	Bill Borror	CA	1983
Jorgensen Brothers	SD	1976	Lee Nichols	IA	1984
Glenn Burrows	NM	1977	Ric Hoyt	OR	1985
James D. Bennett	VA	1978			

1986

Leonard Lodoen ND 1986

Ambassador Award
1986

Warren Kester *Beef Magazine* MN 1986

Pioneer Awards

Jay L. Lush	Iowa State Univ.	Research	1973
John H. Knox	New Mexico State Univ.	Research	1973
Ray Woodward	American Breeders Svc.	Research	1974
Fred Willson	Montana State Univ.	Research	1974
Charles E. Bell, Jr.	USDA-FES	Education	1974
Reuben Albaugh	Univ. of California	Education	1974
Paul Pattengale	Colorado State Univ.	Education	1974
Glenn Butts	Performance Registry Intl.	Service	1975
Keith Gregory	RHLUSMARC	Research	1975
Bradford Knapp, Jr.	USDA	Research	1975
Forrest Bassford	Western Livestock Journal	Journalism	1976
Doyle Chambers	Louisiana State Univ.	Research	1976
Mrs. Waldo Emerson Forbes	Wyoming Breeder	Breeder	1976
C. Curtis Mast	Virginia BCIA	Education	1976
Dr. H. H. Stonaker	Colorado State Univ.	Research	1977
Ralph Bogart	Oregon State Univ.	Research	1977
Henry Holszman	South Dakota State Univ.	Education	1977
Marvin Koger	Univ. of Florida	Research	1977
John Lasley	Univ. of Missouri	Research	1977
W. C. McCormick	Tifton, Georgia Test Stn.	Research	1977
Paul Orcutt	Montana Beef Perf. Assn.	Education	1977
J. P. Smith	Performance Registry Intl.	Education	1977
James B. Lingle	Wye Plantation	Breeder	1978
R. Henry Mathiessen	Virginia Breeder	Breeder	1978
Bob Priode	VPI&SU	Research	1978
Robert Koch	RLHUSMARC	Research	1979
Mr. & Mrs. Carl Roubicek	Univ. of Arizona	Research	1979
Joseph J. Urick	U.S. Range Livestock Experiment Station	Research	1979
Bryon L. Southwell	Georgia	Research	1980
Richard T. "Scotty" Clark	USDA	Research	1980
F. R. "Ferry" Carpenter	Colorado	Breeder	1980
Clyde Reed	Oklahoma State Univ.		1981
Milton England	Panhandle A&M College		1981
L. A. Maddox	Texas A&M Univ.		1981
Charles Pratt	Oklahoma		1981
Otha Grimes	Oklahoma		1981
Mr. & Mrs. Percy Powers	Texas		1982
Gordon Dickerson	Nebraska		1982
Jim Elings	California		1983
Jim Sanders	Nevada		1983
Ben Kettle	Colorado		1983
Carroll O. Schoonover	Univ. of Wyoming		1983
W. Dean Frischknecht	Oregon State Univ.		1983
Bill Graham	Georgia		1984
Max Hammond	Florida		1984
Thomas J. Marlowe	VPI&SU		1984
Mick Crandell	South Dakota State Univ.		1985
Mel Kirkiede	North Dakota State Univ.		1985
Charles R. Henderson	Cornell University (Retired)		1986
Everett J. Warwick	USDA-ARS (Retired)		1986

Continuing Service Awards

Clarence Burch	Oklahoma	1972	C. K. Allen	Am. Angus Assn.	1979
F. R. Carpenter	Colorado	1973	Wm. Durfey	NAAB	1979
E. J. Warwick	ARS-USDA,Wash.DC	1973	Glenn Butts	PRI	1980
Robert De Baca	Iowa State Univ.	1973	Jim Gosey	Univ. Neb.	1980
Frank H. Baker	Okla. State Univ.	1974	Mark Keffeler	South Dakota	1981
D. D. Bennett	Oregon	1974	J. D. Mankin	Idaho	1982
Richard Willham	Iowa State Univ.	1974	Art Linton	Montana	1983
Larry V. Cundiff	RLHUSMARC	1975	James Bennett	Virginia	1984
Dixon D. Hubbard	USDA-FES,Wash.DC	1975	M. K. Cook	Univ. of GA	1984
J. David Nichols	Iowa	1975	Craig Ludwig	Am. Hereford	1984
A. L. Eller, Jr.	VPI&SU	1976		Assn.	1984
Ray Meyer	South Dakota	1976	Jim Glenn	IBIA	1985
Don Vaniman	Montana	1977	Dick Spader	Am. Angus Assn.	1985
Lloyd Schmitt	Montana	1977	Roy Wallace	Select Sires	1985
Martin Jorgensen	South Dakota	1978	Larry L. Benyshek	Univ. of GA	1986
James S. Brinks	Col. State Univ.	1978	Ken W. Ellis	Univ. of CA	
Paul D. Miller	Am. Breeding Svc.			Davis	1986
	Wisconsin	1978	Earl B. Peterson	Am. Simm. Assn.	1986

Organizations of the Year

Beef Improvement Committee, Oregon Cattlemen's Association	1972
South Dakota Livestock Production Records Association	1973
American Simmental Association, Inc.	1974
American Simmental Association, Inc. (Breed)	1975
Iowa Beef Improvement Association (BCIA	1975
The American Angus Association (Breed)	1976
The North Dakota Beef Cattle Improvement Association (BCIA)	1976
The American Angus Association (Breed)	1977
The Iowa Beef Improvement Association (BCIA)	1977
The American Hereford Association (Breed)	1978
Beef Performance Committee or Cattlemen's Association	1978
The Iowa Beef Improvement Association (BCIA)	1979

1986 COMMERCIAL PRODUCER OF THE YEAR NOMINEES

1. KENNETH BENTZ - V Dash Cattle Company, Drewsey, Oregon. Nominated by the Oregon Cattlemen's Association Beef Improvement Committee, Corvallis, Oregon. Twenty-five years in the cattle business, 625 commercial cows, 300 purebred Angus cows. Handles 890 stocker cattle and 100 bulls annually. Has used performance records for 19 years in bull selection and 13 years in cow-herd culling. Calves March 1 to June 1, employs AI and uses sire summary data to select bulls. Has served as President of County Stock Growers Association, Vice-President Oregon Cattlemen's Association, was awarded Harney County Grass Man of the Year 1971.

2. DENNIS AND NANCY DALY - Two Creek Ranch, Douglas, Wyoming. Nominated by Wyoming Beef Cattle Improvement Association, Laramie, Wyoming. Twenty years in the cattle business, 15 years using performance records to select herd bulls, operates 475 head commercial breeding herd, and 450 head of stocker cattle annually. Sells calves as yearlings. Uses cross breeding and natural service. Has increased percent calf crop from 85 to 95 and weaning weights on heifers from 330 lbs to a high of 490 lbs. Yearling weights from 650 lbs in 1970 to 878 lbs in 193. Has served as Vice-President Wyoming BCIA and was recognized as Wyoming's Outstanding Young Farmer in 1973.

3. CARL AND FRAN DOBITZ - Cedar Valley Ranch, Morristown, South Dakota. Nominated by North Dakota BCIA, Hettinger, North Dakota. Have operated a commercial breeding herd for 33 years. Currently 420 commercial cows and 750 stocker cattle annually. A Hereford, Simmental, Tarentaise cross-breeding program is used utilizing artificial insemination. Selecting sires using sire summary data and individual performance. 205 day weights have increased from 491 lbs in 1978 to 612 lbs in 1985. Has served as board member North Dakota BCIA, President of North Dakota Tarentaise Association. Fran writes a monthly column for the National Tarentaise magazine.

4. CHARLES FARISS - Fairhart Farm, Rustburg, Virginia. Nominated by the Virginia Beef Cattle Improvement Association, Blacksburg, Virginia. Commercial cattle business for 24 years. Operates 140 cow herd - 1/3 registered Angus. Handles 400 stocker cattle annually, has used performance records for herd sire selection 24 years, and Virginia BCIA records 14 years. Uses cross breeding in commercial herds. Split calving season fall and spring. Uses sire summary data for selection of AI sires and individual performance and sire summary data for selection of natural service sires. All natural service bulls have come from test stations. Strong forage program. 205 day weaning weights have increased 140 lbs in 7 years. Over 95% of cows exposed weaned calves. Has served as Director and President Virginia BCIA, chairman Red House Central Bull Test Station and sale committee. Recognized as Virginia Commercial Producer of the Year, Virginia Outstanding Grassland Award, Virginia Outstanding Forage Producer, Virginia Conservation Award, and County Conservation Tillage Award, FFA Star Farmer, and State President.

5. DAVID J. FORSTER - Forster Cattle Company, Maxwell, California. Nominated by Glenn County California Cooperative Extension Service, Orland, California. Commercial cattle business 10 years with 715 commercial cows and 700-800 stocker cattle annually. Uses cross breeding with Angus and Gelbvieh. Has used performance records 10 years. Fall calving season. Uses natural service, using sire summary and individual performance data. From 1986 weaning weights have increased 130 lbs on steer calves and 78 lbs on heifer calves. Has served as President Glenn-Colusa Cattlemen's Association and Colusa County Farm Bureau.

6. DANNY GEERSEN - Martin, South Dakota. Nominated by South Dakota BCIA, Rapid City, South Dakota. Twenty-five years in commercial cattle business on a 14,000 acre ranch running 450-500 commercial cross-bred cows with a March and April calving season. Sells yearling feeders. Has used performance records for 15 years to select natural service sires. Many coming from central test stations. Weaning weights on steer calves increased from 407 lbs in 1965 to 532 lbs in 1985. Calving percent increased from 87 to 94 percent. Served as Director, South Dakota BCIA. Awards from Soil Conservation Service and South Dakota BCIA Outstanding Commercial Producer.

7. GARY JOHNSON - Johnson Farms, Dwight, Kansas. Nominated by Kansas Livestock Association Purebred Council, Topeka, Kansas. Twenty years in commercial cattle business. Runs 500 commercial cross-bred cows and 600 stocker cattle annually. Selling mostly yearling feeder cattle. Some replacement heifers. Calves mostly in spring and some in fall. Uses AI,selecting bulls from sire summary data with "stacked" pedigrees. Uses individual performance and sire summary data in selecting natural service bulls. Doubled cow herd size without additional labor. Weaning weights increased 61 lbs in last four years. Pay weight increased 119 lbs in 10 years on yearling feeder steers. Member Kansas Bull Test Committee, Kansas Hereford Association (Commercial Advisor), awarded trip to Spain by feed company.

8. RALPH G. LOVELADY - Randolph, Alabama. Nominated by Alabama BCIA, Auburn, Alabama. In commercial cattle business 36 years, operating 200 cross-bred cows, selling weaner calves. Total forage program. Used performance records to select bulls for 15 years to cull cow herd 5 years. Calves November to January. Uses individual performance records to select natural service bulls from breeders farms and test station. Sale weight on stee calves average over 650 lbs. Served as President Chilton County BCIA, Treasurer and board member Alabam BCIA, Commercial representative Alabama Cattlemen's Association.

9. RAMON H. OLIVER -Cadiz, Kentucky. Nominated by Kentucky Beef Cattle Association, Lexington, Kentucky. Fourteen years in cattle business, 108 commercial cows utilizing Simmental, Salers, Chianina, and Simbrah bulls. Sells weaned calves and some replacement heifers. Has used performance records 12 years through Kentucky's performance program. Uses sire summary data in selection of sires for use AI. Served as Director, Kentucky Beef Cattle Association and received Kentucky's Commercial Producer of the Year Award in 1985.

10. KAY RICHARDSON - Richardson Bros., Inc., Evinston, Florida. Nominated by Florida BCIA, Gainesville, Florida. Thirty-nine years in commercial cattle business with 550 cross-bred cows. Finishes 400 cattle annually in ranch feedlot. Has used performance records 24 years through Florida BCIA. Uses December to March calving season. Uses individual performance to select natural service bulls. No AI. Increased 205 day old weights from 373 lbs in 1962 to 436 lbs in 1985. Served as President, board member and Vice-President Flordia BCIA.

11. MR. AND MRS. CLYDE WATTS - Taylorsville, North Carolina. Nominated by North Carolina Beef Cattle Improvement Program, Raleigh, North Carolina. Twenty-three years in cattle business, herd size 48 cross-bred cows, selling weaner calves. February to April calving season. Selects natural service bulls, using sire summary data and individual performance records. Buys test station bulls. Weaning and sale weights have gone from 464 lbs in 1977 to 586 lbs in 1985.

12. DAVID AND BEV LISCHKA - Deloraine, Manitoba Canada. Nominated by Manitoba Agriculture, Winnipeg, Manitoba Canada. Fifteen years in the commercial business with 118 cross-bred cows. All animals sold as slaughter animals. Performance records since 1981. Increased weaning weights from 465 lbs in 1981 to 567 lbs in 1984 and yearling weights from 868 to 1018. Serves as a 4-H leader.

1986 BIF SEEDSTOCK PRODUCER OF THE YEAR NOMINEES

1. CLIFFORD AND BRUCE BETZOLD - Betzold Farms, Nakomis, Illinois. Nominated by the Illinois Livestock Association and Cooperative Extension Service, Urbana, Illinois. Twenty-seven years in the Seedstock business. Cow herd of 86 Angus cows. Thirteen years on the Illinois Performance Testing Program, and 5 years in AHIR. Spring and early fall calving season. Breeds 15% of cow-herd AI, using sire summary data to select natural service sires. Has tested bulls in Western Illinois University and Southern Illinois University Central Bull Test for 11 years. Has increased the adjusted 205 day weaning weights from 492 lbs in 1972 to 586 lbs average in the last 5 calf crops. The 85 calf crop averaged 605 lbs steer equivalent. Honored as 1985 Illinois Seedstock Producer of the Year, Montgomery County Soil Conservation Award, FFA Honorary Chapter Farmer Award, 4-H and FFA Adult Leader.

2. GLENN L. BRINKMAN - Brinks Brangus and Brinks-Kansas, Kerrville, Texas. Nominated by International Brangus Breeders Association, San Antonio, Texas. Active in seedstock business and development of Brangus breed for 17 years. 680 cows in the Brangus breeding program plus 750 commercial cows. Utilized Brangus Association performance records for 4 years and used PRI Guidelines beginning in 1986. Calves in fall and winter in Texas and fall and spring in Kansas. Sells 210 bulls per year at auction and privately with 25-30 percent going to registered breeders. Has annual bull sale, has been very innovative in merchandizing Brangus. Uses AI on 90% of cows. Three Brinks bred bulls in Brangus Sire Evaluation design program. Thirty-seven bulls in 1985 Brangus Sire Summary carry Brinks prefixes. Utilizes sire summary data in selecting sires as well as performance records. Served as International Brangus Breeders Association President, Director, Executive Committee and Long-Range Planning Committee Chairman. Also President Texas Brangus Breeders Association. 1982 recipient of IBBA Brangus Breeder of the Year Award.

3. JACK AND GINI CHASE - Buffalo Creek Red Angus, Leiter, Wyoming. Nominated by Wyoming Beef Cattle Improvement Association, Laramie, Wyoming. Operates Red Angus cow herd of 210 head with involvement in the seedstock business for 14 years. Also 360 commercial cows. Performance records for 16 years, 14 of those with RAAA. Spring calving season. Sells 100 bulls annually, 97% to commercial herds. Spring bull sale and private treaty. Uses AI on 30-60 percent of cows. Uses performance records and sire summary in selection of herd sires. Utilizes embryo transfer. Changed weaning weights from 450 to 560 lbs in 15 years. Active as 4-H Beef Leader, served as President Wyoming BCIA, President Red Angus Association of America, and Director RAAA.

4. HENRY AND JEANNETTE CHITTY - Stardust Ranch, Micanopy, Florida. Nominated by Florida Beef Cattle Improvement Association, Gainesville, Florida. Forty-one years in Seedstock business with 175 Angus cows and 125 commercial cows. Performance records for 20 years through Florida BCIA and AHIR for 15 years. January to March calving season. Sells 30-50 bulls annually, 90% to commercial herds. All private treaty. Utilizes AI on 40-50% of herd, utilizing Angus sire summary and performance records in selection of herd sires. Improved calving percent to 96-98%. Henry has served as President of Florida BCIA. Henry and Jeannette have been FBCIA directors. Henry served as President and Jeannette as Secretary for Florida Angus Association. Both directors in American Angus Futurity. Florida BCIA recognition for most progress in 1965. Florida and Angus Association awards on cows.

5. LAWRENCE H. GRAHAM - Riverview Farms, Bowling Green, Kentucky. Nominated by Kentucky Beef Cattle Association, Lexington, Kentucky. Charolais breeder with 80 cows. Fifteen years in seedstock business, 17 years performance records through University of Kentucky and CHIP. Both fall and spring calving season. Sells 15 bulls annually, 90% to commercial herds. Utilizing test station and private treaty. Fifty percent bred AI utilizing limited sire summary and full performance data. Founder of KBCA, chairman of KBCA Education Research Committee and Awards Committee, Kentucky representative on NCA Education Research Committee, chaired Kentucky IRM Committee, honorary member of Western Kentucky University Block and Bridle. Kentucky Charolais Association Outstanding Family Award, KBCA Beef Industry Service Award, Kentucky Agriculture Extension Agents Outstanding Lay Leader Award, Kentucky Seedstock Producer of the Year 1985.

6. A. LLOYD GRAU - Grau Charolais Ranch, Grady, New Mexico. A long time breeder of Herefords and Charolais. Forty years in the seedstock business. Currently with 280 cows. Twenty-three years performance testing with New Mexico Beef Cattle Performance Association. Spring calving season. Sells 120 bulls per year. Entirely by private treaty. Uses AI in a limited fashion, mostly natural service. Emphasizing total performance records. Very successful at central bull test stations at Tucumcari, New Mexico - having tested over 200 bulls. Weaning performance on bull calves moved from 512 lbs in 1977 to 616 lbs in 1985 and heifers from 474 lbs to 568 lbs. Sold over 1800 bulls in the last 20 years, 90% going to commercial producers. Served in many leadership capacities including President Golden Spread Charolais Association, Director New Mexico Wheat Growers Association, President local school board, Chairman and member AICA committees, President New Mexico Charolais Association, Chairman Livestock Improvement Committee - New Mexico Cattle Growers Association. Received AICA 1978 Seedstock Producer of the Year Award and had New Mexico Beef Cattle Performance Association 24th Annual Sale dedicated to him.

7. MATHEW WARREN HALL - Bermuda Polled Hereford Farm, Midway, Alabama. Nominated by Alabama Beef Cattle Improvement Association, Auburn, Alabama. Fifty-one years in seedstock business. Currently with 115 Polled Hereford and 23 Gelbvieh cows. Also 30 commercial cows. Performance records 28 years, 22 years Alabama BCIA, 2 years American Gelbvieh Association, 8 years APHA Guidelines. Calves December to April. Sells 40 bulls per year, 75% to commercial herds. Sells private treaty and breed and performance test sales. Ninety percent of cows bred AI utilizing sire summary data heavily in selection of bulls as well as individual performance. Utilizes limited embryo transfer. Test bulls in central test stations. Excellent progress in increasing weaning weights as well as yearling weights. Served as Alabama grader on performance program, chartered member of Alabama BCIA, active in local and state cattlemen's association, Director and President - Alabama Polled Hereford Association. Outstanding cattleman.

8. GERALD E. HOFFMAN - Gerald Hoffman and Son, Leola, South Dakota. Nominated by South Dakota Beef Cattle Improvement Association, Rapid City, South Dakota. Fifty-eight years in seedstock business. Currently with 200 registered Hereford cows and 120 commercial cows. Twenty-two years of performance records. Spring calving season. Sells 50 bulls annually, 97% to commercial breeders with full performance data. Uses AI on 80% of cow herd. Utilizes sire summary data and performance records in selection of sires. Emphasizing fertility milk and growth. Has served as Director of South Dakota Hereford Association, Director of Northern Plains Feeder Calf Association, Chairman McPherson County Livestock Improvement Association, 4-H leader 15 years. Honored as 1984 McPherson County Soil Conservation awardee, 1985 South Dakota Seedstock Producer of the Year Award. Award for Conservation Minded Tree Planting. Outstanding leader.

9. DELTON W. HUBERT - Hubert Charolais Ranch, Monument, Kansas. Nominated by Kansas Livestock Association Purebred Council, Topeka, Kansas. Charolais breeder with 330 cows and 24 years experience as a seedstock breeder. Performance records 18 years - PRI and AICA. Split winter and spring calving season. Sells 90 bulls and private treaty being utilized. AI's 40% of herd. Using performance data and visual appraisal in selection of herd sires. Uses ET on top cows. Test bulls in central test at Beloit, Potwin, and Colby. In last six years weaning weights have increased 13.2%, yearling weights 7.9%. Has served as President of Bluestem Charolais Association, Director of Kansas Livestock Association, and AICA committees. Received KLA Director Service Award and award for ASCS service for 17 years.

10. DICK AND ELLIE LARSON - DSH Simmental Farms, Mt. Horeb, Wisconsin. Nominated by Wisconsin Beef Improvement Association, Madison, Wisconsin. Herd consists of 50 Simmental cows, 13 years in business, and all with records. Nine years with WBIA, 13 years with American Simmental Association, Spring calving, sells 20-25 bulls per year, 20% going to registered herds. Full performance data supplied. 100% artificial insemination. Heavy reliance on breed association national sire summary data. Makes use of limited embryo transfer. Has tested bulls in central test stations for 11 years with considerable success. Ellie has served on the WBIA board and as President and Vice-President - Manager Central and Northern Bull test sales. National BIF annual convention committee 1985. Board member American Simmental Association and ASA Performance and Breed Improvement Committee, Associate Editor of Simmental Shield. Was awarded 1986 Wisconsin Seedstock Producer of the Year Award. WBIA award for outstanding contribution to the beef cattle industry in Wisconsin.

11. LEONARD LODOEN - Lodoen Hereford Farms, Westhope, North Dakota. Nominated by North Dakota BCIA, Hettinger, North Dakota. Outstanding Hereford breeder with 250 cows, 34 years in seedstock business. Twenty-three years with performance records. North Dakota BCIA and AHATPR Program (21 years). March 15 to May 1 calving season. Sells 60 bulls annually, 90% to commercial herds. Annual sale for 60% of bulls and some females. Utilizes AI on 25% of herd relying on sire summary data. Has 13 owned bulls in AHA sire summary. Does not use embryo transfer. Comparing 1968 with 1984 - weaning weights on bulls have moved from 455 to 580 lbs and on heifers from 440 lbs to 540 lbs. From 1977 to 1985 - bull yearling weights have moved from 840 lbs to 1090 lbs and heifers from 630 to 725 lbs. Has served as Director, Chairman of Total Performance Records Committee, Vice-President and President American Hereford Association. Appointed by North Dakota Governor to State Livestock Sanitation Committee, President and Vice-President of Bottineau County Fair Board. Awards - North Dakota Outstanding Seedstock Producer 1985, North Dakota Hereford Breeder of the Year 1984, FFA Honorary Chapter Farmer 1980, County Outstanding Young Farmer and National 4-H Beef Award winner in 1957.

12. RALPH McDANOLDS - Riverside Charolais Farm, Madison, Virginia. Registered Charolais breeder with 60 cows plus 25 commercial cows. In seedstock business for 14 years - all with records through Virginia BCIA and American International Charolais Association. Split fall and spring calving season, selling 25 bulls annually - 95% to commercial breeders. Utilizing test station sales, farm auction sales and private treaty. Utilizes AI on 20% of cows. Emphasizes problem-free Charolais seedstock. Utilizes performance records and national sire summary in selection of sires. Very successfully has tested some 50 bulls in Virginia Central Bull Test Stations. Has served as Director Virginia Cattlemen's Association and Chairman VCA Seedstock Council, Director Virginia BCIA, Chairman Culpeper Central Bull Test Station Committee, current Director AICA, President and Vice-President Virginia Carolinas' Charolais Association, President Virginia Charolais Association, President Madison County Farm Bureau and other local leadership. Recognized as Virginia Seedstock Producer of the Year, Virginia Charolais Sire of the Year Award and Virginia Charolais Promotion of the Year Award.

13. ROY D. McPHEE - McPhee Red Angus, Lodi, California. Nominated by California Cooperative Extension Service, Modesto, California. Red Angus and Red Brangus Breeder of 15 years with 350 registered cows and 50 commercial cows. Performance records 15 years through Red Angus Association of America, 12 years through California BCIA. Sells 115 bulls per year. Almost exclusively to commercial producers through a fall auction at the ranch plus private treaty. Uses AI on 25-30% of herds. Test bulls in Cal Poly Central Test Station annually. In past 11 years,yearling weights have increased 130 lbs for bulls and 110 lbs for heifers. Increased buyer acceptance. Served as Director CBCIA, Director Red Angus Association of America, and California Cattlemen's Association. Recognized with Breeder of the Year Award - presented by Red Angus Association of America in 1984.

14. MORRIS, W.D., & JAMES PIPKIN - Clearwater Farm, Springfield, Missouri. Nominated by University Extension Center, Buffalo, Missouri. Farm has been in seedstock business 52 years. Currently with 170 registered Angus cows. Performance records through AHIR 23 years. Sells 50 bulls per year with 75% going to commercial herds. Utilizes private treaty, performance, and breed association sales. Uses artificial insemination on 50-60 percent of cow herd. Utilizes sire summary data to select sires for calving ease, weaning weight, and yearling weight. Tests all bulls on the farm. Have increased weaning weights over 100 lbs. Served as President and Director Southwest BCIA, President and Director Missouri Angus Association, Director Southwest Missouri Angus Association, and Director Four State Angus Association. Herd recognized as a Centennial Angus Herd.

15. RICHARD J. PUTNAM - Pack Power Farms, Snow Hill, North Carolina. Nominated by North Carolina Beef Cattle Improvement Program, Raleigh, North Carolina. Richard is a young man in the seedstock business 9 years. Has 75 registered Angus cows. Nine years of records with North Carolina BCIP, 2 years AHIR. Calves January 1 to February 28. Sells 20 bulls per year - 90% going to commercial herds. Test bulls at Central Test Stations in Virginia and North Carolina and on the farm. Uses AI to breed 90% of cows. Selecting sires utilizing breed sire summary data and individual performance records. Makes use of embryo transfer. Has served as Director North Carolina Angus Association, Vice-President North Carolina BCIP, Chairman of the North Carolina BCIP. Was recognized as North Carolina Seedstock Producer of the Year in 1985, CHC winner Ralston Purina Company, Cattle Producer of the Year - East N.C. Community Development Association.

16. ROBERT J. STEWARD & PATRICK C MORRISSEY - Stewart & Morrissey, Inc., Baker, Oregon. Sixteen years in the seedstock business with base herd of 250 registered Limousin cows. Sixteen years with records in North American Limousin Foundation program. Calves a split season fall and spring. Sells 175 bulls annually with 98% going to commercial breeders with full performance data. Mostly private treaty sales. All cows bred natural service, utilizing performance data to select herd sires. Several bulls owned in Limousin National Sire Summary. Bob Steward has served as NALF Board member and Northwest Limousin Association board member. Pat Morrissey has served as Northwest Limousin Association board member. Patrick Morrissey received special President's Award from Morgan Cattlemen's Association. Bob Steward received Oregon Department of Agriculture Distinguished Service Award and NALF Outstanding Service Award and Diamond Pioneer Career Agricultural Achievement Registry OSU.

17. CLARENCE VAN DYKE - Van Dyke Angus Ranch, Manhattan, Montana. Nominated by Montana Beef Performance Association, Bozeman, Montana. Two hundred registered Angus cows, 24 years with performance records through Montana Beef Performance Association, 7 years records through AHIR. Calves January 1 to February 20. Sells 75 bulls annually - 87% going to commercial herds. Utilizes ranch production sale, bull test's sales, and a few consignment sales. Uses AI on 90% of cows. Relying heavily on sire summary data. Nine sires in AHIR Sire Summary. Utilizes proven females in embryo transfer program. Has utilized Central Bull Test Stations to test bulls for 19 years. Weaning weights have moved from 1967 to 1985 from 419 to 619 lbs. Yearling weights have increased from 763 to 1090 lbs. Served as Director Montana Angus Association, Director Southwest Montana Angus Association, and delegate to national meeting AAA. Honored as Montana Performance Man of the Year in 1985, served as ABS District Representative of the Year and Regional Representative of the Year in 1985.

18. JOHN H. WOOD - Manager Clarendon Plantation, Burton, South Carolina. Plantation and seedstock business 19 years. John Wood manager for 11 years. Excellent herd of 450 registered Santa Gertrudis cows. Performance program through South Carolina BCIA for 9 years and through Santa Gertrudis Breeders International 3 years. Calves January 15 to May 15. Sells 125 bulls annually with 20% going to other purebred breeders. Utilizes artificial insemination on 10-20% of cow herd. Utilizes performance data in the selection of herd sires. Breeds all heifers, building to a goal of 1000 producing cows. Some embryo transfer utilization. Test bulls in Clemson and Edisto bull test program and have been highly successful. Adjusted 205 day weaning weights have improved 186 lbs since 1974. Fifteen month yearling weights improved 217 lbs in that period. Has served as Director South Carolina Cattlemen's Association, Clemson Bull Tests, Animal Science and Beaufort County Ag. Advisory Committees, South Carolina Purebred Breeder's Council, President Santa Gertrudis Breeders of the Carolinas. Board of Directors Breed Improvement Committee and other committees Santa Gertrudis Breeders International. Awarded the South Carolina Outstanding Seedstock Producer 1985, the Santa Gertrudis Weight Per Day of Age Award and Breeder of Record Yearling Weight Bull, honorary member National Junior Santa Gertrudis Association.

19. LEONARD WULF - Leonard Wulf and Sons, Inc., Morris, Minnesota. Nominated by Minnesota Beef Cattle Improvement Association, St. Paul, Minnesota. Seventeen years in the seedstock business. An excellent herd of 700 registered Limousin cows with performance records for 25 years through Minnesota BCIA and NALF. Split calving season spring and fall. Sells 125 bulls with 20% to other purebred breeders. Complete performance records. AI used on 85% of cow herd with heavy use of sire summary data. Uses total performance approach including growth, carcass, and reproductive traits. Operates a 5000 head feedlot operation. Limited use of embryo transfer. Has tested bulls in Minnesota Central Bull Test Station. Mr. Wulf has served as Director Minnesota State Cattlemen's Association, Minnesota Beef Cattle Improvement Association, West Central Cattlemen's Association, and North American Limousin Foundation. Has served as President Minnesota Limousin Association and Vice-President American Limousin Foundation. 1985 Minnesota Seedstock Producer of the Year, 1981 BIF Commercial Producer of the Year, 1980 Minnesota Commercial Producer of the Year. Produced carcass winners at 1986 National Western.

20. EVIN AND VERNE DUNN - E & V Dunn's Hereford Ranch, Russell, Manitoba Canada. Nominated by Manitoba Agriculture, Winnipeg, Manitoba Canada. Herd consists of 35 registered Hereford cows. Twenty-one years on a performance testing program. Adjusted 200 day weights increased 425 to 500 lbs. Yearling weights 675 to 800 lbs. Uses artificial insemination. Evin has served as Director of Northeast Bull Test Station. Verne as Director for Manitoba Hereford Association and Canadian Hereford Association.

1986 BIF SEEDSTOCK AND COMMERCIAL PRODUCER OF THE YEAR AWARDEES
(Left to Right)
Henry Gardiner, President, BIF; Betty Lodoen; Leonard Lodoen, Seedstock Producer of the Year; Charles Fariss,Commercial Producer of the Year; Carol Fariss; and A. L. Eller, Jr., Executive Director.

BIF SEEDSTOCK PRODUCER OF THE YEAR

Leonard Lodoen

Leonard Lodoen, owner-operator of Lodoen Hereford Farms at Westhope, North Dakota, has been named 1986 Seedstock Producer of the Year by the Beef Improvement Federation (BIF) during their annual convention at Lexington, Kentucky, May 7-9, 1986. BIF is a federation of state beef cattle improvement associations, national breed associations, artificial insemination organizations, and other groups involved in the genetic improvement of beef cattle.

Leonard Lodoen has for thirty-four years been responsible for building, breeding, and merchandizing the product of a planned breeding program from one of the nations elite performance testing programs. From a meager beginning thirty-four years ago, his herd has grown to 250 cows where every animal born on the farm compiles as much objective performance information as is possible to collect. Individual performance records have been kept on all cattle for the past 23 years.

While performance records from one breeding season to the next have always been important at Lodoen Farm, Leonard Lodoen has turned his attention during the past five years to sire evaluation and cattle evaluation records. Cattle evaluation and the expected progeny difference (EPD) comparisons for the objective performance traits are primary considerations in the Lodoen selection and culling program. Lodoen was a first in the cattle industry to realize the potential economic consequences of scrotal circumference measurements on yearling bulls and the importance of udder and teat size and shape on the production potential of females. Lodoen's astute understanding and keen interest in performance records and the cattle evaluation EPD concept has made him a leader in the promotion of these concepts to both registered and commercial cattlemen throughout the nation.

In addition to being a superb cattleman, he has served his industry in a very unselfish manner and promotes the interest of the industry over any thoughts of his own operation. Lodoen currently is serving as President of the American Hereford Association. During his five years as a Director of AHA, he has influenced the organization's policies regarding the use of performance progreams and has served as chairman of the Performance Committee and as a member of the Show Committee. He has demanded that performance play a priority role in decisions affecting these association programs. In addition, he serves on the North Dakota Livestock Sanitation Committee appointed by the Governor.

BIF COMMERCIAL PRODUCER OF THE YEAR

Charles Fariss

Charles Fariss, owner and operator of Fairhart Farm at Rustburg, Virginia, was named the 1986 Commercial Producer of the Year by the Beef Improvement Federation (BIF) during their annual convention at Lexington, Kentucky, on May 7-9, 1986. BIF is a federation of state beef cattle improvement associations, national breed associations, artificial insemination organizations, and other groups involved with the genetic improvement of beef cattle. The Commercial Producer of the Year Award is the highest award bestowed upon a commercial cattleman by BIF.

Charles Fariss is a native Virginian who has the unusual capability of matching beef cattle and forages on his farm of 730 acres.

Charles Fariss became interested in cattle as a child and owned his first cattle when he was a high school student. Cattle numbers have steadily grown on Fairhart Farm to the present inventory of approximately 550 head. He and his family know how to make money with cattle, and he does an incredible job combining genetic principles and forage production in making the cattle operation a profitable one.

In addition to the completely performance tested cow-calf herd which is one-third registered Angus and two-thirds commercial cows, 300-400 small and/or mismanaged calves are purchased in the fall and wintered for sale as heavier feeders the following spring. These calves are wintered on economical rations including corn silage and broiler litter. No commercial supplement has been purchased for cattle on Fairhart Farms for the past five years.

Charles Fariss has been recognized as Virginia's Commercial Producer of the Year as well as Virginia's Outstanding Forage Producer. He is an excellent leader and has served on the board of directors and as President of the Virginia Beef Cattle Improvement Association. He serves as chairman of Test and Sale Committee at the Red House Central Bull Test Station located a few miles from his farming operation.

Charles is married to the former Carole Hartley of Louisa County, Virginia. They have three children, Mathew (17), Margaret (16), and Marybeth (12).

1986 BIF CONTINUING SERVICE AWARDEES (Left to Right)
Earl Peterson, Executive Vice-President, American Simmental Association, Bozeman, MT; Larry Benyshek, Professor of Animal Science, University of Georgia, Athens, GA; Ken Ellis, Area Extension Director, California Extension Service, Davis, CA; and Henry Gardiner, President, BIF.

LARRY L. BENYSHEK
1986 BIF CONTINUING SERVICE AWARD

Larry Benyshek is a native Kansan, born and raised on a crop and livestock farm. He earned his B.S. degree at Kansas State and his M.S. and Ph.D. degrees from Virginia Polytechnic Institute and State University. He served as Director of Research and Education for the North American Limousin Foundation from 1973-74, taught at Fort Hays State from 1974-76 prior to moving to his present position in teaching and research at the University of Georgia.

Dr. Benyshek's contributions have been in the area of development and application of technology for genetic improvement in beef cattle. His research has provided analyses for the Limousin Sire Summary since 1973. He initiated the use of BLUP mixed model procedures in the analyses of field data for the Limousin breed in 1975. He began use of the sire and dam model in 1984 sire summaries; and, reduced animal model methodologies for the 1985 Angus, Horned Hereford, Brangus and Limousin sire summaries. These analyses resulted in the genetic evaluation of more than 2.5 million beef cattle in 1985-86.

Dr. Benyshek has conducted selection studies using elite sires from National Sire Evaluation which have shown the magnitude of selection response possible through utilization of this technology. Furthermore, he has directed crossbreeding research involving Angus, Brahman, Gelbvieh, Limousin, Polled Hereford, Santa Gertrudis and Simmental cattle. He and his colleagues are studying the effects of sire interactions on genetic evaluation techniques and refining variance and covariance component estimation procedures.

Dr. Benyshek is a member of Sigma Xi, Phi Kappa Phi, Gamma Sigma Delta and AGHON honorary societies. He has received the Gamma Sigma Delta Young Faculty Award for Research as well as the Outstanding Teacher Award in Animal Science given by the Block and Bridle Club. He and his wife Cheri and their two children reside on a ranch near Danielsville, Georgia.

KENNETH W. ELLIS

1986 BIF CONTINUING SERVICE AWARD

Ken was born and raised on a livestock and grain farm in east central Illinois. He graduated from the University of Illinois in 1956 with majors in Animal Science and Agricultural Economics.

After graduation Ken spent several years working for Kraft Foods in Marshall, Indiana. He managed and coordinated the hauling of milk from 700 dairies to the plant and was responsible for maintaining high milk quality and no antibiotic residues.

In 1969 he was hired as the County Director and Livestock Farm Advisor for Tehama County, California. In this position Ken was responsible for coordination, training and guidance of Cooperative Extension academic staff in Tehama County. He also carried on an active program of research and education as the livestock farm advisor.

Ken transferred to U.C. Davis as a Statewide Livestock Specialist in 1972 where his primary responsibilities were genetic improvement and management of beef cattle, sheep and swine. He also trained farm advisors and developed educational material and research projects for statewide use.

From 1976 to 1982 Ken served as Program Director of the Animal Sciences Program Area of Cooperative Extension. He had administrative responsibility for Animal Science, Avian Science, Forestry, Marine, Veterinary Medicine and Wildlife Units including support staff and resource allocation. He also served as Livestock Industry liaison, technical advisor to California Beef Cattle Improvement Association and extension animal scientist for beef cattle and sheep.

Currently Ken is the Regional Director for the North Central Region of California. He has administrative responsibility for 16 counties and 77 academic employees in that region.

BIF CONTINUING SERVICE AWARD

Dr. Earl B. Peterson

Earl is Executive Vice President of the American Simmental Association which is headquartered in Bozeman, Montana. He has been with ASA for eleven years and has served as its chief executive officer for the past eight years.

As Executive Vice President, Earl is responsible for overseeing all registration and promotional programs for Simmental and Simbrah cattle as well as serving the needs of the association's 10,000 active members nationwide.

Representing ASA, Earl has been active in several national beef industry organizations including the Beef Improvement Federation, National Livestock and Meat Board, NCA Purebred Advisory Council, and U. S. Beef Breeds Council, of which he was president in 1984 and 1985.

Prior to his affiliation with ASA, Earl spent nine years in university administration at the University of Alaska, Montana State University, North Carolina State University, and the University of Minnesota. His background in agriculture also includes experience as a vo-ag teacher, bank loan officer and agricultural experiment station administrative officer. He is a native of North Dakota and holds a B.S. degree in agricultural education from North Dakota State College, and M.S. and Ph.D. degrees in agricultural economics from Montana State University. He has also served on the board of directors of BIF.

Earl and his wife, Jeannine, are the parents of two sons, Todd and Tim.

<u>1986 BIF PIONEER AWARDEES</u> (Left to Right)
Charles R. Henderson, Professor of Animal Science, Emeritus, Cornell University, Ithaca, NY; Mrs. Marian Henderson; Mrs. Esther Warwick; Everett Warwick, USDA ARS Retired, Hyattsville, MD; and Henry Gardiner, BIF President, Ashland, KS.

1986 BIF PIONEER AWARD

Everett J. Warwick

A recipient of the 1986 BIF Pioneer Award is Dr. Everett J. Warwick. Warwick has a national and international reputation in the field of Animal Breeding and Genetics.

He was born May 3, 1917, and was reared on a livestock farm in Illinois. As a youth, he was active in 4-H and FFA. Dr. Warwick started his formal education at the University of Illinois where he received a B.S. degree in General Agriculture in 1939. He then attended graduate school at the University of Wisconsin and received his M.S. and Ph.D. degrees in Genetics and Animnal Husbandry in 1942 and 1943. He was a member of the Animal Husbandry Faculty at Washington State College (1943 to 1947) and Purdue University (1947 to 1950) before joining the U. S. Department of Agriculture as a Geneticist in 1950. From 1955 to 1968, Everett Warwick was Chief of the Beef Cattle Research Branch, U.S.D.A. then Assistant Director, Animal Husbandry Research Division U.S.D.A. from 1968 to 1972. Dr. Warwick retired as Staff Scientist, National Program Staff ARS-U.S.D.A. where he had responsibilities for policy and program development and review as related to beef cattle research.

Dr. Warwick is co-author of the widely used textbook "Breeding and Improvement of Farm Animals" and author or co-auathor of over 75 professional papers and many popular and review publications. He has been active in international programs concerned with Animal Production and served as delegate to the fifth and sixth Inter-American Conferences on Animal Production. He has participated in the first and second World Animal Production Conferences and has travelled extensively in Europe, South America, New Zealand and Australia.

Everett Warwick has been an active member of the American Society of Animal Science. He has served as Chairman of many Society committees, and was President of the Southern Section of A.S.A.S. in 1962 to 1963.

1986 BIF PIONEER AWARD

Charles Roy Henderson

A 1986 recipient of the Pioneer Award is Dr. Charles R. Henderson, Emeritus Professor, Cornell University. Dr. Henderson is being so honored in recognition of his lifetime work in the area of genetic evaluation. Dr. Henderson is a native of Coin, Iowa, where he was raised on a general livestock farm. He received his Ph.D. in Genetics and Animal Breeding in 1948 after which he joined the staff at Cornell University in a research and teaching position.

Dr. Henderson's research program has been aimed at the application of genetic principles to the improvement of livestock and the development of methodology to accurately evaluate animals from field records. He was one of the early pioneers in the promotion and demonstration of the use of progeny tested bulls to enhance genetic progress through selection. Throughout his career, Dr. Henderson has been very interested in the development of methodology to accurately evaluate animals from this type of data. This interest led to the development early on of the herdmate comparison and the methodology for best linear unbiased prediction (BLUP). The beef industry in the United States has witnessed a tremendous evolution in the area of genetic evaluation. Much of this evolution has been predicated on the application of the principles founded by Dr. Henderson to the beef data available at breed organizations. Although Dr. Henderson worked primarily with dairy cattle records while at Cornell, his procedures have become quite prominent in the advancement of genetic programs in the beef industry.

Although formally retired in 1976, Dr. Henderson has continued to maintain a highly visible and active research program. His dedication to research and innovations have earned him many national and international awards. Most recently Dr. Henderson has been elected to the National Academy of Sciences. He has truly pioneered the application of genetic principles to the improvement of domestic animals and the development of the methodology necessary to aid in this improvement. Dr. Henderson is certainly a worthy recipient of this year's Pioneer Award.

WARREN KESTER
1986 BIF AMBASSADOR AWARD

Through 42 years of writing and broadcasting, Warren Kester has witnessed the evolution of the beef industry first hand. He began his career in agriculture with the Soil Conservation Service in eastern Iowa immediately after graduating from college in 1943. He became farm editor for WMT radio in Cedar Rapids in 1944 and then moved to KAYX in Waterloo, IA. This was followed by 20 years as public relations manager and market commentator for the Sioux City Stockyard. He then shifted to the magazine field where he spent 10 years as managing editor of Farm Journal's BEEF Extra and then joined BEEF seven years ago as senior managing editor. This Webb Publishing Company controlled-circulation publication serves 125,000 cow-calf producers, backgrounders and feedlot operators in the United States.

Warren has witnessed the birth of performance testing and its growth to become a key factor in breed association programs and breeding systems. In the mid-fifties, he remembers hearing cattlemen and market salesmen ridicule the first "performance-tested" cattle to arrive at the market for sale. Through the years that followed, he saw cattlemen, breed and industry representatives slowly jump on the performance bandwagon. He observed the transition from the "compact cattle" of the 50's to the large-framed exotics in the late 60's and 70's, and now has heard the admonishments of concerned cattlemen that "bigger isn't necessarily better".

Warren saw wrecking balls batter down multi-story antiquated packing plants and the famed Chicago Stockyards, signalling the end of an era and the beginning of a new breed of packers. He has been an observer of the feedlot explosion in the Southwest, and the rise and fall of the Midwest farmer feeding industry.

As senior managing editor of BEEF and managing editor of Farm Journal's Beef Extra, Warren has interviewed such performance minded leaders as Glenn Butts, Burke and Skip Healey, John Glaus, J.C. Holbert, Les Holden and Jack Cooper, Dave Nichols, Ray Woodard, Frank Baker, Orville Sweet, Henry Gardiner and Steve Radakovich. The resulting feature articles have helped launch some of these personalities into the national spotlight.

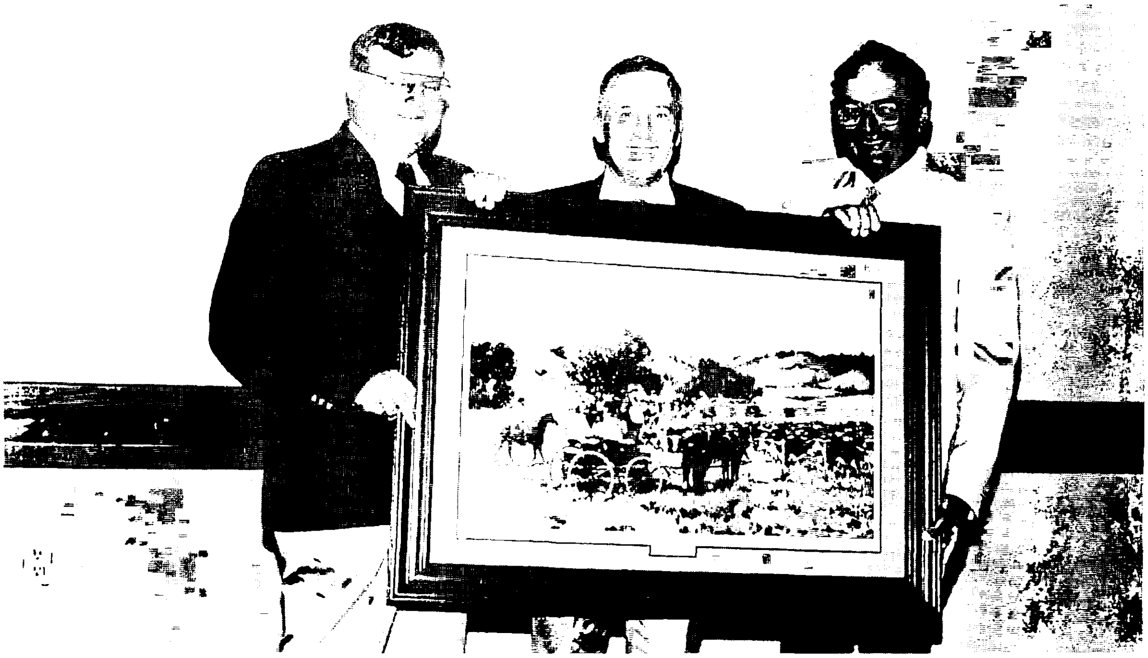
Warren has seen the industry grow in complexity and size through the post World War II era, beef become the nation's most-wanted food and now, one that faces a battle for survival with the broiler industry, diet-conscious and health-oriented consumers and wild-eyed animal activists.

Now on the eve of his retirement, Warren is ready to watch the future unfold- to observe how dedicated breeders, commercial producers and feeders meet the economic challenges of the 80's and 90's.

Warren was born in Audubon County, IA, graduated from Iowa State University in 1943 and was married to Lucile Yount, Monticello, IA, in 1945. They have two children, Diane Eilers, the wife of Cargill engineer, Jerry Eilers, Ottumwa, IA; and a son, Gary, systems project manager, Rush Presbyterian Hospital, Chicago, IL, and four grandsons.

Warren has previously been the recipient of awards from the Livestock Publications Council, the American Agricultural Editor's Association and the Iowa Beef Improvement Association.

<u>1986 BIF AMBASSADOR AWARD</u>
Presented by Henry Gardiner to Warren Kester, Editor <u>BEEF</u>
as Mrs. Lucille Kester looks on.



AWARD TO EXECUTIVE DIRECTOR (Left to Right)
Roy Wallace, Chairman-Awards Committee; A. L. Eller, Jr., Retiring Executive Director; Henry Gardiner, BIF President.

KENTUCKY COLONELS
Executive Director, Ike Eller and President, Henry Gardiner become Kentucky Colonels with the help of Carla Nichols, Extension Beef Specialist, University of Kentucky.

1986 BEEF IMPROVEMENT FEDERATION BOARD OF DIRECTORS

Front Row (L-R) A. L. Eller, Jr., Retiring Executive Director; Ron Bolze, Eastern Secretary; Harvey Lemmon, President; Roger McCraw, Executive Director; Henry Gardiner, Past-President; Bob Dickinson, Vice-President; Doug Hixon, Western Secretary.

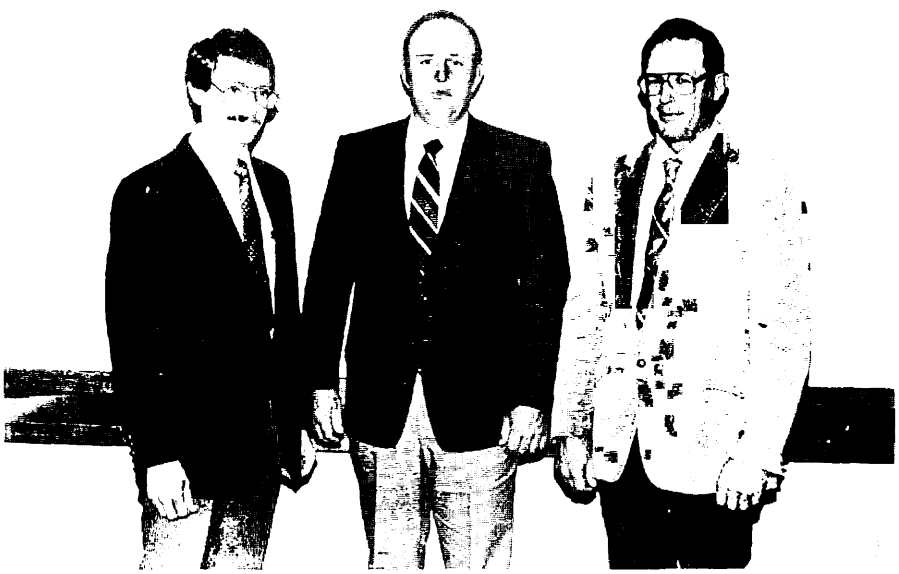
Second Row (L-R) Roy Wallace; Dixon Hubbard; John Crouch; Ken Ellis, Retiring Western Secretary; Jack Chase; Larry Cundiff; and Daryl Strohbehn, Central Secretary.

Third Row (L-R) Richard Whitman; Frank Baker; Bruce Howard; Leonard Wulf; Jim Gibb; Bill Warren; and Wayne Vanderwert.

Directors Not Pictured - Craig Ludwig; Al Smith; Steve Wolfe; Glenn Butts; Darrell Wilkes; Keith Vandervelde.

1985 BIF PRESIDENT - Henry Gardiner

NEW BIF EXECUTIVE DIRECTOR (Left to Right)
Dr. Roger McCraw, Extension Animal Scientist, North Carolina State University, Raleigh, NC and A. L. (Ike) Eller, Jr., Retiring Executive Director, Extension Animal Scientist, Blacksburg, VA



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(L-R) Roger McCraw, Executive Director; Harvey Lemmon, President; Bob Dickinson, Vice-President

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EVIDENCE FOR A SIRE BY DAMTYPE INTERACTION IN CALVES SIRED BY SIMMENTAL SIRES MATED TO TWO TYPES OF CROSSBRED COWS

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Introduction

Sires in breeds being introduced into the U.S. are commonly evaluated on the basis of progeny born to dams of differing breed makeup. Since sires were mated to dams of differing genetic makeup, a sire x breed of dam interaction becomes a distinct possbility. The existance of a sire x breed of dam interaction could decrease the accuracy of predicting sires' breeding values. The presence of a sire x breed of dam interaction has been found in Limousin field data for several preweaning traits (1,2).

The objectives of this study were: (1) to investigate the possible existance of a sire x damtype interaction in calf preweaning traits and (2) investigate the effect of a sire x damtype interaction on estimates of genetic parameters and sire evaluation.

Materials and Methods

The data set contained 345 calf preweaning records collected at the Lake City Experiment Station located at Lake City, MI from 1978 to 1982. Seventeen Simmental sires were mated to two distinct crossbred female types (DT): Charolais x Angus x Hereford (DT1) and Holstein-Friesian x Angus x Hereford (DT2). Sires were mated to the cows at random and each sire had progeny in both dam classifications. The traits analyzed were birth weight (BWT), percentage assisted births (%AB), preweaning average daily gain (PWDG), and weaning weight (WWT).

The model used in the analysis was:

$$Y_{ijklmn} = \mu + YR_i + DT_j + AGE_k + SEX_l + S_m + S*DT_{mj} + e_{ijklmn}$$

where:

μ = overall mean;
YR_i = fixed effect of the i^{th} year, i=1,...,5;
DT_j = fixed effect of the j^{th} dam type, j=1,2;
AGE_k = fixed effect of the k^{th} age of dam, k=1,..,4;
SEX_l = fixed effect of the l^{th} sex of calf, l=1,2;
S_m = random effect of the m^{th} sire, m=1,...,17, $s1 \sim N(0, A_1 \sigma^2_{s1})$;
$S*DT_{mj}$ = random interaction of the m^{th} sire with the j^{th} dam type, $s2 \sim N(0, A_2 \sigma^2_{s2})$;
e_{ijklmn} = random residual pertaining to the n^{th} observation.

Days of age at weaning was included as a covariate in the analysis of weaning weight. The model expressed in matrix notation was $\mathbf{y} = \mathbf{Xb} + \mathbf{Z_1 s1} + \mathbf{Z_2 s2} + \mathbf{e}$. Mixed model equations were constructed as shown below:

$$\begin{bmatrix} Z_1'MZ_1 + A_1^{-1}k_1 & Z_1'MZ_2 \\ Z_2'MZ_1 & Z_2'MZ_2 + A_2^{-1}k_2 \end{bmatrix} \begin{bmatrix} s1 \\ s2 \end{bmatrix} = \begin{bmatrix} Z_1'My \\ Z_2'My \end{bmatrix}$$

where: $\mathbf{M} = \mathbf{I} - \mathbf{X(X'X)^{-}X'}$, $k_1 = \sigma_e^2/\sigma_{s1}^2$, $k_2 = \sigma_e^2/\sigma_{s2}^2$.

Known pedigree relationships between the sires used in the study were used to construct a relationship matrix for sires ($\mathbf{A_1}$). The relationship matrix for the interaction ($\mathbf{A_2}$) was obtained by duplicating the rows and columns of A_1, sorted by sire, and multiplying the off-diagonal elements by .25 (relationship between paternal-half sibs) (3).

Variance components were estimated using restricted maximum likelihood (REML). The REML estimators are shown below:

$$\hat{\sigma}_{s1}^2 = [\hat{s1}'A_1^{-2}\hat{s1} + \hat{\sigma}_e^2 tr(C_{11}A_1^{-1})]/q_{s1}$$

$$\hat{\sigma}_{s2}^2 = [\hat{s2}'A_2^{-2}\hat{s2} + \hat{\sigma}_e^2 tr(C_{22}A_2^{-1})]/q_{s2}$$

$$\hat{\sigma}_e^2 = [\mathbf{y'My} - \hat{s1}'Z_1'\mathbf{My} - \hat{s2}'Z_2'\mathbf{My}]/(n - r(X'X))$$

Iteration was performed upon the variance ratios until convergence criteria were met.

The variance component estimates were used to obtain across- and within-DT heritabilities (h_1^2 and h_2^2). An expected progeny difference (EPD) for each sire within a damtype was obtained by summing the sire solution with the corresponding S*DT solution for a given sire in a particular damtype classification. Sires were ranked within each damtype for each trait and changes in rank were determined by Spearman rank correlation. Product-moment correlations were obtained for sires''EPDs in both damtypes.

Results and Discussion

Estimates of variance components and genetic parameters are shown in Table 1. The sire variance accounted for a greater proportion of the total variance in BWT and %AB than the interaction variance. Sires tended to be ranked similarly based upon performance of progeny from the two crossbred dam types. The high correlation between sires' EPDs for BWT and %AB indicated differences between dam types did not affect the prediction of sires' breeding values based on progeny performance in two different genetic groups.

The variance due to the sire x damtype interaction was greater than the sire variance for PWDG and WWT. In the analysis of WWT, the sire x damtype interaction variance was approximately two times greater than the sire variance. When sires were ranked based upon their EPDs in each damtype, changes in sire ranking and evaluation were evident as indicated by the rank and product-moment correlations.

The heritability estimates for BWT and %AB were increased slightly when expressed on a within-damtype basis compared to an across-damtype basis. When the sire x damtype variance was considered part of the additive genetic variance, heritability estimates were substantially increased from .11 and .08 to .26 and .23 for PWDG and WWT,respectively.

Conclusions

Realizing large sampling variances for the estimated variance components and estimates of heritability exist due to the small sample size, the data does suggest the existance of a sire x damtype interaction for preweaning traits. When sires were mated to crossbred female groups that differed in their maternal contribution to calf performance, sires tended to be ranked and evaluated differently in the two dam groups. Estimates of heritability were increased when expressed on a within-damtype basis compared to an across-damtype basis.

References

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TABLE 1. ESTIMATES OF VARIANCE COMPONENTS AND GENETIC PARAMETERS

	BWT	%AB	PWDG	WWT
n_{s1} [a]	20.1	20.3	18.0	18.2
n_{s2}	10.0	10.1	9.0	9.1
$\hat{\sigma}^2_{s1}$	2.44	.002	3.44*E-4	10.42
% [b]	10	2	3	2
$\hat{\sigma}^2_{s2}$	.12	.001	4.93*E-4	19.84
%	1	1	4	4
$\hat{\sigma}^2_{e}$	21.40	.125	1.18*E-1	495.61
%	89	97	93	94
h^2_1 [c]	.41	.06	.11	.08
h^2_2 [d]	.43	.10	.26	.23
r_s [e]	.99	.95	.57	.62
r_{pm}	.99	.87	.72	.65

[a]Number of progeny per sire and sire-damtype subclass.

[b]Percentage of total variance which is the sum of the three estimated variance components (σ^2_y).

[c]Across-damtype h^2: $h^2_{s1}=4\ \sigma^2_{s1}/\ \sigma^2_y$.

[d]Within-damtype h^2: $h^2_{s2}=4(\ \sigma^2_{s1}+\ \sigma^2_{s2})/\ \sigma^2_y$.

[f]Sprearman rank correlation and product-moment correlation.