1-1991

1991 NEBRASKA CATTLEMEN BULL SELECTION CLINICS

1991
NEBRASKA CATTLEMEN
BULL SELECTION CLINICS

Nebraska Cattlemen

University of Nebraska

SPONSORED BY THE NEBRASKA CATTLEMEN PUREBRED COUNCIL
AND THE COOPERATIVE EXTENSION SERVICE - UNIVERSITY OF NEBRASKA

Monday
JANUARY 28
Columbus Ag. Park Arena
Columbus, NE.

Wednesday
JANUARY 30
North Platte Auction
North Platte, NE.

Thursday
JANUARY 31
Chadron Sale Co.
Chadron, NE.

Friday
FEBRUARY 1
Platte Valley Livestock
Gering, NE.

Monday
FEBRUARY 4
Fairbury Livestock Co.
Fairbury, NE.

Tuesday
FEBRUARY 5
Sutton Livestock Comm. Co.
Sutton, NE.

Wednesday
FEBRUARY 6
Verdigre Livestock Market
Verdigre, NE.

LUNCH AT 11:30 A.M., PROGRAM 12:30 TO 4:00 P.M. EACH DAY

$10.00 REGISTRATION INCLUDES LUNCH AND PROCEEDINGS

1991 Nebraska Cattlemen
Bull Selection Clinics
Program

11:30 - 12:30 Lunch

12:30 Welcome and Introduction

12:40 Use of Expected Progeny Differences (EPD's) in Bull Selection.
... at Columbus
- by Steve McGill, Director Shorthorn Performance Records, American Shorthorn Association, Omaha, NE

... at North Platte, Chadron and Gering
- by Keith Vander Velde, Director Beef Programs, American Breeders Service, De Forest, WI

... at Fairbury, Sutton, Verdigre
- by Roy Wallace, Director Beef Programs, Select Sires, Plain City, OH

1:10 Demonstration of EPD use in Bull Selection
- Dr. Jim Gosey, NU Extension Beef Specialist
Nebraska Cattlemen, Purebred Council Representative
Featured Speaker--McGill, Vander Velde or Wallace

1:45 Break

2:00 Discussion of Breeding Soundness Examination (BSE) of Bulls

... - by Extension Veterinarians Don Hudson, DVM, North Platte or Dr. Dale Grotelueschen, DVM, Scotts Bluff or area practicing veterinarians.

2:30 Use of Pelvic Measurements in Bull and Heifer Selection
... - at North Platte, Chadron and Gering
- by Dr. Gene Deutscher, NU Extension Beef Specialist, North Platte

... - at Columbus, Fairbury, Sutton and Verdigre
- by Dr. Rick Rasby, NU Extension Beef Specialist, Lincoln

3:00 Importance of Cow Condition to Reproductive Performance
- by NU Extension Beef Specialist

3:30 Wrap up and Adjourn

ADDITIONAL COPIES OF PROCEEDINGS = $ 5.00

TABLE OF CONTENTS

BULL SELECTION WORKSHEET

_______________ Breed Group

Bull I.D.	Calv. Ease/ B. wt. EPD	Wean wt. EPD	Milk EPD	Maternal EPD	Yrlg. wt. EPD	Comments
1.						
2.						
3.						
4.						

Scenario A _______________

1st Choice ________ 2nd Choice ________

Reasoning _______________

Scenario B _______________

1st Choice ________ 2nd Choice ________

Reasoning _______________

BULL SELECTION WORKSHEET

Bull I.D.	Calv. Ease/ B. wt. EPD	Wean wt. EPD	Milk EPD	Maternal EPD	Yrlg. wt. EPD	Breed Group ______ Comments
1.						
2.						
3.						
4.						

Scenario A ____________________

1st Choice ______ 2nd Choice ______

Reasoning ____________________

Scenario B ____________________

1st Choice ______ 2nd Choice ______

Reasoning ____________________

USING EPDs IN SELECTING BULLS

Edited by*
Jim Gosey
Extension Beef Specialist
University of Nebraska, Lincoln

Genetic evaluation programs used by the beef cattle industry have changed substantially in the last decade. These programs provide both purebred breeders and commercial bull buyers with a powerful tool to make directional change in beef performance traits. With this tool, commercial cow-calf producers can design a herd that satisfies their goals and production objectives. Expected Progeny Differences (EPDs) are the key to being in control of this designing process.

The use of EPDs are resulting in significant genetic change within purebred populations of cattle. It is time for the commercial industry to start capitalizing on these same genetic improvement programs. Commercial bull buyers need to understand EPDs and how to use them when buying a bull.

WHAT EPD VALUES ARE

Expected progeny differences or EPDs simply predict how future progeny of a sire will perform for various production traits.

For example, suppose bull A has an EPD of +35 pounds for weaning weight and bull B of the same breed has an EPD of +10 pounds for the same trait. If these two bulls are mated to comparable cows, the average weaning weight on calves from bull A would be expected to be 25 pounds heavier than the calves from bull B. The 25 pounds is the difference between the two EPDs (35 - 10 = 25).

Bull	EPD, lb	Average Progeny Calf Weaning Weight, lb.
A	+35	585
B	+10	560
Difference	25	25

Every EPD value published on a bull has an accompanying accuracy (ACC) value. The ACC value tells how reliable the EPD is and range between 0 and 1, least reliable to most reliable. The ACC value depends upon the amount of information available when the bull was last evaluated. Sources of information include the bull's own performance records, records on his progeny as calves and records on relatives (sire, dam, full and half-sibs). The more information available, the higher the ACC value. The following table can be used as a guide when considering bulls of similar EPD values, but differing in the ACC values.

*Adopted from a paper by Dr. Doyle E. Wilson, Livestock Systems Specialist, Iowa State University.

Range of Accuracy Values	Meaning	Potential of EPD to Change
.10 - .30	Low reliability, little information available	High
.40 - .70	Moderate reliability evaluated on 10-20 progeny	Moderate
.70 - .99	High reliability bull evaluated on more than 20 progeny	Low

The following table of ACC values gives typical ranges in EPD changes that could occur for Simmental bulls. Approximately 67 percent of all EPD changes will fall within + or - the possible change value (one standard deviation) for a given ACC. For example, if a Simmental bull has a yearling weight EPD of +20.3 lb. with an ACC of .60, then there is a 67 percent chance that his next EPD value will not be less than +10.0 lb. (20.3 - 10.3) nor greater than +30.6 lb. (20.3 + 10.3).

STANDARD ERRORS OF PREDICTION FOR VARIOUS LEVELS OF ACCURACY

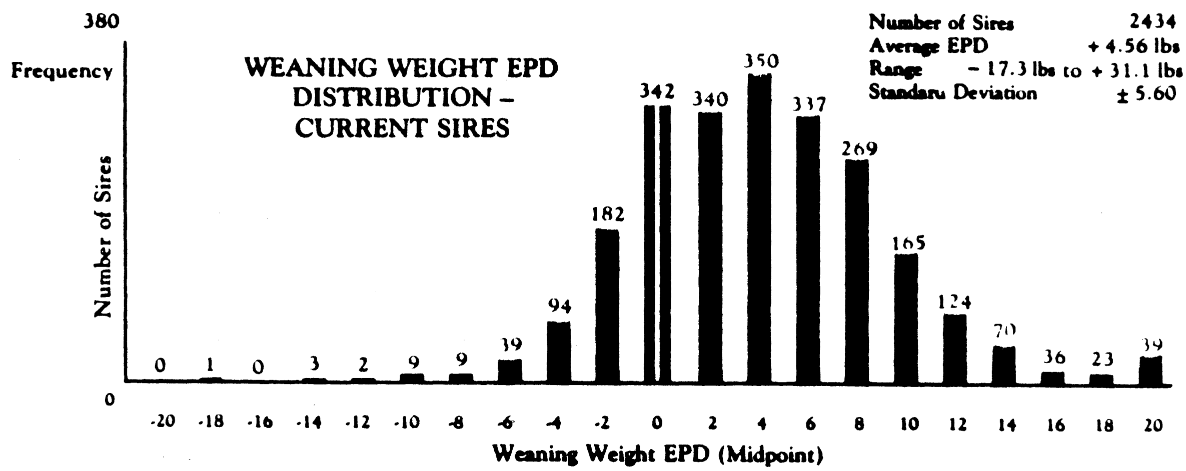
ACC	First Calf Calving Ease	Birth Weight	Weaning Weight	Yearling Weight	Maternal First Calf Calving Ease	Maternal Weaning Weight	Maternal Milk
0.00	5.5	3.0	16.3	25.9	5.6	12.1	11.9
0.10	5.0	2.7	14.7	23.3	5.1	10.9	10.7
0.20	4.4	2.4	13.0	20.7	4.5	9.6	9.5
0.30	3.9	2.1	11.4	18.1	3.9	8.4	8.3
0.40	3.3	1.8	9.8	15.5	3.4	7.2	7.1
0.50	2.8	1.5	8.1	12.9	2.8	6.0	5.9
0.60	2.2	1.2	6.5	10.3	2.3	4.8	4.7
0.70	1.7	0.9	4.9	7.8	1.7	3.6	3.6
0.80	1.1	0.6	3.3	5.2	1.1	2.4	2.4
0.90	0.6	0.3	1.6	2.6	0.6	1.2	1.2
1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source - 1989 Simmental Sire Summary

EPD values are the result of computerized genetic evaluation programs that analyze calf performance records as a part the breed's herd improvement program. Performance records include birth weights, 205-day adjusted weaning weights, 365-day adjusted yearling weights, calving ease scores, frame size, scrotal circumference, and various carcass traits. The genetic evaluation programs account for trait heritabilities, environmental and management differences among herds, the number of records available for evaluation, and the pedigree relationships among all of the animals being evaluated. The EPD values are obtained simultaneously for all animals within a breed, including EPD values for animals no longer living. The EPD values are then published by the various breed associations for bulls that are currently being used and meet a minimum level of ACC. Many of the breeds are also putting the EPDs on microcomputer floppy disks so that the lists can be quickly scanned to find the bulls meeting certain standards.

EPD values are relatively new tools available to breeders. The first sire summaries that were truly national in scope came out in 1980, and were made possible by the incorporation of field records in the evaluation model. EPD values replace and go beyond estimated breeding values (EBV) and contemporary group ratios that have been used for several years by breeders. While EBV values and contemporary group ratios have and continue to be useful to purebred breeders for within-herd selection decisions, their value to commercial bull buyers is somewhat limited. The biggest problem with EBVs and contemporary group ratios is that a ratio of 105 for weaning weight for a bull from one herd cannot be compared to a ratio of 105 for another bull from a different herd. Purebred herd genetic differences can be significant, and the differences can be covered up by the different environments and management. As a commercial bull buyer, only compare ratios on bulls that come from the same herd and have been reared in the same management group. Do not use ratios of bulls to ascertain the level of genetic merit between purebred herds.

EPD values on bulls within a breed follow a normal distribution. The majority of bulls will cluster around an average EPD value. Then there are the few that are extreme for a given trait. A typical distribution of EPD values is given in the following figure. This distribution is for current sires appearing in the Limousin 1988 Sire Summary. Equally, if not more important, would be a distribution of EPD values for the birth year group from which you are making your bull selection.



Source - North American Limousin Foundation 1988 Sire Summary.

WHAT EPD VALUES ARE NOT

EPD values can be used effectively, and they can be misused and be totally ineffective. It is very important for commercial bull buyers to understand the limitations of EPDs so that they are not misused.

EPD values are not an absolute guarantee of how calves from a particular bull are going to perform. First, it must be noted that most beef performance traits are about 20 to 30 percent heritable. This means that 70 to 80 percent of all the variation seen in calf performance is environmental in origin. A big component of performance can be due to disease, weather, parasites, and management. Second, each calf receives only a sample half of the genes from the bull, and a sample half from the cow. Each calf receives a different sample. This is the main reason for differences observed in full-sibs, or calves that have the same parents, such as embryo transfer (ET) calves.

EPD are not static. EPD for any given bull will change. In fact, every registered bull that is currently being evaluated will get a new set of EPDs annually, or as often as the breed association runs another genetic evaluation. Recall that EPDs are expectations of how the calves sired by a particular bull will perform. As more information is collected on which to evaluate this bull, its EPD values will probably change. In the absence of genetic trend within a breed, bulls having EPD with high ACC values will change very little, bulls having EPD with low ACC values could change considerably. In the presence of positive genetic trend even the EPD values with high ACC will decrease from one evaluation to the next. Some important points to remember are:

1. When comparing two bulls, concentrate on their EPD difference. Only the difference is relevant, not the absolute values themselves.

2. Many of the bulls bought by commercial cow-calf producers are yearling bulls, so these bulls automatically fall into the category of low ACC bulls. The herd that is large enough to use a group of bulls has an advantage over a small herd in minimizing the risk of using an unproven bull.

3. The EPD of a yearling bull born in 1986 cannot be fairly compared to the EPD of a yearling bull born in 1988, unless the older bull's EPD is updated and the genetic trend accounted for.

EPD values are not directly comparable across breeds. This is a source of frustration to commercial bull buyers. A Simmental bull with an EPD of +25 pounds for weaning weight is not directly comparable to a Hereford bull with the same EPD value, even if the ACC values are the same. One Simmental EPD value can only be compared to another Simmental EPD; one Hereford EPD value can only be compared to another Hereford EPD. Previous use of bulls with known EPDs from both of these breeds in your herd and results of breed evaluation studies in research stations are ways that you have of assessing how new bulls of different breeds may compare in terms of progeny performance.

EPDs are not available on all bulls. The only bulls that have EPDs are those that have been involved in a breed performance program. However, even some purebred herds that participate in their breed's program will not have EPDs for yearling bulls. There are three main reasons for this: 1) the bull did not have his own individual performance record included in the most recent across-herd genetic evaluation, or 2) the breed association computes EPDs only for bulls with progeny performance records, or 3) the bull was an embryo transfer calf. If EPDs are not available for a young bull, then the commercial bull buyer will need to put together a pedigree estimated EPD.

PEDIGREE ESTIMATED EPDs

A few breed associations have implemented "interim EPD" programs to compute EPDs for young bulls and heifers that have not had the opportunity to have their own performance record included in the most recent evaluation. However, there are still going to be many cases where the EPDs are not available for review at sale time.

The procedure to put together a "Pedigree Estimated EPD" for a young bull is straight forward as long as two conditions are satisfied: 1) you understand how breeding value is transferred from one generation to the next, and 2) you have access to EPDs on animals in the young bull's pedigree.

TRANSFER OF BREEDING VALUE

The calf receives a sample half of the sire's genes and a sample half of the dam's genes. Similarly, the sire had received a sample half of the genes from its sire and dam (the young bull's paternal grandsire and granddam).

ACCESS TO PEDIGREE EPDs

Some breeders holding production bull sales provide a performance pedigree along with the individual bull performance data. The pedigree typically includes EPDs of the sire and maternal grandsire (MGS). If the pedigree EPDs are not listed in the sale catalog, then your only alternative to constructing the Pedigree Estimated EPDs is to go through the breed's sire summary and hope the bulls in the pedigree appear in the summary.

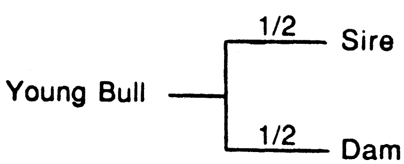
With a calculator, or paper and pencil, you can construct a Pedigree Estimated EPD using the following rule:

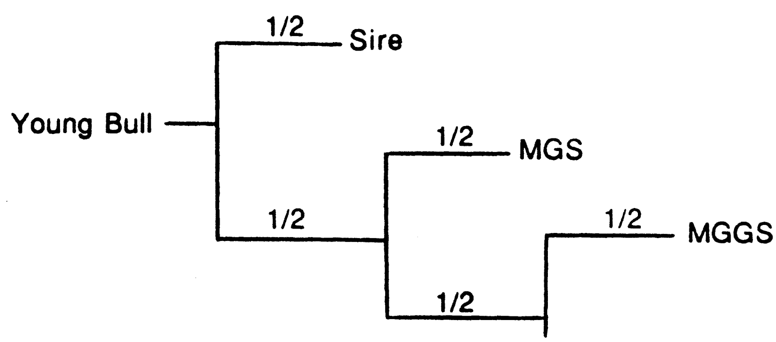
$$EPD^{\text{Young Bull}} = 1/2\ EPD^{\text{Sire}} + 1/2\ EPD^{\text{Dam}}$$

If the dam's EPD is unavailable, the Pedigree Estimated EPD can include EPDs from the dam's pedigree using the following rule:

$$EPD^{\text{Young Bull}} = 1/2\ EPD^{\text{Sire}} + 1/4\ EPD^{\text{MGS}} + 1/8\ EPD^{\text{MGGS}}$$

Note that genetic material is halved each generation in the following pedigree diagrams. In the first pedigree, both the sire and dam EPDs are known. In the second pedigree, the dam's EPDs are not known, but EPDs for both the MGS and maternal great grandsire (MGGS) are known. If the dam's EPDs are known and used in the Pedigree Estimated EPD, you cannot include the MGS or MGGS EPDs in the estimate, because their genetic contribution to the young bull is already accounted for in the dam's EPDs.





The following table lists some examples of pedigree estimated EPDs for a young bull.

Relationship to the Young Bull	Pedigree EPDs lb		
	BWT*	WWT	YWT
Sire	+5.6	+23.2	+38.2
Dam	+1.2	-2.3	+2.3
MGS	+2.1	-7.3	+1.2

Young Bull EPDs:

EPD_{BWT} = 1/2 (5.6) + 1/2 (1.2) = +3.4 lb
or 1/2 (5.6) + 1/4 (2.1) = +3.3 lb

EPD_{WWT} = 1/2 (23.2) + 1/2 (-2.3) = +10.45 lb
or 1/2 (23.2) + 1/4 (-7.3) = +9.79 lb

EPD_{YWT} = 1/2 (38.2) + 1/2 (2.3) = +20.25 lb
or 1/2 (38.2) + 1/4 (1.2) = +19.4 lb

*BWT=Birth weight, WWT=Weaning, YWT=Yearling weight

CONTEMPORARY GROUP RATIOS

After you have computed the Pedigree Estimated EPDs for the bulls of interest, then look at their individual contemporary ratios. For two young bulls with similar EPDs, the ratio can be used to decide which bull is genetically superior.

HOW TO USE EPD VALUES

As a commercial bull buyer, you need to think "performance specification" when looking at buying a replacement bull. You also need to think in terms of four categories of specification as they relate to your breeding and production objectives:

1. Reproduction as affected by calving ease or birth weight, fertility and mature cow size,

2. Growth to weaning and postweaning gain,

3. Maternal or milking ability in replacement females, and

4. Carcass merit.

All of the breed genetic evaluation programs are geared to provide specifications for the first three categories. The manner in which this is accomplished may differ. For example, the American Simmental Association provides calving ease information on bulls, whereas, the American Angus Association provides EPD for birth weight. Both systems are aimed at helping breeders minimize calving difficulties, particularly in first-calf heifers. There is currently little capability to select bulls based upon EPDs for carcass merit. The American Angus Association has a few bulls evaluated for carcass merit as does the American Simmental Association. Many of the breeds will probably be expanding their emphasis on carcass merit within the next few years because of packer interest in carcass "specs" and because of changing consumer preferences.

The task in selecting bulls based upon EPD values would be fairly straight forward if you only had to be concerned with one objective. However, this is seldom the case. You may be interested in calving ease, but do not want to sacrifice weaning weight performance. Or you may want to increase milking level in the cow herd and keep mature size where it currently is. Not every bull will satisfy all of your criteria and some tradeoffs will probably have to be made.

An example of the tradeoffs made by two different commercial cow-calf producers (A and B) when searching for their next bull are summarized in the following three tables. The tradeoffs and final bull choices were made by matching EPD values with production objectives.

Producer	Objective
A	Minimize calving difficulty in first calf heifers, while maintaining good growth to weaning
B	Increase milking ability in replacement females and post weaning gain in all calves

The following is a list of bulls being considered by the producers to satisfy their breeding objectives.

	EPDs, lb			
Bull	Birth	Weaning	Yearling	Milk
1	+5.2	+25.4	+45.3	+10.2
2	+1.2	+27.3	+35.6	-3.2
3	+2.3	+18.3	+35.1	+2.3
Breed Average*	+2.3	+26.2	+39.3	+1.5

*Breed average for bulls born the same year as bulls 1, 2 and 3.

The following table summarizes each producer's bull choice and reasons.

Producer	Choice	Reasons
A	Bull 2	Bull 2 is slightly below his birth year average for birth weight which should minimize the potential for calving difficulties. Bull 2 is just about average for weaning weight which satisfies the objective of maintaining good growth to weaning.
B	Bull 1	Bull 1 is an easy choice for increased milking ability and postweaning gain because he has above average EPD values for both of these traits. However, producer B will only use this bull on mature cows because of the high birth weight EPD.

EIGHT STEPS IN PREPARING TO USE EPDs

Even though the definition of an EPD is straight forward, there is some homework required to effectively use them. The following eight steps may be helpful in this regard.

1. Obtain a copy of the most current sire summary from the breed or breeds of interest to you. Then familiarize yourself with the reporting format and the traits the bulls are evaluated on.

2. Determine what your selection goals are before going to the production sale or to a breeder's place to look at new bulls.

3. Have some idea of the trait tradeoffs that you may have to make.

4. Determine what the acceptable range of EPDs are for your herd.

5. Determine what the average EPD is for the age category of bulls you are considering buying. You will often hear that the average EPD value is zero, however, most of the bulls with EPDs equal to zero are dead. It is important that you know what the breed's EPD reference points are.

6. Challenge yourself to be more knowledgeable on the subject of EPDs than the bull seller.

7. Be able to compute a pedigree estimated EPD for a young bull. Many commercial bull buyers will only be considering young bulls that do not have published or available EPDs.

8. Keep track of bull performance in your herd. Know what a bull with an EPD of +35 pounds for weaning weight actually did to the performance average of your calves. The track record will make buying the next specification bull a lot easier.

Opportunities for genetic improvements that translate into increase profits are now available to all commercial cow-calf producers.

Remember that the bull selection decision is, without question, the most critical and far-reaching decision made in a cow-calf operation. EPDs take much of the uncertainty out of this decision and allow you to know how the next crop of calves should perform, even before they hit the ground.

NATIONAL BEEF BREEDERS ASSOCIATIONS

AMERIFAX
Amerifax Cattle Assn
P.O. Box 149
Hastings, NE 68901
(402) 463-5289

***ANGUS**
American Angus Assn
3201 Frederick Blvd
St. Joseph, MO 64501
(816) 233-3101

ANKINA
Ankina Breeders, Inc
5803 Oakes Road
Clayton, OH 45315
(513) 837-4128

***BEEFMASTER**
Beefmaster Breeders Universal
6800 Park Ten Blvd
Suite 290 West
San Antonio, TX 78213
(512) 732-3132

BELGIAN BLUE
Belgian Blue Assn of America
P.O. Box 6111
Sarasota, FL 34278
(800) 533-2374

***BRAHMAN**
American Brahman Breeders Assn
1313 LcConcha Lane
Houston, TX 77054
(713) 795-4444

***BRANGUS**
Int'l Brangus Breeders Assn
P.O. Box 696020
San Antonio, TX 78269-6020
(512) 696-8231

RED BRANGUS
American Red Brangus Assn
P.O. Box 1326
Austin, TX 78767
(512) 451-0469

BRAUNVIEH
Braunvieh Assn of America
P.O. Box 6396
Lincoln, NE 68506

***CHAROLAIS**
American Int'l Charolais Assn
P.O. Box 20247
11700 NW Plaza Circle
Kansas City, MO 64195
(816) 464-5977

***Publish Sire Summaries**

***CHIANINA**
American Chianina Assn
P.O. Box 890
Platte City, MO 64079
(816) 431-2808

GALLOWAY
American Galloway Breeders Assn
28289 Norris Road
Bozeman, MT 59715
(406) 587-3031

***GELBVIEH**
American Gelbvieh Assn
5001 National Western Drive
Denver, CO 80216
(303) 296-9257

***HEREFORD**
American Hereford Assn
1501 Wyandotte
P.O. Box 4059
Kansas City, MO 64101
(816) 842-3757

***LIMOUSIN**
No. American Limousin Foundation
Box 4467
Englewood, CO 80155
(303) 220-1693

***MAINE-ANJOU**
American Maine-Anjou Assn
567 Livestock Exchange Bldg
Kansas City, MO 64102
(816) 474-9555

MURRAY GREY
American Murray Grey Assn
P.O. Box 30085
1222 No. 27th, Suite 208
Billings, MT 59101
(406) 248-1266

MARCHIGIANIA
Am. Int'l Marchigiania Society
(Marky Cattle Assn)
Box 198
Walton, KS 67151
(316) 837-3303

NORMANDE
P.O. Box 350
Kearney, MO 64060
(816) 635-5722

PIEDMONTESE
Piedmontese Assn of the U.S.
Livestock Exchange Bldg #108
Denver, CO 80216
(303) 295-7287

PINZGAUER
American Pinzgauer Assn
R.R. 1, Box 104E
Kelly, IA 50134
(517) 597-3010

***POLLED HEREFORD**
American Polled Hereford Assn
4700 East 63rd Street
Kansas City, MO 64130
(816) 333-7731

***RED ANGUS**
Red Angus Assn of America
4201 I 35 North
Denton, TX 76201
(817) 387-3502

RED POLL
American Red Poll Assn
P.O. Box 35519
Louisville, KY 40232
(502) 635-6540

***SALERS**
American Salers Assn
5600 S. Quebec, Suite 220A
Englewood, CO 80111
(303) 770-9292

***SANTA GERTRUDIS**
Santa Gertrudis Breeders Int'l
P.O. Box 1257
Kingsville, TX 78364
(512) 592-9357

SCOTCH HIGHLAND
Am. Scotch Highland Breeders Assn
P.O. Box 81
Remer, MN 56672
(218) 566-1321

***SHORTHORN**
American Shorthorn Assn
8288 Hascall Street
Omaha, NE 68124
(402) 393-7200

***SIMBRAH & SIMMENTAL**
American Simmental Assn
1 Simmental Way
Bozeman, MT 59715
(406) 587-4531

***SOUTH DEVON**
No. American South Devon Assn
P.O. Box 68
Lynnville, IA 50153
(515) 527-2437

***TARENTAISE**
American Tarentaise Assn
P.O. Box 446
Reed Point, MT 59069
(406) 326-2100

TEXAS LONGHORN
TX Longhorn Breeders Assn of Am.
2315 N. Main Street, Suite 402
Fort Worth, TX 76106
(817) 625-6241

WHITE PARK
White Park Cattle Assn of America
419 N. Water Street
Madrid, IA 50156
(515) 795-2013

A.I. STUDS WITH BEEF SIRE DIRECTORIES

American Breeders Service
P.O. Box 459
DeForest, WI 53532
(608) 846-3721

21st Century Genetics
100 MBC Drive
Shawano, WI 54166
(715) 526-2141

Genetic Horizons
c/o Vandervoort A.I. Inc
HC 80, Box 760
Piedmont, SD 57769
(605) 787-4678

Select Sires, Inc
11740 U.S. 42
Plain City, OH 43064
(614) 873-4683

Tri State Breeders
E. 10890 Penny Lane
Baraboo, WI 53913
(608) 356-8357

***Publish Sire Summaries**

A A R MAVERICK 2240 #9825048 2-19-80
Sire: SCHEARBROOK EMULOUS 20X9
Breeder: ARNTZEN ANGUS RANCH, HILGER, MT
Owner: ARNTZEN ANGUS RANCH, HILGER, MT
STEVENSON ANGUS RANCH, HOBSON, MT

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+4.5	.95	+33.5	.94	-8.1	.90	402	+8.6	+55.5	.92

A A R NEW TREND 9958634 4-5-81
Sire: V D A R SHOSHONE 548
Breeder: ARNTZEN ANGUS RANCH, HILGER, MT
Owner: GALEN & LORI FINK, MANHATTAN, KS
WM H & BARBARA A RISHEL, NORTH PLATTE, NE
THOMAS ANGUS RANCH, BAKER, OR

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+5.7	.96	+31.4	.96	+29.7	.90	456	+45.4	+55.9	.94

A A R NEW TREND 804 - 10577961 2-28-84
Sire: A A R NEW TREND
Breeder: ARNTZEN ANGUS RANCH, HILGER, MT
Owner: ARNTZEN ANGUS RANCH, HILGER, MT

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+2.1	.75	+21.0	.72	+18.3	.49	11	+28.8	+37.5	.66

A D D BLACK STAR 10407399 4-6-83
Sire: CRACKER JACK BAROS 2459
Breeder: A D D ANGUS FARM, ARLINGTON, IA
Owner: A D D ANGUS FARM, ARLINGTON, IA

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+7.4	.76	+17.8	.74	+7.0	.57	20	+15.9	+28.0	.70

A D D SWEETNESS C387 10785873 4-1-86
Sire: HAR BANG 1774
Breeder: A D D ANGUS FARM, ARLINGTON, IA
Owner: A D D ANGUS FARM, ARLINGTON, IA
SHAMROCK LAND & CATL CO, O NEILL, NE

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+6.8	.76	+23.0	.72	+.3	.15		+11.7	+35.8	.64

A E S EMULATION H 18 10318511 10-20-82
Sire: EMULATION N BAR 1201
Breeder: AUBURN UNIVERSITY, CAMDEN, AL
Owner: AUBURN UNIVERSITY, CAMDEN, AL

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
-.6	.69	+11.4	.64	+11.5	.21	1	+17.2	+28.5	.57

A E S GREAT NORTHERN C 9643961 10-29-79
Sire: PREMIER GREAT NORTHERN 1056
Breeder: AUBURN UNIVERSITY, CAMDEN, AL
Owner: CLIFFORD MEIGS, DAVISTON, AL

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
-1.3	.70	-5.3	.67	+11.4	.47	11	+8.8	-1.7	.64

A J S GUNNER 10344639 2-16-83
Sire: QLC WINCHESTER
Breeder: ARNOLD SIMONSEN & SON, YODER, WY
Owner: K & K CATTLE CO, LINCOLN, NE
T J R ANGUS, HASTINGS, NE
TAURUS BRDRS SERVICE INC, LONE GROVE, OK

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+4.1	.84	+32.1	.82	+8.0	.67	35	+24.1	+40.9	.73

A PLUS OF VEROLA 384 10325105 4-7-83
Sire: MR A PLUS OF VEROLA
Breeder: VAUGHN & JUDITH DOMEIER, SUTTON, NE
Owner: QUIRK LAND & CATTLE CO, HASTINGS, NE

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+3.7	.78	+22.6	.76	+8.2	.58	22	+19.4	+10.9	.68

A&B POWER BOSS 140 10046430 5-2-80
Sire: P S POWER PLAY
Breeder: ARLEN J & BECKY SAWYER, BASSETT, NE
Owner: SWEN BUD SEVERSON, CLARK, SD

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+2.9	.79	+17.5	.84	+3.5	.72	58	+12.2	+30.4	.75

ADVENTURE 423N J R S 9970800 3-8-81
Sire: CALLISON BLACK ADVENTURE
Breeder: STEVENSON ANGUS RANCH, HOBSON, MT
Owner: CORLETT RANCH, DRUMMOND, MT

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+4.0	.84	+13.7	.82	+12.5	.66	37	+19.3	+23.1	.78

ALAMO 4108 H W B 10580515 2-22-84
Sire: GUNSTON ALAMO
Breeder: BROOKS RANCH, RHAME, ND
Owner: STANLEY G CALDWELL, PIERRE, SD

BW EPD	BW ACC	WW DIRECT EPD	WW DIRECT ACC	WW MATERNAL MILK EPD	WW MATERNAL MILK ACC	DTS	COMB. VALUE	YW EPD	YW ACC
+.5	.74	+20.5	.72	-1.9	.54	17	+8.4	+25.2	.69

BIRTH WEIGHT EPD DISTRIBUTION
NON-PARENT COWS & BULLS
193,084 ANIMALS
AVERAGE EPD +2.7
RANGE -6.9 LBS. TO +11.6 LBS.

EPD RANGE	NUMBER	PERCENT
-6.9 thru -6	7	
-5.9 thru -5	25	.01
-4.9 thru -4	92	.05
-3.9 thru -3	333	.17
-2.9 thru -2	1,295	.67
-1.9 thru -1	4,114	2.13
-.9 thru 0	10,501	5.44
.1 thru 1	21,335	11.05
1.1 thru 2	32,901	17.04
2.1 thru 3	38,005	19.68
3.1 thru 4	35,245	18.25
4.1 thru 5	25,531	13.22
5.1 thru 6	14,378	7.45
6.1 thru 7	6,339	3.28
7.1 thru 8	2,215	1.15
8.1 thru 9	625	.32
9.1 thru 10	122	.06
10.1 thru 11	16	.01
11.1 thru 12	5	

WEANING WEIGHT EPD DISTRIBUTION
NON-PARENT BULLS & COWS
217,777 ANIMALS
AVERAGE EPD +18.9
RANGE -24.7 LBS. TO +58.7 LBS.

EPD RANGE	NUMBER	PERCENT
-99.9 thru -30	0	
-29.9 thru -25	0	
-24.9 thru -20	11	.01
-19.9 thru -15	10	
-14.9 thru -10	52	.02
-9.9 thru -5	298	.14
-4.9 thru 0	1,630	.75
.1 thru 5	7,347	3.37
5.1 thru 10	20,670	9.49
10.1 thru 15	38,930	17.88
15.1 thru 20	52,494	24.10
20.1 thru 25	48,694	22.36
25.1 thru 30	29,475	13.53
30.1 thru 35	8,762	4.02
35.1 thru 40	4,414	2.03
40.1 thru 45	1,332	.61
45.1 thru 50	242	.11
50.1 thru 55	39	.02
55.1 thru 60	3	

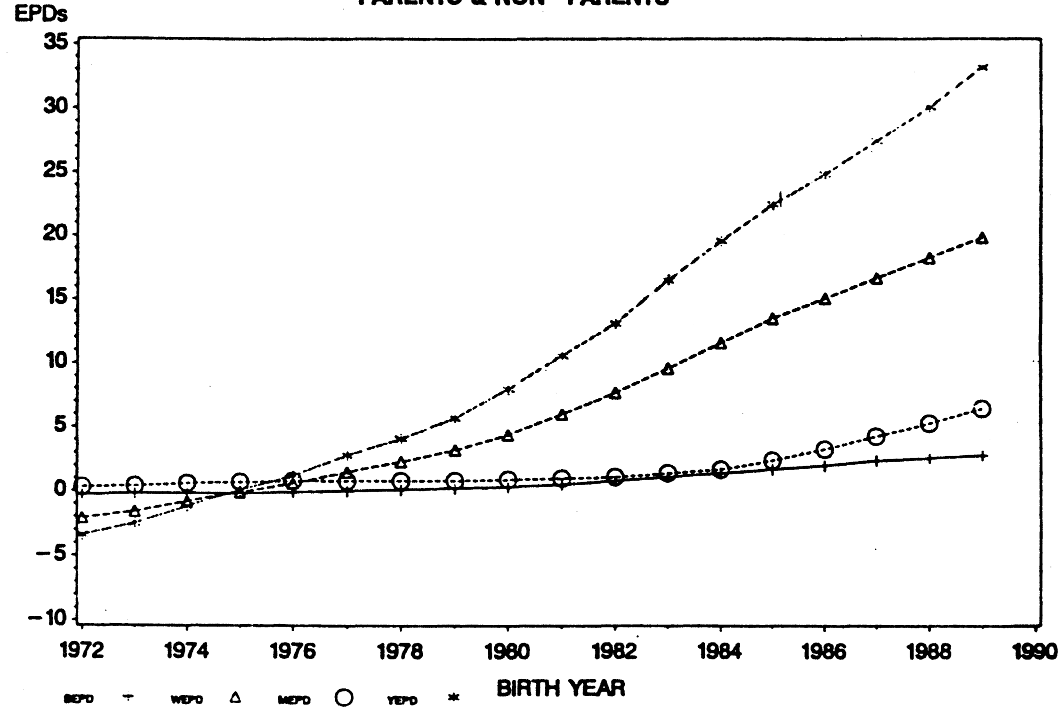
YEARLING WEIGHT EPD DISTRIBUTION
NON-PARENT BULLS & COWS
117,612 ANIMALS
AVERAGE EPD +30.0
RANGE -17.8 LBS. TO +90.5 LBS.

EPD RANGE	NUMBER	PERCENT
-19.9 thru -15	6	.01
-14.9 thru -10	28	.02
- 9.9 thru - 5	155	.13
- 4.9 thru 0	552	.47
.1 thru 5	1,753	1.49
5.1 thru 10	3,859	3.28
10.1 thru 15	7,255	6.17
15.1 thru 20	11,527	9.80
20.1 thru 25	15,752	13.39
25.1 thru 30	18,637	15.85
30.1 thru 35	14,779	12.57
35.1 thru 40	15,594	13.26
40.1 thru 45	10,876	9.25
45.1 thru 50	6,399	5.44
50.1 thru 55	3,234	2.75
55.1 thru 60	1,633	1.39
60.1 thru 65	879	.75
65.1 thru 70	629	.53
70.1 thru 75	263	.22
75.1 thru 80	70	.06
80.1 thru 85	20	.02
85.1 thru 90	13	.01
90.1 thru 99	1	

MILK EPD DISTRIBUTION
NON-PARENT BULLS & COWS
217,777 ANIMALS
AVERAGE EPD +5.5
RANGE -20.8 LBS. TO +28.6 LBS.

EPD RANGE	NUMBER	PERCENT
-24.9 thru -20	1	
-19.9 thru -15	41	.02
-14.9 thru -10	507	.23
- 9.9 thru - 5	5,054	2.32
- 4.9 thru 0	28,011	12.86
.1 thru 5	68,009	31.23
5.1 thru 10	72,896	33.47
10.1 thru 15	34,381	15.79
15.1 thru 20	8,062	3.70
20.1 thru 25	771	.35
25.1 thru 30	44	.02

ANGUS EPD TRENDS
PARENTS & NON-PARENTS



ANGUS GENETIC TREND BY BIRTH YEAR

YEAR	BEPD	WEPD	MEPD	YEPD
1972	- .3	- 2.1	+ .3	- 3.4
1973	- .2	- 1.6	+ .4	- 2.5
1974	- .2	- .8	+ .6	- 1.2
1975	- .2	- .1	+ .7	+ .1
1976	- .1	+ .6	+ .8	+ 1.2
1977	+ .0	+ 1.5	+ .8	+ 2.8
1978	+ .1	+ 2.3	+ .8	+ 4.1
1979	+ .2	+ 3.2	+ .8	+ 5.7
1980	+ .3	+ 4.4	+ .9	+ 8.0
1981	+ .5	+ 6.0	+1.0	+10.6
1982	+ .8	+ 7.7	+1.1	+13.1
1983	+1.1	+ 9.6	+1.4	+16.5
1984	+1.4	+11.6	+1.7	+19.6
1985	+1.7	+13.5	+2.4	+22.5
1986	+2.0	+15.1	+3.3	+24.9
1987	+2.4	+16.7	+4.3	+27.5
1988	+2.6	+18.3	+5.3	+30.1
1989	+2.8	+19.9	+6.5	+33.2

AHIR
AVERAGE ADJUSTED WEIGHTS BY YEAR

YEAR	BIRTH BULLS	BIRTH HEIFERS	WEANING BULLS	WEANING HEIFERS	YEARLING BULLS	YEARLING HEIFERS
1972	69	65	486	433	856	630
1973	69	65	485	434	867	647
1974	70	65	488	436	865	640
1975	69	65	485	436	877	652
1976	70	66	503	449	894	671
1977	72	67	510	456	891	667
1978	73	68	509	455	892	673
1979	74	69	518	463	911	684
1980	75	70	528	473	933	703
1981	76	71	541	484	937	703
1982	78	72	541	485	951	706
1983	79	73	544	490	949	713
1984	80	74	548	494	966	721
1985	81	75	565	509	988	740
1986	82	76	564	508	994	746
1987	82	76	582	525	1,019	770
1988	83	77	593	535	1,037	784
1989	83	78	603	545	1,064	804
Averages	78	73	539	484	950	716

BRINKS EXTRA 193R7

R279481 193R7LH
BD: 03/05/83 Gen: 4 Scurs: no
S: EXTRA OF BRINKS
MGS:WSR CLOUD 942
B: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
O: SYLER CATTLE COMPANY, BURTON, TX

Dist		Birth Weight		Weaning Weight		Yearling Weight		Maternal			
HD	CG	EPD	ACC	EPD	ACC	EPD	ACC	DGT	MILK	TOTL	ACC
4	17	-1.3	.58	1	.64	-1	.48	7	3	3	.40

BRINKS EXTRA 193S12

R332172 193S12
BD: 03/08/84 Gen: 4 Scurs: no
S: EXTRA OF BRINKS
MGS:WSR CLOUD 942
B: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
O: MURDOCHS BRANGUS FARM, RISING STAR, TX

Dist		Birth Weight		Weaning Weight		Yearling Weight		Maternal			
HD	CG	EPD	ACC	EPD	ACC	EPD	ACC	DGT	MILK	TOTL	ACC
1	11	-0.1	.38	-1	.51	1	.18	0	1	1	.06

BRINKS EXTRA 359S2

R315102 359S2LH
BD: 02/28/84 Gen: 4 Scurs: no
S: EXTRA OF BRINKS
MGS:WSR CLOUD 942
B: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
O: JOHN J. LUTHER, ABILENE, TX

Dist		Birth Weight		Weaning Weight		Yearling Weight		Maternal			
HD	CG	EPD	ACC	EPD	ACC	EPD	ACC	DGT	MILK	TOTL	ACC
1	25	1.1	.45	7	.57	13	.20	2	0	3	.19

BRINKS EXTRA 619R

R286582 619R LH
BD: 03/04/83 Gen: 2 Scurs: no
S: EXTRA OF BRINKS
MGS:BRAVO OF BRINKS
B: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
O: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
JACK & SONDRA BRADEN, TERREBONNE, OR
TURNER BRANGUS RANCH, DREWSEY, OR

Dist		Birth Weight		Weaning Weight		Yearling Weight		Maternal			
HD	CG	EPD	ACC	EPD	ACC	EPD	ACC	DGT	MILK	TOTL	ACC
19	69	9.4	.84	9	.85	8	.70	22	-30	-25	.60

BRINKS EXTRA 65S4

R332165 65S4
BD: 01/09/84 Gen: 4 Scurs: no
S: EXTRA OF BRINKS
MGS:BRINKS CARSON 351/0
B: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
O: DR. A. ROLAND YOUNG, MT. VERNON, TX

Dist		Birth Weight		Weaning Weight		Yearling Weight		Maternal			
HD	CG	EPD	ACC	EPD	ACC	EPD	ACC	DGT	MILK	TOTL	ACC
1	26	-0.2	.50	-9	.57	-13	.29	0	3	-2	.06

BRINKS EXTRA 71P16

R275385 71/P16LH
BD: 12/20/82 Gen: 4 Scurs: no
S: EXTRA OF BRINKS
MGS:PW OSCAR 120/3
B: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
O: W. P. HAYMAN JR., KENANSVILLE, FL
HELDON RANCH, OCALA, FL
MO BRANGUS, LONGWOOD, FL R & D FARMS, OKEECHOBEE, FL B. J. RICHARDS, ASTATULA, FL

Dist		Birth Weight		Weaning Weight		Yearling Weight		Maternal			
HD	CG	EPD	ACC	EPD	ACC	EPD	ACC	DGT	MILK	TOTL	ACC
9	41	-2.1	.78	0	.81	-12	.65	25	-8	-8	.60

BRINKS EXTRA 837S

R332204 837S
BD: 09/01/84 Gen: 4 Scurs: no
S: EXTRA OF BRINKS
MGS:WBH RSV TITAN 23/6
B: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
O: MICHEL'S ROLLING ACRES FARM 99, HARRISON, AR

Dist		Birth Weight		Weaning Weight		Yearling Weight		Maternal			
HD	CG	EPD	ACC	EPD	ACC	EPD	ACC	DGT	MILK	TOTL	ACC
3	17	-0.4	.58	-9	.62	-9	.34	0	3	-1	.06

BRINKS EXTRA 894R25

R282991 894R25LH
BD: 06/02/83 Gen: 4 Scurs: no
S: EXTRA OF BRINKS
MGS:ROCKY JOE
B: BRINKS BRANGUS-FOUNDATION, EUREKA, KS
O: GARTH S. LUNT, PIMA, AZ
ROBBS BRANGUS, WILLCOX, AZ

Dist		Birth Weight		Weaning Weight		Yearling Weight		Maternal			
HD	CG	EPD	ACC	EPD	ACC	EPD	ACC	DGT	MILK	TOTL	ACC
8	33	-	-	-3	.69	-8	.24	4	-1	-3	.32

Genetic Trend For Brangus Since 1975

Year	Birth Weight No. Animals	Birth Weight EPD (lb.)	No. Animals Evaluated For Growth And Maternal Traits	Weaning Weight EPD (lb.)	Yearling Weight EPD (lb.)	Milk EPD (lb.)	Total Maternal EPD (lb.)
1975	1646	-.10	2638	- .55	- .62	.03	- .24
1976	1782	-.05	2812	- .41	- .47	.18	- .02
1977	2195	.01	3993	- .39	- .65	.16	- .04
1978	2718	.16	5073	.00	- .06	.25	.26
1979	3421	.21	7217	.30	.48	.28	.43
1980	4525	.24	8046	.50	.73	.25	.50
1981	4806	.30	8675	.77	1.16	.46	.85
1982	6326	.37	11518	1.02	1.57	.70	1.21
1983	7710	.50	13309	1.63	2.30	.42	1.24
1984	10135	.56	16267	2.57	3.57	.22	1.51
1985	10114	.60	17952	3.23	4.60	.29	1.91
1986	9695	.65	17211	3.96	5.84	.31	2.29
1987	8540	.81	14564	5.59	8.27	.12	2.92
1988	8226	.96	13386	6.98	10.57	.57	4.05
1989	6831	.91	10314	7.15	10.98	.72	4.29

Summary of All Sires With EPDs

Trait	No. of Sires	Average EPD	Range in EPDS	Standard Deviation in EPD lbs.
Birth Weight	5640	+ .35	- 6.0 to + 9.4	± 1.27
Weaning Weight	7472	+1.74	-32.2 to +63.7	± 7.49
Yearling Weight	7472	+2.66	-41.3 to +85.0	± 10.39
Milking Ability	7472	+ .34	-29.7 to +23.4	± 5.04
Total Maternal	7472	+1.22	-25.1 to +28.2	± 5.85

Summary of All Non-Parents With EPDs

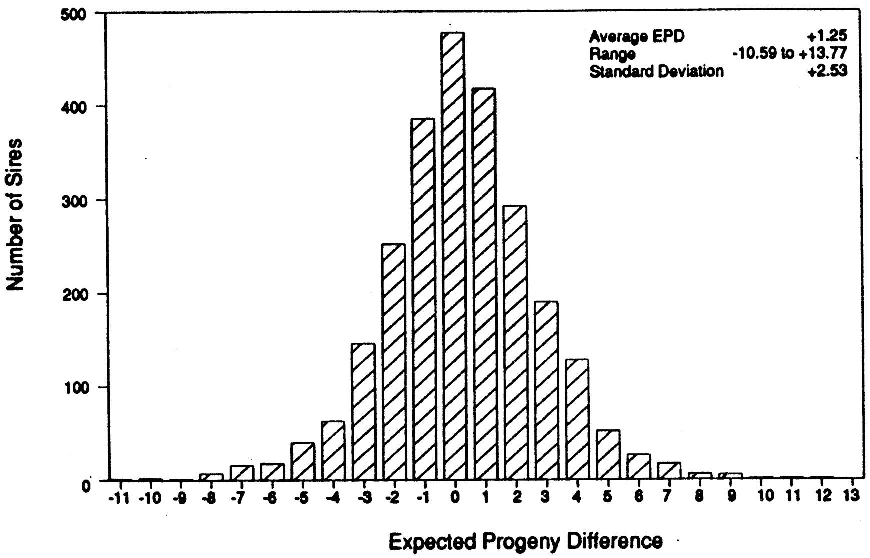
Trait	No. of Animals	Average EPD	Lowest EPD	Highest EPD
Birth Weight	51695	+ .68	- 5.7	+ 7.7
Weaning Weight	104294	+3.56	-33.5	+49.2
Yearling Weight	104294	+5.28	-51.7	+70.0
Milking Ability	104294	+ .36	-21.4	+23.7
Total Maternal	104294	+2.13	-24.0	+28.8

PROGENY PROVEN SIRES

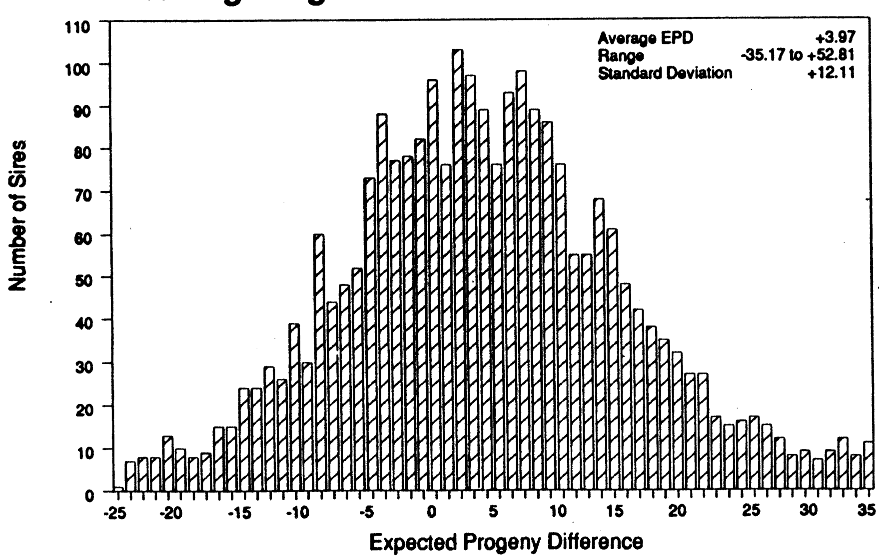
Name of Bull Date of Birth	AICA Reg. Number	Sire Dam Sire of Dam	Current Owner & Address	Birth Weight EPD ACC	Weaning Weight EPD ACC	Yearling Weight EPD ACC	Milk EPD ACC	Total Mtnl. EPD
AAI ELEVATION 212 04/15/82	M 229543	IOWNA ELEVATION 58N9 SILVER CREEK ELEUTHERA ELEUTHERA INTERNATIONAL	Elm Grove Charolais Route 2 Box 23 Vetal, Sd 57551	2.6 .68	26.5 .68	30.0 .61	-3.3 .57	9.8
ABC AARON BERNIE 05/04/81	M 228592	MGM SIR AIGLON 4 DOBLE HILAR BERNICE ABC BARON HIDALGO	A B Cobb Jr Box 348 Augusta, Mt 59410	0.9 .70	5.1 .70	14.3 .66	-9.0 .58	-6.4
ABC ALI 03/15/80	M 225737	MGM HILARIO BARRIGON IMP EXCALIBURA EXCALIBUR ECONOME	A B Cobb Jr Box 348 Augusta, Mt 59410	-0.4 .77	6.1 .77	7.4 .76	-3.6 .76	-0.5
ABC ALI JACK 03/29/83	M 246261	ABC ALI ABC HEBA JACKIE ABC HECTOR BRAMARD	Lonnie Allen Jr Box 159 Augusta, Mt 59410	0.6 .67	4.5 .66	0.4 .59	-4.3 .55	-2.0
ABC ALLEGRO 04/15/80	M 225731	MGM SIR AIGLON 2 HERCULA EDIE ABC HERCULES JACK	A B Cobb Jr Box 348 Augusta, Mt 59410	3.9 .72	0.1 .72	-1.9 .69	-27.2 .64	-27.2
ABC CHIP 04/20/83	M 246258	ABC HILMACSON JOEL MISS EDMUND 184 ABC PRINCE CHIP	Jorgensen Ranches H C R 57 Box 91 Ideal, Sd 57541	3.0 .68	13.6 .68	-3.8 .64	-13.2 .54	-6.4
ABC FERN JUGGERNAUT 519 03/20/85	M 259574	ABC FERNANDO MISS BC JUGGERNAUT 7033J JUGGERNAUT OF NUTMEG	Boehler Dennis T P O Box 677 Sheridan, Mt 59749	-2.2 .74	21.6 .73	21.8 .62	-11.7 .48	-0.9
ABC FERN PACESETTER 551 04/07/85	M 259573	ABC FERNANDO MISS IC CRESTOMERE 4473 IC CRESTOMERE 2029	Boehler Dennis T P O Box 677 Sheridan, Mt 59749	-4.4 .67	22.1 .66	33.0 .59	-6.6 .48	4.4
ABC FERNANDO SON 530 03/27/85	M 259586	ABC FERNANDO EATONS MISS CHARLO 0325 ABC HERN SON	Schurr Bros H C 70 Box 75 Farnam, Ne 69029	3.5 .64	31.4 .65	38.5 .57	-17.5 .39	-1.8
ABC FRANZ HECTORO 04/08/85	M 270687	ABC HECTORO ABC HILCHIP HILARY ABC HILMACSON HILCHIP	Franz Ranch Girard Route Box 157 Sidney, Mt 59270	3.7 .71	34.9 .69	46.4 .64	-10.9 .49	6.4
ABC HECTORAGAN 03/31/76	M 190970	ABC D'ARTAGAN HECTA MAY MGM HECTOREO HECTORIZO	A B Cobb Jr Box 348 Augusta, Mt 59410	0.3 .74	-2.9 .74	-3.6 .72	-1.1 .70	-2.5
ABC HECTORO 04/13/82	M 241665	ABC HECTORAGAN ABC MARIA EDA ABC HIDALGO MARIO	A B Cobb Jr Box 348 Augusta, Mt 59410	-0.4 .76	-22.8 .76	-9.9 .71	4.2 .62	-7.2
ABC HILARIO HERNANDEZ 05/02/77	M 198327	ABC HIDALGO FJ BERNIE 3 HERA JEAN ABC FORTINS HERMAN	Lindseth Charolais Ranch Box 183 Dupuyer, Mt 59432	2.3 .79	-23.0 .79	-22.2 .76	-1.1 .70	-12.6
ABC HILMACSON HILCHIP 04/10/79	M 218459	ABC HILMACSON HILICI MAXY ABC HILDALGO F CHIP 2	A B Cobb Jr Box 348 Augusta, Mt 59410	4.3 .71	-1.9 .71	6.6 .68	-12.0 .63	-13.0
ABC ICEMAN 811 03/17/78	M 200648	JOHNNY CAKE EXTERMINATOR GIGET IRON MAN	Wesson Charolais Inc Koshkonong Mo J Bar J Ranch Holts Summit Mo Carl A Ahrens Martinsburg Mo	1.6 .89	2.9 .90	1.5 .89	-12.5 .88	-11.0
ABC INJECTOR RSC 236 09/08/82	M 235350	ABC ICEMAN 811 ABC BENITA 5000 POLLED MR BENJAMIN	Carl A Ahrens Martinsburg Mo Rising Sun Charolais Alden Ia	5.9 .78	31.3 .78	41.8 .74	-3.9 .68	11.7
ABC JOES HECTORO 04/27/82	M 241668	ABC HECTORAGAN JOES ELFIE ABC JOE TWIN	Charles W Stipe 11191 Moiese Vly Rd Moiese, Mt 59824	0.6 .68	1.7 .68	-7.7 .64	5.3 .60	6.2
ABC LATIN AIGDAN 03/08/80	M 242230	MGM AIGDAN HIJACKS 1409 ABC TINA LOUISE ABC LATIN SON	Charles W Stipe 11191 Moiese Vly Rd Moiese, Mt 59824	0.5 .70	8.8 .69	0.6 .66	-3.7 .63	0.6
ABC LATIN EDMUND 03/19/85	M 259688	ABC 44 MAGNUM ABC LATINA EDE MAY MGM LATIN HOMBRE	A B Cobb Jr Box 348 Augusta, Mt 59410	-3.6 .65	-12.7 .65	-7.1 .48	-15.9 .22	-22.3
ABC LATIN VECTORO 04/09/83	M 246256	ABC VECTORO LATINA HILDINA MGM LATIN HOMBRE	A B Cobb Jr Box 348 Augusta, Mt 59410	3.5 .67	24.6 .67	28.0 .56	-29.2 .47	-16.9
ABC MACK 04/05/83	M 246257	ABC MAVERICK ABIGAL HERA JACKIE MGM AIGLON ABRAHAM 613	A B Cobb Jr Box 348 Augusta, Mt 59410	5.8 .65	22.1 .65	23.0 .54	-18.4 .39	-7.3
ABC MARK TWAIN 505 PLD 02/25/85	M 252524	SILVER CREEK HIGH-RISE ABC BENITA 308 POLLED ABC ICEMAN 811	A W Compton Nanafalia Al Carl A Ahrens Martinsburg Mo Dr Harlan B Rogers Collins Ms	-0.0 .69	10.4 .72	14.4 .51	2.1 .25	7.4
ABC MAVERICK 03/23/80	M 225736	MGM LATIN HOMBRE NIKKO HITA ABC NIKKO ED	A B Cobb Jr Box 348 Augusta, Mt 59410	7.6 .72	20.6 .72	23.8 .71	-20.1 .70	-9.7
ABC MONTANA BINGO 04/19/82	M 241666	ABC MONTANA HOMBRE MISS EDMUND 184 ABC PRINCE CHIP	A B Cobb Jr Box 348 Augusta, Mt 59410	-0.5 .65	2.4 .65	-1.4 .61	-4.1 .59	-2.9
ABC OSCAR 952 05/31/79	M 216448	JOHNNY CAKE EXTERMINATOR J BAR J MALENEHE 551 BROADACRES AMOUR 704	Ricketts Charo Ranches Rt 3 Box 368 Hallsville, Mo 65255	-0.2 .66	-30.8 .66	-30.0 .65	-10.3 .64	-25.7
ABC SILVER BULLET 543PLD 11/14/85	M 259994	WF SILVER HATCHET 234 ABC MAGGIE THE 3RD ABC ICEMAN 811	A W Compton Nanafalia Al Martin Henry Ahrens Martinsburg Mo	1.5 .64	10.4 .69	12.2 .46	-1.1 .26	4.1
ABC SILVER HOMBRE 04/24/80	M 225733	ABC MONTANA HOMBRE BRAMARDS SILVER ABC HILDALGO 2 FORTUNE	Lonnie Allen Jr Augusta Mt A B Cobb Jr Augusta Mt	2.1 .74	2.8 .74	3.2 .72	-2.0 .72	-0.6

EPD SIRE DISTRIBUTION

Birth Weight EPD Sire Distribution

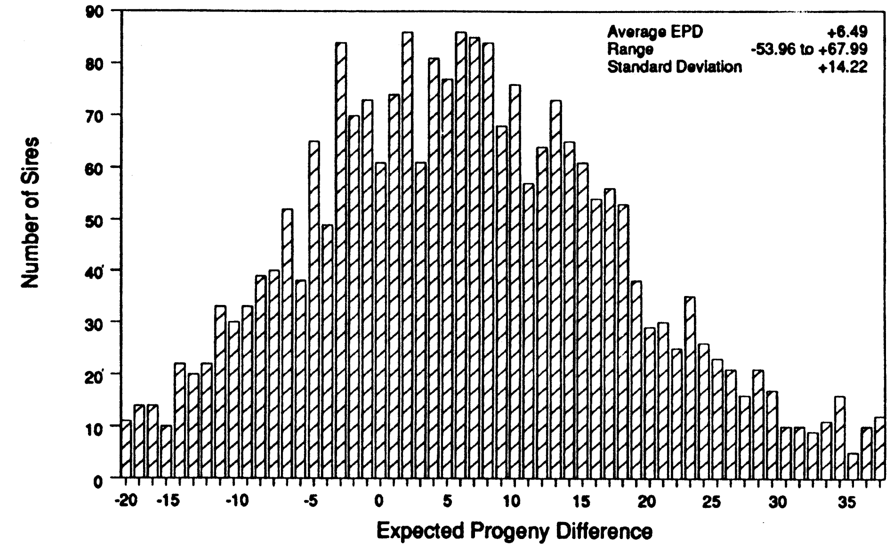


Weaning Weight EPD Sire Distribution

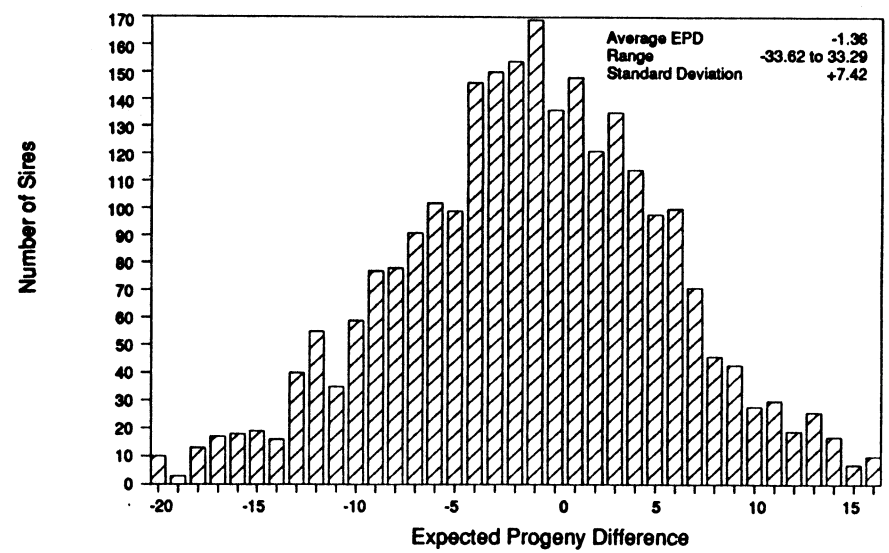


EPD SIRE DISTRIBUTION

Yearling Weight EPD Sire Distribution



Milking Ability EPD Sire Distribution

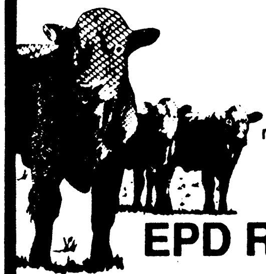


18.

PROGENY PROVEN SIRES

Prefix Color	Name of Bull Date Of Birth	B T	H P S	AGA Reg. Number	Sire Dam Sire of Dam	%	Current Owner & Address	No. of Herds	Birth Weight EPD ACC	Weaning Weight EPD ACC	Yearling Weight EPD ACC	Milk EPD ACC	Total Maternal EPD	Gest. Length EPD ACC	Calving Ease Direct EPD ACC	Calving Ease Daughter EPD ACC
	ABS CANADIAN HEIZER 05/03/72	•	H	32	HEIZER LONI	FB	HASART RANCH BOX 603 CUSTER, SD 57730	21	-1.1 .71	-18.7 .69	-17.3 .65	8.6 .61	-.7	.5 .76	103.0 .63	105.1 .60
WSD	ACLE LEO 02/23/83	•		113662	ACLE GRIFFIN ACLE HOLLY	FB	PETER ENGELHARDT 28 OAKLAND PLACE SUMMIT, NJ 07901	11	2.9 .68	21.3 .61	24.6 .59	4.1 .56	14.7	.7 .58	91.8 .59	100.0 .57
DGM	ADLIGER 9833940 04/14/83	•	P	112064	MERANO 70750 ROSWITHA 9781685	FB	EUGENE O. PERKINS 925 ARCTURUS DRIVE COLORADO SPRINGS, CO 80906	7	-.5 .72	-.4 .62	14.8 .62	-1.5 .59	-1.7	-.6 .74	107.0 .66	97.5 .60
DPR	ADMIRAL 03/02/80	•	H	45445	HOCHREIN MISS BAR JC 327J BELGRAD 62837	FB	PURKEYPILE/NELSON GELBVIEH RT 4 BOX 257 ELLENSBURG, WA 98926	198	5.2 .93	25.4 .92	28.7 .91	2.7 .90	15.4	-2.2 .93	91.9 .90	98.8 .90
LNR	ADMIRATION 03/28/82			61418	ADMIRAL MISS MAGNUM 488 MAGNUM	FB	HAGLUND RANCH INC. BROCKWAY, MT 59214	3	7.3 .74	15.8 .70	22.7 .63	7.3 .56	15.2	2.3 .61	81.4 .58	84.1 .57
BMB	ADOLPH N147 11/27/81		H	56059	MONARCH JLC312J 4L MONARCH JLC312J	PB	FASTENAU FARMS ROUTE 2 BOX 165 BERTRAND, NE 68927	1	3.9 .62	39.1 .61	51.1 .58	4.4 .54	23.9	-.4 .59	95.0 .57	101.8 .54
LAF	AHAB 01/18/80	•		3396	INN WENKE	FB	AHAB SYNDICATE 129 COLUMBIA DRIVE SASKATOON S7K 1E8 SK CANADA,	42	2.2 .83	-.1 .82	-12.3 .80	-2.8 .77	-2.8	.4 .84	91.8 .79	96.0 .78
AKA	ALBERS SENSATION 128S 10/26/84		P	133427	POLLED SENSATION 270PLIZ 306H	PB	ALAN & KATHLEEN ALBERS RR 2, BOX 118 NASHVILLE, KS 67112	1	-4.5 .75	-10.3 .71	-3.2 .56	3.2 .33	-1.9	-.4 .50	126.1 .46	126.3 .36
BSR	ALBRO 05/06/83		H	112516	MR M91 MISS 101J MISSOURI SCOUT	PB	ROY W GRANGER PO BOX 1058 ALEXANDER, AL 35010	4	-4.2 .72	-10.1 .69	-3.5 .64	-4.9 .58	-9.9	-.1 .62	113.4 .63	107.3 .59
CJM	ALLAN 28K 01/05/78			3393	HEIJAK KATHI 112F	FB	XZ RANCH STAR ROUTE STANFORD, MT 59479	7	.4 .73	12.7 .73	13.5 .69	-2.8 .65	3.5	-.8 .69	100.4 .66	95.8 .65
KRR RED	ALUFFE KOURTNEY 534T 04/07/85		H	151961	101 ALUFE 14R FORSITE 247H	PB	STEPTOE GELBVIEH RR 1 BOX 8 HIGHMORE, SD 57345	5	-1.1 .73	5.6 .66	2.4 .57	6.9 .26	9.7	-1.0 .27	104.3 .48	111.1 .26
CRB RED	AMBASSADOR ET 12/05/84	•	H	135702	HARMON ZT LISSA E T BELGRAD 62837	FB	CUNNINGHAM CATTLE & DIEHL RANCHES 7511 WCR 110 CARR, CO 80612	4	1.0 .74	8.3 .73	1.6 .64	1.3 .50	5.4	4.8 .65	93.9 .61	94.3 .51
ECC	APOLLO 04/07/81			51034	IMEX ANTIGONE T3H GERONIMO	FB	CHARLES CLEMENT & SONS RR 1 BOX 7 HIGHMORE, SD 57345	13	2.2 .85	4.4 .84	5.5 .81	.9 .74	3.1	1.2 .86	97.8 .75	85.2 .74
TJD	APPLETON DODGER 1H 03/15/76	•		113688	SCOTTISH HORST APPLETON RETE HASS	FB	CUNNINGHAM CATTLE CO RT 1, BOX 298 BRIDGEPORT, NE 69336	13	-.2 .66	-5.6 .61	-16.0 .57	-1.7 .51	-4.5	1.2 .58	95.5 .54	99.7 .52
FDA	ARATA MAGNUM K888 12/15/78	•	H	49949	MINNESOTA MAGNUM MISS MAGNUM 762H MAGNUM	FB	GENETICS X/Y CHARTERED COLONY [WYO] RT ALZADA, MT 59311	6	-.4 .71	6.4 .65	5.6 .59	4.4 .54	7.6	.1 .55	103.1 .60	101.7 .55
DPR	ARMIN 01/29/83	•	H	64717	ADMIRAL MISS PURKEY MAGNET	PB	MIKRON RANCH ROUTE 5, BOX 152 MANHATTAN, KS 66502	4	3.7 .79	28.1 .76	26.6 .72	12.5 .67	26.5	-1.9 .68	99.6 .70	98.3 .68
GRF	ASPEN BOY S012 ET 04/21/84	•	H	134235	SPOTLIGHT MISS BELGRAD 201M BELGRAD 62837	FB	FASTENAU FARMS ROUTE 2 BOX 165 BERTRAND, NE 68927	1	-.4 .66	2.8 .65	3.2 .61	7.7 .52	9.1	-.4 .51	112.6 .54	118.9 .54
GRF	ASPEN LEADER ET 04/15/84	•	H	134232	SPOTLIGHT MISS BELGRAD 201M BELGRAD 62837	FB	GRAFF GELBVIEH 1136 ROBIN LANE OGALLALA, NE 69153	12	5.2 .78	31.6 .73	27.7 .66	8.4 .57	24.2	-.2 .64	94.8 .60	103.2 .59
AAA	BALDRIDGE DUDLEY 01/22/84	•		107044	DERWALL RESI 9740781 FLORI	FB	FASTENAU FARMS ROUTE 2 BOX 165 BERTRAND, NE 68927	26	3.8 .70	.2 .65	-1.8 .61	1.2 .56	1.3	-1.2 .62	87.6 .60	102.6 .57
AAA	BALDRIDGE DePAUL 03/11/84	•		106061	DERBY 70741 SEEROSE 6361003 HEILIG 62871	FB	EUGENE O. PERKINS 925 ARCTURUS DRIVE COLORADO SPRINGS, CO 80906	22	6.9 .79	-7.1 .77	-1.9 .74	2.9 .67				96.0 .68

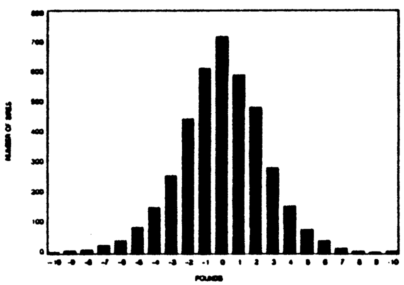
GELBVIEH



The EPD values for Gelbvieh bulls follow a normal distribution with the majority of the bulls falling into the average area of the range. Below are the EPD distributions, ranges and average EPD values of all bulls for each trait.

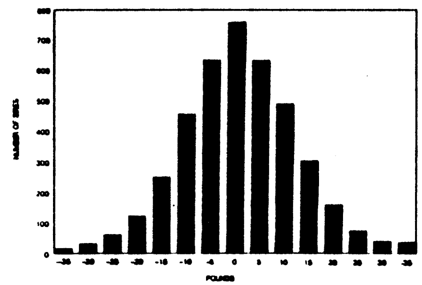
EPD RANGES

Birth Weight EPDs



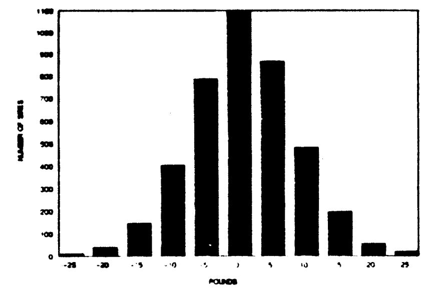
High: 16.0
Avg: .51
Low: -12.9

Weaning Weight EPDs



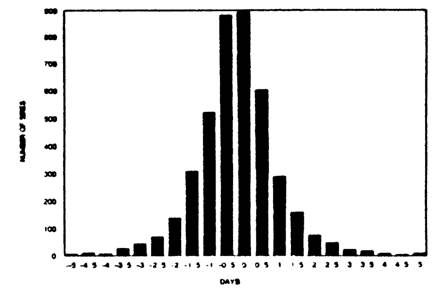
High: 58.4
Avg: 3.25
Low: -43.8

Total Maternal EPDs



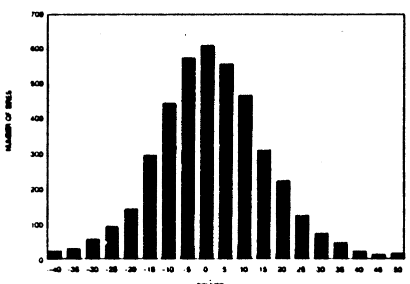
High: 37.7
Avg: 3.02
Low: -31.48

Gestation Length EPDs



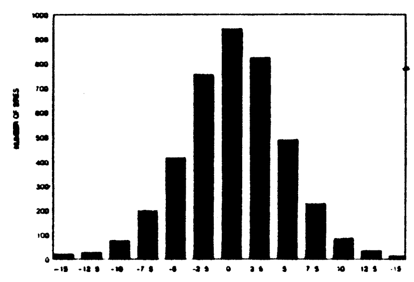
High: 8.4
Avg: .03
Low: -6.7

Yearling Weight EPDs



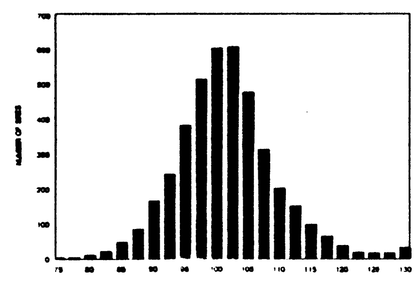
High: 61.0
Avg: 3.76
Low: -66.7

Milk EPDs



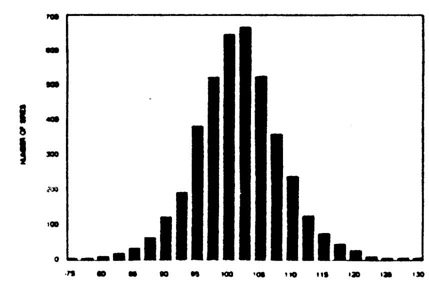
High: 18.3
Avg: 1.39
Low: -22.1

Calving Ease Direct EPDs



High: 148.3
Avg: 100.3
Low: 69.8

Daughters Calving Ease EPDs



High: 135.8
Avg: 100.2
Low: 64.6

ABC ENCORE 5094 3/10/85 18670948
S: GK ENCORE 609R
B: ADAMS BROS & CO KILGORE NEB
O: LAMAR MONROE & SONS SCIPIO UTAH

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
3	58	+5.3	.46	+40	.67	+68	.62	+1.1	.67	+0.3	.24	0	+6	+26	.15

ABC L1 DOMINO 0246 8/27/80 18055129
S: KB L1 DOMINO 7212
B: ADAMS BROS & CO KILGORE NEB
O: ADAMS BROS & CO KILGORE NEB
CK RANCH BROOKVILLE KAN
JACK VANIER BROOKVILLE KAN
STEVE HENDERSHOT GONZALES TEX

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
29	495	+6.5	.83	+29	.89	+42	.86	+1.1	.87	+0.4	.55	74	−3	+12	.77

ABC STAR MARK ET 3/01/83 18459747
S: STAR MARK DONALD ET
B: ADAMS BROS & CO KILGORE NEB
O: ADAMS BROS & CO KILGORE NEB

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
5	79	+2.8	.76	+24	.73	+20	.65	+0.5	.15	+0.1	.52	13	+1	+13	.50

ABC 150 ADVANCE 5118 3/17/85 18670913
S: SH ADVANCER 150 ET
B: ADAMS BROS & CO KILGORE NEB
O: DONALD H MELCHER PAGE NEB
JAMES MELCHER PAGE NEB
MELCHERS HEREFORDS INC PAGE NEB

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
1	228	+2.3	.78	+20	.82	+35	.63	+0.5	.70			0	+12	+22	.15

ADVANCED MARK ET 3/04/83 18449119
S: BLR C L1 DOMINO 5109
B: LONE STAR HEREFORD RANCH HENRIETTA TEX
O: GRASS VALLEY RANCH AUSTIN NEV
LONE STAR HEREFORD RANCH HENRIETTA TEX

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
2	83	+1.9	.13	+42	.70	+58	.63	+0.7	.66			0	+4	+25	.15

ADVANCE DOMINO 8152 2/15/78 17474612
S: HH ADVANCE A456
B: MADONNA INN SAN LUIS OBISPO CAL
O: MADONNA INN SAN LUIS OBISPO CAL

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
2	126	+2.7	.77	+27	.79	+33	.61					18	+11	+24	.55

ADVANCE L1 MARK 3002 1/04/83 18446446
S: L1 SPECIAL MARK ET
B: INDIAN MOUND RANCH CANADIAN TEX
O: HARVEY HEREFORD RANCHES CLOUDCROFT N M

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
2	149	+3.8	.82	+29	.80	+39	.74	+1.1	.78			30	+12	+26	.64

ADVANCER EXCEL 449H 4/09/84 18636694
S: ADVANCER K DOM 233
B: LAWRENCE E BARTEL MANCOS COLO
O: LAWRENCE E BARTEL MANCOS COLO

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
3	67	+5.3	.70	+46	.69	+67	.61	+0.1	.25	+0.6	.57	3	+9	+32	.29

AEP L1 SUN DANCER 5/07/78 17609601
S: L1 CL3 DOMINO 73197
B: EUGENE M PETERSON LIVINGSTON MONT
O: EUGENE M PETERSON LIVINGSTON MONT
BROOKS RANCH HARDIN MONT

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
1	110	+4.4	.80	+22	.79	+23	.75			+0.4	.53	29	+13	+24	.63

ALCO REAL PR 79063J 3/24/79 17744459
S: 3J REAL PR 19D 2
B: JENSEN BROS CIRCLE MONT
O: T E MITCHELL & SON INC ALBERT N M
DOOLITTLE RANCH WATROUS N M

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
3	208	−1.1	.85	+27	.83	+31	.77	+0.4	.82	+0.5	.52	28	+9	+22	.62

AR POWER PLAY 3/16/83 18489993
S: CH DOMINO 439
B: ALBERS HEREFORD RANCH HANNOVER N D
O: JARMAN HEREFORDS ELLENSBURG WASH
MID-AMERICA CATTLE CO LOLO MONT
ALBERS HEREFORD RANCH HANNOVER N D
CHURCHILL CATTLE CO MANHATTAN MONT

DISTRIBUTION HERDS	PROGENY	BIRTH EPD	ACC	WEANING WT. EPD	ACC	YEARLING WT. EPD	ACC	YEARLING HT. EPD	ACC	SCROTAL CIRC. EPD	ACC	MATERNAL DGT	MLK	TOTL	ACC
19	203	+3.0	.83	+25	.83	+41	.77	+0.8	.63	0.0	.58	33	+3	+15	.68

NONPARENT EPDS

CALVES BORN AFTER JULY 1, 1987

JUNE 1989 SUMMARY OF EPDs FOR ALL CALVES BORN AFTER JULY 1, 1987			
Trait	Number of Bulls	Average EPD	Range in EPDs
Birth Weight	33,382	+ 1.7 lb.	-5.7 to +11.5 lb.
Weaning Weight	52,224	+ 20 lb.	- 22 to + 66 lb.
Yearling Weight	25,754	+ 32 lb.	- 18 to + 90 lb.
Yearling Height	11,455	+ 0.4 in.	-0.7 to + 1.9 in.
Yr. Sc. Circumference	2,709	+ 0.1 cm.	-1.2 to + 1.4 cm.
Milk	46,999	+ 6 lb.	- 14 to + 29 lb.
Milk + Growth	46,999	+ 17 lb.	- 11 to + 43 lb.

JUNE 1989 PERCENTAGE BREAKDOWN FOR ALL CALVES BORN AFTER JULY 1, 1987						Maternal	
% of Animals	Birth Weight = to or less	Weaning Weight = to or more	Yearling Weight = to or more	Yearling Height = to or more	Yr. Scrt. Circum. = to or more	Milk = to or more	Milk+Growth = to or more
Upper 5%	-1.3 lb.	+35 lb.	+54 lb.	+1.0 in.	+0.7 cm.	+14 lb.	+28 lb.
10%	-0.6 lb.	+32 lb.	+49 lb.	+0.9 in.	+0.5 cm.	+12 lb.	+26 lb.
15%	-0.2 lb.	+29 lb.	+46 lb.	+0.8 in.	+0.5 cm.	+11 lb.	+24 lb.
20%	+0.2 lb.	+27 lb.	+43 lb.	+0.7 in.	+0.4 cm.	+10 lb.	+23 lb.
25%	+0.5 lb.	+26 lb.	+41 lb.	+0.7 in.	+0.3 cm.	+ 9 lb.	+22 lb.
30%	+0.7 lb.	+25 lb.	+38 lb.	+0.6 in.	+0.3 cm.	+ 9 lb.	+21 lb.
35%	+1.0 lb.	+23 lb.	+37 lb.	+0.6 in.	+0.2 cm.	+ 8 lb.	+20 lb.
40%	+1.2 lb.	+22 lb.	+35 lb.	+0.5 in.	+0.2 cm.	+ 8 lb.	+19 lb.
45%	+1.4 lb.	+21 lb.	+33 lb.	+0.5 in.	+0.1 cm.	+ 7 lb.	+18 lb.
50%	+1.7 lb.	+20 lb.	+32 lb.	+0.4 in.	+0.1 cm.	+ 7 lb.	+17 lb.
55%	+1.9 lb.	+19 lb.	+30 lb.	+0.4 in.	+0.1 cm.	+ 6 lb.	+17 lb.
60%	+2.1 lb.	+18 lb.	+29 lb.	+0.4 in.	0.0 cm.	+ 6 lb.	+16 lb.
65%	+2.4 lb.	+17 lb.	+27 lb.	+0.3 in.	0.0 cm.	+ 5 lb.	+15 lb.
70%	+2.6 lb.	+16 lb.	+25 lb.	+0.3 in.	-0.1 cm.	+ 5 lb.	+14 lb.
75%	+2.9 lb.	+14 lb.	+24 lb.	+0.2 in.	-0.1 cm.	+ 4 lb.	+13 lb.
80%	+3.3 lb.	+13 lb.	+22 lb.	+0.2 in.	-0.2 cm.	+ 3 lb.	+12 lb.
85%	+3.7 lb.	+11 lb.	+19 lb.	+0.1 in.	-0.2 cm.	+ 3 lb.	+12 lb.
90%	+4.2 lb.	+ 9 lb.	+16 lb.	0.0 in.	-0.3 cm.	+ 2 lb.	+11 lb.
95%	+5.0 lb.	+ 6 lb.	+12 lb.	-0.1 in.	-0.4 cm.	+ 1 lb.	+ 9 lb.

EPD SUMMARY

SIRE GENERAL LISTING

Registration #	Name/Owner	Birthdate	Sire/Maternal Grandsire	Birth Wt. EPD	Birth Wt. ACC (Herds)	Weaning Wt. EPD	Weaning Wt. ACC	Yearling Wt. EPD	Yearling Wt. ACC	Milking Ability EPD	Milking Ability ACC (# Dts. Rec.)
NPM-539359 F	**ABCB CASEY** SA CATTLE CO CLOVIS CA	4/22/86	**COLORADO 153** GIBRALTAR	-0.7	.57 (2)	1.5	.50	-1.0	.20	-3.4	.37 (0)
NPM-435212 P	**ABRAHAM SH H01P** JIM & JEANETTE CLEMMER GLENWOOD WA	4/01/82	**WS ROCKY 10K** EDMOND	-1.5	.66 (3)	3.0	.56	2.1	.22	-2.0	.37 (1)
CPM-13390 P	**ACH POLLED B/SIZZLER ACD** FLYING BOX LIMOUSIN BILLINGS MT	6/30/84	**WS CY 361M** GKF CANADIAN PACIFIC GKF3	-1.1	.82 (4)	-1.9	.70	3.7	.61	4.6	.37 (1)
NPM-514450 P	**ACLL POLLED ECLAIR 4T** ROSCO J GREEN SR HENDERSONVILLE NC	4/24/85	**ECLAIR** WS VISA 87J	1.4	.72 (3)	3.3	.57	3.3	.23	-1.9	.29 (0)
CFM-418 F	**ADAM SOONER 6F** SOONER ENTERPRISE MIAMI OK	3/04/74	**FANFARON** DAKOTA	0.0	.99 (111)	-4.5	.99	-7.2	.98	-3.8	.98 (168)
NPM-547762 P	**ADMM MR POLLED ENERGY** JACK TROGDEN/STEVE ZYBACH MT VERNON MO	4/24/85	**ENERGIZER** POLLED DESIGNER	1.1	.88 (7)	7.3	.81	11.0	.41	-5.6	.29 (0)
NPM-322078 F	**AFFIRMED 0263N** SIMMONS LIMOUSIN RANCH VERNON FL	1/18/81	**BOVENTURE FARFELU 913E** ECLAIR	1.3	.66 (1)	-11.6	.77	-4.8	.74	7.4	.62 (5)
NPM-488815 F	**AHSA DAKOTA SLICK 212S** REX COWLEY DECHERD TN	8/30/84	**SYBB DAKOTA SLICK** MASTER KEY FRISSON	-0.4	.76 (3)	-5.4	.59	-11.9	.24	-5.5	.37 (1)
NPM-539143 F	**ALADDIN FLINTLOCK** RUNNING CREEK RANCH ELIZABETH CO	9/01/85	**BILD DELTA 1346** RIVERBEND HONNEUR RBF 71H	0.2	.84 (1)	7.6	.83	15.6	.77	-6.1	.29 (0)
NPM-427693 F	**ALADDIN SHOTGUN** RUNNING CREEK RANCH ELIZABETH CO	4/22/83	**MR CLEAN** ASTUCIEUX	-0.2	.93 (1)	-2.1	.93	-3.6	.87	0.8	.76 (14)
NPM-564456 F	**ALADDIN TITAN** RUNNING CREEK RANCH ELIZABETH CO	8/18/85	**WRC PUNCH** GKF CANADIAN PACIFIC GKF3	0.1	.85 (1)	1.9	.82	1.4	.70	5.9	.29 (0)
NPM-349311 F	**ALADDIN'S COLT FORTY FIVE** DIETMAR A HABECK MINOT ND	2/13/82	**DEUX AMIS KLIMER** FRISSON	-2.5	.73 (3)	-1.3	.62	-8.6	.58	-3.7	.29 (0)
NPM-233457 F	**ALEX** JAMES AND JANICE CUMMINS PARIS KY	4/27/78	**2 HANCHON AV HAGADAL** FILOU	0.4	.93 (1)	4.7	.94	5.6	.55	-7.7	.87 (28)
NPM-533322 P	**ALHH MOHAWK 04T** LAVACA TRAIL RANCH COLLEYVILLE TX	12/06/85	**FZ POLLED HAWKEYE 33K** MR LCCO	-0.1	.63 (2)	7.6	.58	6.5	.52	2.6	.29 (0)
NPM-613192	**AMBL BILLIE BOY 142V** DON ROWLETT MC DUEL CA	4/01/87	**EARTHQUAKE 93** LOOKOUT BILLY JACK 200N	-0.7	.66 (6)	-2.5	.52	0.0	.21	-4.6	.29 (0)
NPM-614200 B	**AMBL BLACK EARTH** BEGERT/BLACKJACK ALLISON TX	4/07/87	**EARTHQUAKE 93** LOOKOUT BILLY JACK 200N	0.7	.55 (2)	4.1	.64	8.4	.26	-6.5	.29 (0)
NPM-614203	**AMBL EQUALIZER 219V** 6 D RANCH INC DELTA CO	4/07/87	**EARTHQUAKE 93** LOOKOUT BILLY JACK 200N	0.8	.74 (1)	4.5	.68	8.9	.28	-6.6	.29 (0)
NPM-612874 F	**AMBL SECRET AGENT 909V** 6 D RANCH INC DELTA CO	2/19/87	**TALENT** NELSON ACK 530N	2.0	.78 (4)	2.4	.63	5.1	.25	0.9	.29 (0)
AVERAGE EPD FOR CURRENT SIRES				**+0.46**		**+2.41**		**+4.32**		**+0.17**	

Table 2. 1991 EPD STATISTICS FOR CURRENT SIRES*

Trait	Number of Sires	Average EPD	Standard Deviation	EPD Range
Birth Weight	5764	+0.46	±1.18	- 7.1 to + 6.8
Weaning Weight	3533	+2.41	±5.78	-23.2 to +27.3
Yearling Weight	3533	+4.32	±8.86	-27.5 to +51.1
Milking Ability	3533	+0.17	±4.46	-20.7 to +20.8

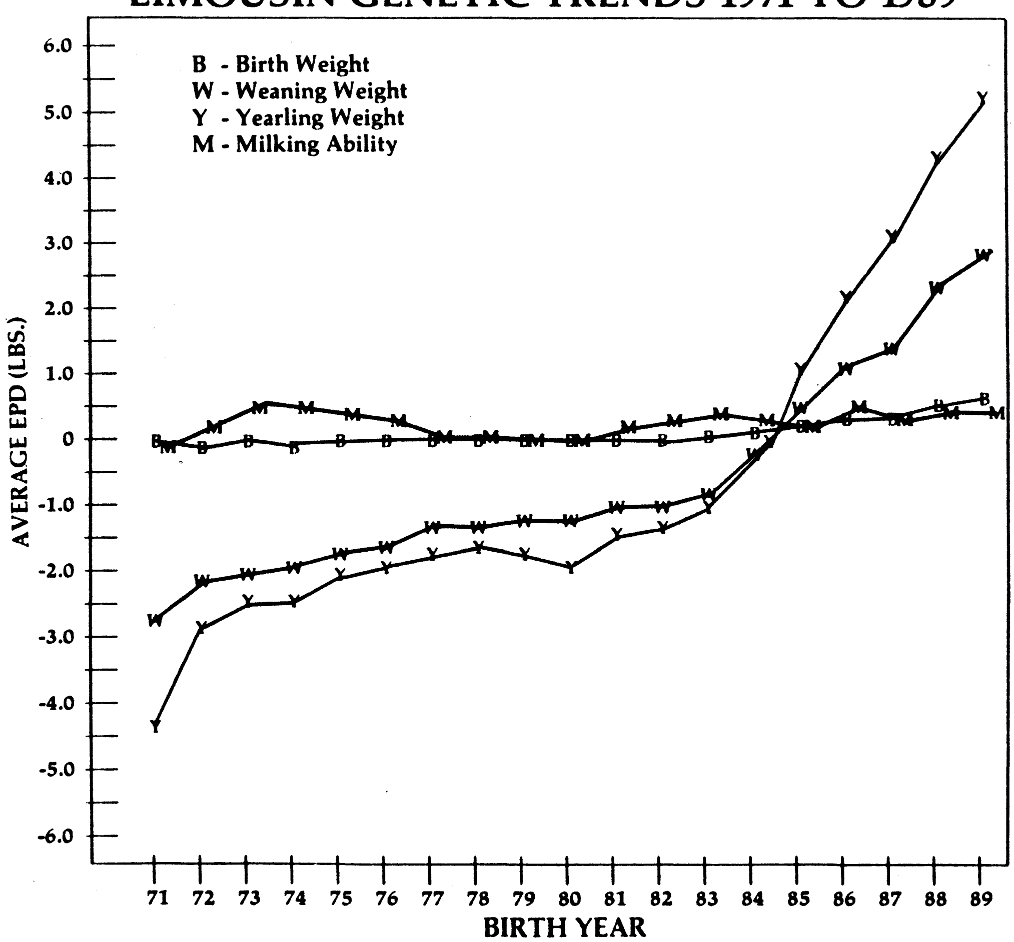
* Current sires are registered bulls that have produced at least one progeny reported in the 1989 or 1990 birth year.

Table 3. 1991 EPD STATISTICS FOR CURRENT DAMS*

Trait	Number of Dams	Average EPD	Standard Deviation	EPD Range
Birth Weight	49269	+0.14	±0.97	- 5.7 to + 5.2
Weaning Weight	34936	+0.36	±4.55	-22.1 to +23.0
Yearling Weight	34936	+0.94	±7.01	-25.8 to +37.4
Milking Ability	34936	+0.41	±4.35	-21.6 to +19.9

* Current dams are registered cows with at least one progeny reported in the 1989 or 1990 birth year.

LIMOUSIN GENETIC TRENDS 1971 TO 1989



Main List of Active Sires

12 O'CLOCK HIGH X22730864
7/3/82 **S:** ENFORCER 107H
B: HY BECKMAN & SONS R&D CO., ST LOUIS, MO
O: KEITHLEY HEREFORD FARMS, FRANKFORD, MO
ROTH HEREFORD FARM, TROY, MO
TRIPLE J FARMS, GLEN ALLEN, VA
THE 12 OCLOCK CLUB, GLEN ALLEN, VA

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 4.0	.86	+23.9	.84	+40.8	.71	+0.09	.44	+29.1	+17.1	.73

4E SIR ROCKY T33 X23035980
3/20/85 **S:** MSU ROCKY BANNER
B: FOREE POLLED HEREFORDS, EMINENCE, KY
O: L.W. PURCELL & SON, SOMERSET, KY

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 4.7	.71	+17.8	.63	+30.6	.50	–0.09	.28	+ 7.9	– 0.9	.25

5D&S POWERLINE U5 X23043920
2/15/86 **S:** PRL 347 DUELINE 729R
B: NORBERT DITTMER & SONS, LACONA, IA
O: NORBERT DITTMER & SONS, LACONA, IA

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
– 0.8	.76	+12.3	.67	+33.4	.44	+0.17	.23	+10.1	+ 3.9	.15

5E SF 4WF 38 SPECIAL X23152222 (G.T.)
3/5/87 **S:** TOP MSU KNIGHT RYDER
B: JULIE, JEFF & JAY D. EVANS, WINONA, MS
O: SKAGGS FARMS, HERNANDO, MS
FOUR WINDS FARM, BERLIN, CT
EE HEREFORD RANCH INC., WINONA, MS
JULIE, JEFF & JAY D. EVANS, WINONA, MS

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 8.0	.74	+39.2	.61	+58.6	.23			+10.1	– 9.4	.15

AA R TOP PRIORITY 398 X22794742 (G.T.)
7/16/83 **S:** BT BUTLER 452M
B: ANDREW DUNCAN, VEEDERSBURG, IN
O: PLUMLEY FARMS, PARIS, TN
OAK HILL FARM, PORTLAND, OR
PLEASANT VALLEY FARM, LAMBERTVILLE, NJ

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 4.6	.90	+25.3	.86	+38.1	.67	–0.38	.34	+19.8	+ 7.1	.72

AA THUNDERBOLT E24 X22952194
9/10/84 **S:** CIR R THUNDERBOLT 535N
B: ALLIE HALBERT ASKEW, SONORA, TX
O: GLEN & LINDA FISHER, SONORA, TX

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
		– 5.8	.60	– 4.0	.21			– 3.9	– 1.0	.15

ACE BEAU STICK 96P X22707362
4/4/82 **S:** STLBRK GILEAD 67K
B: ACE LAND & CATTLE COMPANY, SKIATOOK, OK
O: FRANCIS & JANICE MCDONALD, GARNETT, KS

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 1.1	PE	+ 8.3	.80	+12.5	.28			+ 0.8	– 3.2	.48

ACE MOHICAN BROKER 4U X23054574 (G.T.)
1/15/86 **S:** EMPIRES EQUALIZER 400R
B: ACE LAND & CATTLE CO., SKIATOOK, OK
O: SYNDICATED - CONTACT ACE LAND & CATTLE CO., SKIATOOK, OK

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 7.2	.92	+31.3	.88	+51.0	.73	+0.35	.55	+ 6.6	– 9.0	.15

ACE MOHICAN CENTAUR 147U X23078131
4/16/86 **S:** MKP GK BLASTOFF
B: ACE LAND & CATTLE COMPANY, SKIATOOK, OK
O: ACE LAND & CATTLE COMPANY, SKIATOOK, OK
MOHICAN POLLED HEREFORD FARMS, GLENMONT, OH
SLOCUM FARM INC., NEW HAVEN, MO
BIG T RANCH, ASHLAND, OH

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 5.2	.85	+24.8	.77	+51.7	.50	+0.01	.23	+14.0	+ 1.6	.15

ACE MOHICAN DIVIDEND 16U X23070808
1/22/86 **S:** EMPIRES EQUALIZER 400R
B: ACE LAND & CATTLE COMPANY, SKIATOOK, OK
O: ALVERNAZ POLLED HEREFORDS, WILLIAMS, CA

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 4.8	.76	+22.1	.64	+34.4	.22	+0.22	PE	+ 3.9	– 7.1	.15

ACE SOLID GOLD 237R X22831830
12/4/83 **S:** STERLING
B: ACE LAND & CATTLE COMPANY, SKIATOOK, OK
O: ACE LAND & CATTLE COMPANY, SKIATOOK, OK
MM HEREFORDS, NORTHBORO, IA

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 2.6	.72	+15.5	.77	+27.5	.25			+ 6.8	– 0.8	.58

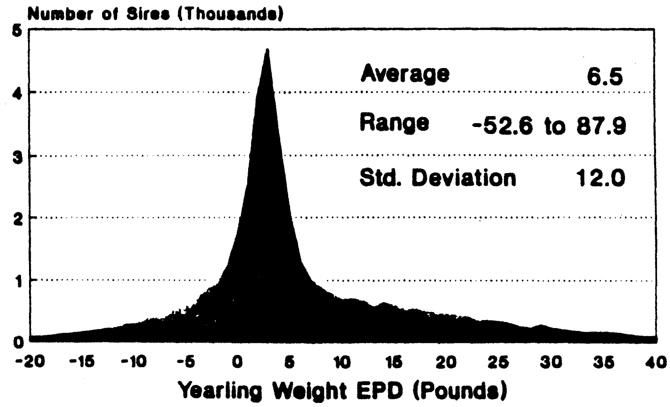
ACE VENTURE 68S X22867823
3/26/84 **S:** STLBRK GILEAD 67K
B: ACE LAND & CATTLE COMPANY, SKIATOOK, OK
O: CLYDE AUDAS, WALDRON, AR
GARY B. ASHFORD, WALDRON, AR
WALKER POLLED HEREFORD FARM, MORRISON, TN
BLUEBERRY HILL FARMS, NORFOLK, NE

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Scrotal Circum. EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
– 0.6	.71	+15.0	.63	+25.5	.42	–0.29	.26	+14.3	+ 6.8	.29

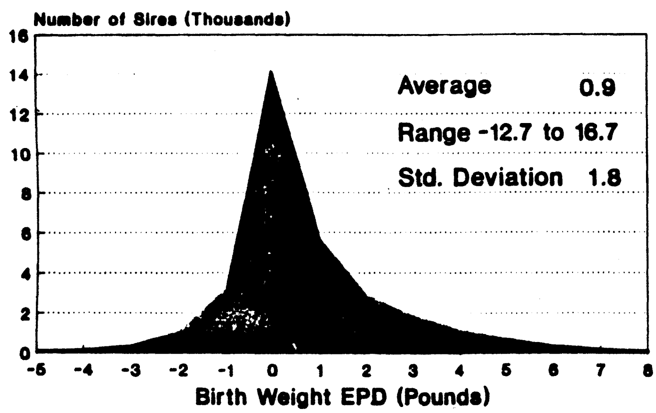
Distribution of EPDs

EPDs provide for the comparison of individual bulls, but can also be used to determine how a bull ranks within a given population. Distribution graphs are provided below for all Polled Hereford sires. These graphs may be used to evaluate the total genetic variation in the Polled Hereford breed, as well as indicate where individual bulls rank in the population. Printed in the upper right hand corner of each graph are the average, range and standard deviation for that trait.

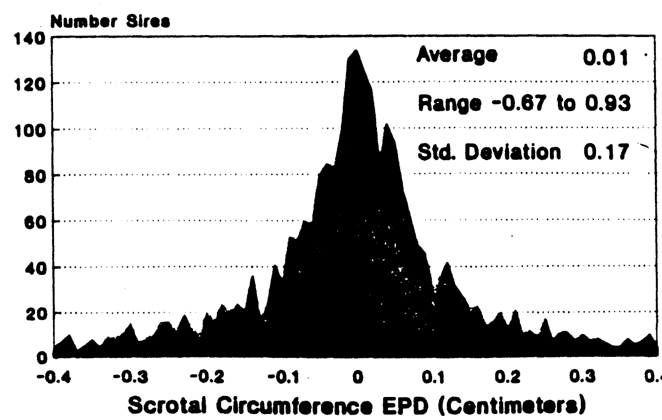
Yearling Weight Distribution
All Sires (N= 42,547)



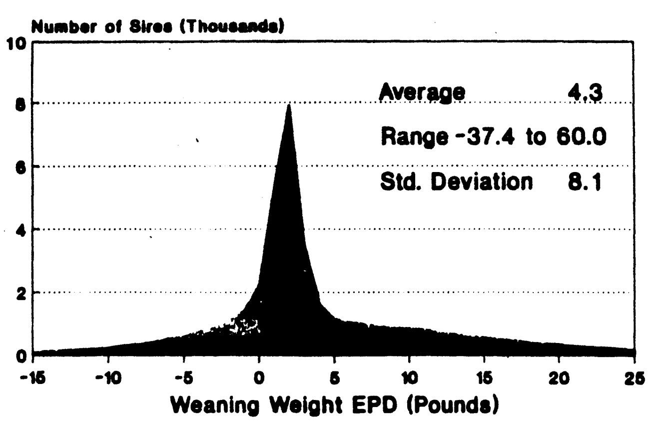
Birth Weight Distribution
All Sires (N= 32,157)



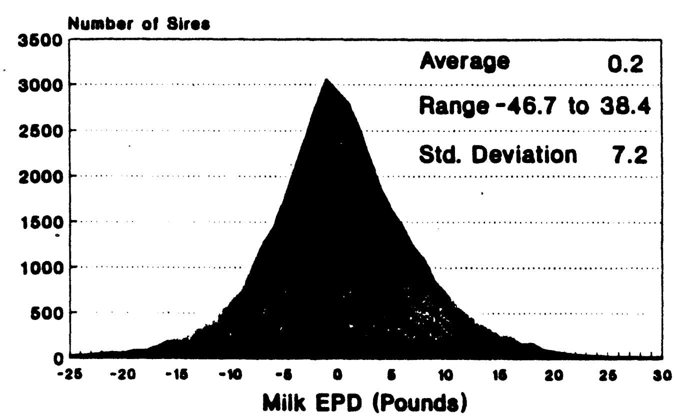
Scrotal Circumference Distribution
All Sires (N= 2,614)



Weaning Weight Distribution
All Sires (N= 42,547)



Milk Distribution
All Sires (N= 42,547)



SIRE-EVALUATION OF PROVEN ACTIVE SIRES

ANIMAL NAME SIRE PATERNAL SIRE	OWNER/STATE		REG. NO.	BIRTH DATE	DISTRIBUTION		BIRTH WT		WEAN WT		YRLG WT		MATERNAL			
					GRPS	PROG	EPD	ACC	EPD	ACC	EPD	ACC	DTRS	MILK EPD	TOTAL EPD	
03 BIEN MUR CPR ROYAL 3006 CPR ROYAL 034	LORENZ, GUS	AR	88371	05/04/77	32	94	-1.6	.66	-.3	.60	-.6	.51	6	4.8	4.7	
116 PANHANDLER 480 MUE DYNAMO BP 116 BELLE POINT DYNAMO	PIEPER, MARK & DEB	NE	171134	04/14/84	9	38	5.9	.65	20.3	.62	35.4	.59	0	5.3	15.4	
12145 JAY• FRANKIE A 45 RC LBL J121X	GOODMAN, MR & MRS E T	TX	93726	01/04/78	29	80	.5	.65	7.0	.70	7.0	.66	22	-.1	3.4	.63
651-27M VRR RED QUANTOCK 27M UMPIRE 1000	COLE, J W	CO	159930	03/15/83	14	136	-1.3	.79	6.9	.78	11.4	.73	31	9.7	13.1	.69
741 PANHANDLER 189 PANHANDLER 741 PBC D0202 6M F0895	GILCHRIST & SON, KEN MUELLER RED ANGUS FM PANHANDLE CATTLE CO	IA NE NE	137013	08/04/81	20	115	6.0	.78	32.2	.76	57.8	.73	14	8.4	24.5	.60
741 PANHANDLER 240 PANHANDLER 741 PBC D0202 6M F0895	PANHANDLE CATTLE CO	NE	140393	04/05/82	15	60	5.7	.71	18.6	.68	21.2	.64	7	3.0	12.3	.48
741 PANHANDLER 248 PANHANDLER 741 PBC D0202 6M F0895	PANHANDLE CATTLE CO	NE	140381	04/09/82	19	131	3.3	.80	33.8	.78	37.1	.74	19	.3	17.2	.63
81 CWA 956-605 LEACHMAN CHINOOK 605 ANKONIAN DYNAMO	BYERS, LORRAYNE C	NM	135572	02/05/81	13	81	6.5	.74	18.2	.73	33.5	.71	18	5.3	14.4	.63
860 PANHANDLER 124• PANHANDLER 4860 PBC D0202 6M F0895	BOURDON, MARY M BOURDON, RICHARD M	WY CO	128629	04/08/81	23	100	3.7	.80	31.9	.78	26.1	.77	34	4.9	20.8	.72
AHE JAY 871 835 ESS TSGPRIDE JUAN871 ESS TGPD LD 809	GLO-MAR RED ANGUS FM	MS	129007	11/16/80	28	76	.3	.71	9.5	.69	11.0	.66	14	12.1	16.8	.57
AHE PATRIOT 1776 CV THUNDERBOLT SAYRE PATRIOT	ANGEL, R L ENFINGER, ALVIN H	GA FL	176734	11/25/84	19	78	3.9	.70	26.6	.66	36.6	.62	0	10.2	23.5	.25
AHE TUSGAPRIDE 176 AHE TUSGAPRIDE 794 ESS TSGPRIDE JUAN871	HILLIARD RED ANGUS	GA	159718	05/11/83	11	96	-.2	.70	10.6	.65	12.0	.56	8	5.2	10.5	.46
AHE UMPIRE 700 UMPIRE 1000 ANKONIAN DYNAMO	NEO-SHO FARMS MCLEAN RANCHES ENFINGER, ALVIN H	MO MO FL	123114	10/17/79	54	235	1.0	.84	4.8	.82	7.8	.79	42	6.3	8.7	.74
AHM 3511• LEACHMAN CHINOOK1421 LEACHMAN CHINOOK 605	HAECKEL, GERALD B	VA	131387	04/02/81	16	78	-.5	.72	2.3	.68	1.5	.63	16	4.0	5.1	.58
ALALTA ACRES THOR 9S RED PINEMEADOW FITZUM7P RED QUANTOCK 27M	BRADBURY CATTLE COMP ALLEN, FRED & DOREEN THE RED DIMENSION	CO CN MT	168336	02/20/84	18	138	-2.9	.78	30.9	.76	39.3	.73	10	2.8	18.2	.48
ANGIN GLNA 17 913 BPD GALENA 17 MD GALENA 162 RC 584	SELECT SIRES INC	OH	114100	04/01/79	28	43	1.0	.64	1.1	.63	10.2	.59	11	6.5	7.0	.53
BAYOU MINER 414• JHL DYNAMO 327 ANKONIAN DYNAMO	WAGNER, M D & M J	CO	166499	02/02/84	11	24	.8	.63	9.9	.61	21.1	.58	9	3.9	8.8	.49
BB 1385 TAW 3085• BB 100TAW 1385 KEE 373 TAW 100	RANDOL REDS	OK	117690	04/16/80	19	57	.7	.70	13.9	.69	-7.8	.64	18	11.8	18.7	.60
BB 1995 BBRED 5040 BB 1369 SALEE 1995 BB CHOCJULS SLEE1369	BEEBY, ROY G	OK	137292	10/14/81	17	133	-.4	.74	19.1	.75	12.4	.70	13	6.1	15.6	.58
BB L902 BBRED 5236 LUN CHEROKEE CHF 902 PRF CHIEFTON 7309	BEEBY, ROY G	OK	152077	03/13/83	9	56	5.4	.72	30.5	.71	62.3	.68	19	8.4	23.6	.62

* Category I-B † Category II • Dead

1990 EPD AVERAGES AND RANGES

TRAITS	EPD AVERAGES	EPD RANGE	
Birth Weight	1.1	− 8.4	+ 11.5
Weaning Weight	17.4	− 29.9	+ 57.3
Yearling Weight	27.8	− 31.5	+ 82.3
Milk	5.2	− 18.5	+ 25.0
Total Maternal	13.9	− 19.3	+ 44.1

The EPD Averages and Ranges listed above are only for the 688 sires listed in the 1990 Sire Evaluation. All EPD information from trait leaders, proven sires, and genetic opportunity sires have been used to calculate these averages.

AC P-EARLESS 01P 000677
1/4/82 FULLBLOOD HORNED
S: PACHA
B: AC RANCHES, TEES, ALTA.
O: MONTY EWING & SONS, NEZPERCE, ID

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
− 0.3	.68	− 11.3	.69	− 16.3	.68	− 14.1	− 8.5	.62

ARCHER 000811
3/12/82 FULLBLOOD HORNED
S: GSR JAVELIN 4J
B: NICHOLS FARMS, BRIDGEWATER, IA
O: NICHOLS FARMS, BRIDGEWATER, IA

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
− 2.0	.81	− 20.8	.84	− 18.8	.84	− 14.8	− 4.4	.73

BANKER T007956
6/19/81 FULLBLOOD RED HORNED
S: MR PRESIDENT
B: SALERS CATTLE BREEDERS, BLEIBLERVILLE, TX
O: C M BERGLEE, BROCKTON, MT
CIRCLE DIAMOND SALERS, ARNEGARD, ND
EARL & RILLA SEMMEL, FORGAN, OK

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
− 2.4	.61	− 5.5	.61	− 8.4	.61	− 3.9	− 1.1	.49

BANNER 000758
7/2/77 FULLBLOOD HORNED
S: LIBAN
B: COMO RANCHES, LOWRY CITY, MO
O: SHADY RIDGE STOCK FARM, RED DEER, ALTA.
SCATTERED OAKS RANCH, BLEIBLERVILLE, TX
RANDALL INC-969 RANCH, BROADUS, MT
BANNER SYNDICATE, RED DEER, ALTA.

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 1.8	.82	+ 11.8	.82	+ 21.8	.82	+ 13.1	+ 7.1	.78

BDF LORD ROY 3N 013541
3/21/81 PUREBRED HORNED
S: TV LORD ROI
B: TURNER VALLEY RANCH, TURNER VALLEY, ALTA.
O: BOKE RANCH, SPEARFISH, SD

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 3.0	.53	+ 17.1	.60	+ 17.6	.59	+ 8.6	0.0	.03

BDF MR JAY 7R 105741
3/19/83 PUREBRED HORNED
S: JAY
B: SPRING HILL SALERS, EDGERTON, ALTA.
O: BOKE RANCH, SPEARFISH, SD

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
− 2.5	.55	− 34.5	.61	− 35.8	.61	− 23.5	− 6.3	.13

BIG DUKE 231R 000881
3/27/83 FULLBLOOD RED HORNED
S: MR. BLUE GRASS
B: SALERS CATTLE BREEDERS, BLEIBLERVILLE, TX
O: DAVIDSON BROS, BONESTEEL, SD

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
− 1.1	.61	+ 0.5	.64	− 4.0	.63	− 1.8	− 2.1	.43

BIG JIM 000009
1/3/74 FULLBLOOD RED HORNED
S: VOLTIGEUR
B: PIERRE GINESTE, CONRACLOUPIAC, FRANCE
O: TURNER VALLEY RANCH, TURNER VALLEY, ALTA.

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 1.5	.78	+ 0.9	.78	+ 4.5	.78	− 0.3	− 0.7	.78

BJC CRACKER JACK 30P 000907
6/22/82 FULLBLOOD HORNED
S: KARDINAL
B: BLACK JACK CATTLE CO LTD, COCHRANE, ALTA.
O: QUARTER CIRCLE J SALERS, ALAMOSA, CO

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
− 1.2	.75	− 4.0	.79	− 4.1	.79	+ 8.3	+ 10.3	.55

BJC MOJACK 6M 100717
3/28/80 FULLBLOOD HORNED
S: KARDINAL
B: BLACK JACK CATTLE CO LTD, COCHRANE, ALTA.
O: TOM SUNDERLAND, MEDICINE HAT, ALTA.

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
− 0.7	.60	− 6.1	.60	− 8.1	.60	− 2.7	+ 0.4	.61

BJC POKER JACK 10P 011829
3/29/82 PUREBRED HORNED
S: KARDINAL
B: BLACK JACK CATTLE CO LTD, COCHRANE, ALTA.
O: RONALD LEWIS & SONS, GOVE, KS

Birth Weight EPD	ACC	Weaning Weight EPD	ACC	Yearling Weight EPD	ACC	Maternal Wean. Wt. EPD	Maternal Milk EPD	ACC
+ 0.9	.59	+ 12.1	.60	+ 10.2	.60	+ 4.7	− 1.3	.48

TABLE 1

PERCENTILE BREAKDOWN OF EPD's FOR SIRES IN MAIN LIST

Percent of Sires	Birth Weight	Weaning Weight	Yearling Weight	Maternal Wean Wt.	Maternal Milk
5%	−2.9	+16.0	+23.5	+14.2	+12.4
10%	−2.1	+12.4	+18.4	+11.2	+9.3
15%	−1.9	+9.8	+15.1	+8.4	+7.5
20%	−1.4	+8.3	+9.8	+6.5	+5.5
25%	−1.1	+6.5	+7.2	+5.0	+3.0
30%	−0.7	+5.4	+5.5	+3.8	+2.8
35%	−0.5	+4.1	+4.3	+2.9	+1.8
40%	−0.3	+3.0	+2.6	+1.9	+0.9
45%	−0.1	+2.0	+2.2	+0.9	+0.4
50%	0.0	+0.9	−1.5	−0.1	−0.2
55%	+0.4	+0.1	−2.9	−1.2	−0.8
60%	+0.5	−1.8	−3.7	−2.7	−1.6
65%	+0.8	−4.0	−5.0	−3.3	−2.3
70%	+1.1	−4.7	−6.4	−4.0	−3.8
75%	+1.5	−6.4	−8.8	−5.8	−4.8
80%	+1.7	−8.8	−11.6	−7.0	−5.7
85%	+2.1	−10.9	−13.1	−9.6	−7.2
90%	+2.5	−12.6	−16.3	−11.9	−10.1
95%	+3.1	−16.6	−22.4	−15.9	−13.3
Avg. EPD	0.2	0.0	−0.1	−0.4	−0.4
EPD Range	−4.7 to +5.8	−34.5 to +32.7	−40.6 to +60.8	−25.6 to +29.7	−26.3 to +24.6

As an example of how to use percentile table, consider a listed sire with the following EPD's birth weight −.5 lbs., weaning weight +5.0 lbs., yearling weight +15.0 lbs., maternal milk +4.2 lbs., and maternal weaning weight +6.7 lbs. By referring to the table it can be determined he ranks in the upper 35% for birth weight, upper 35% for weaning weaning weight, upper 20% for yearling weight, upper 25% for daughter's milk, and upper 20% for daughter's weaning weight amongst listed sires.

TABLE 2

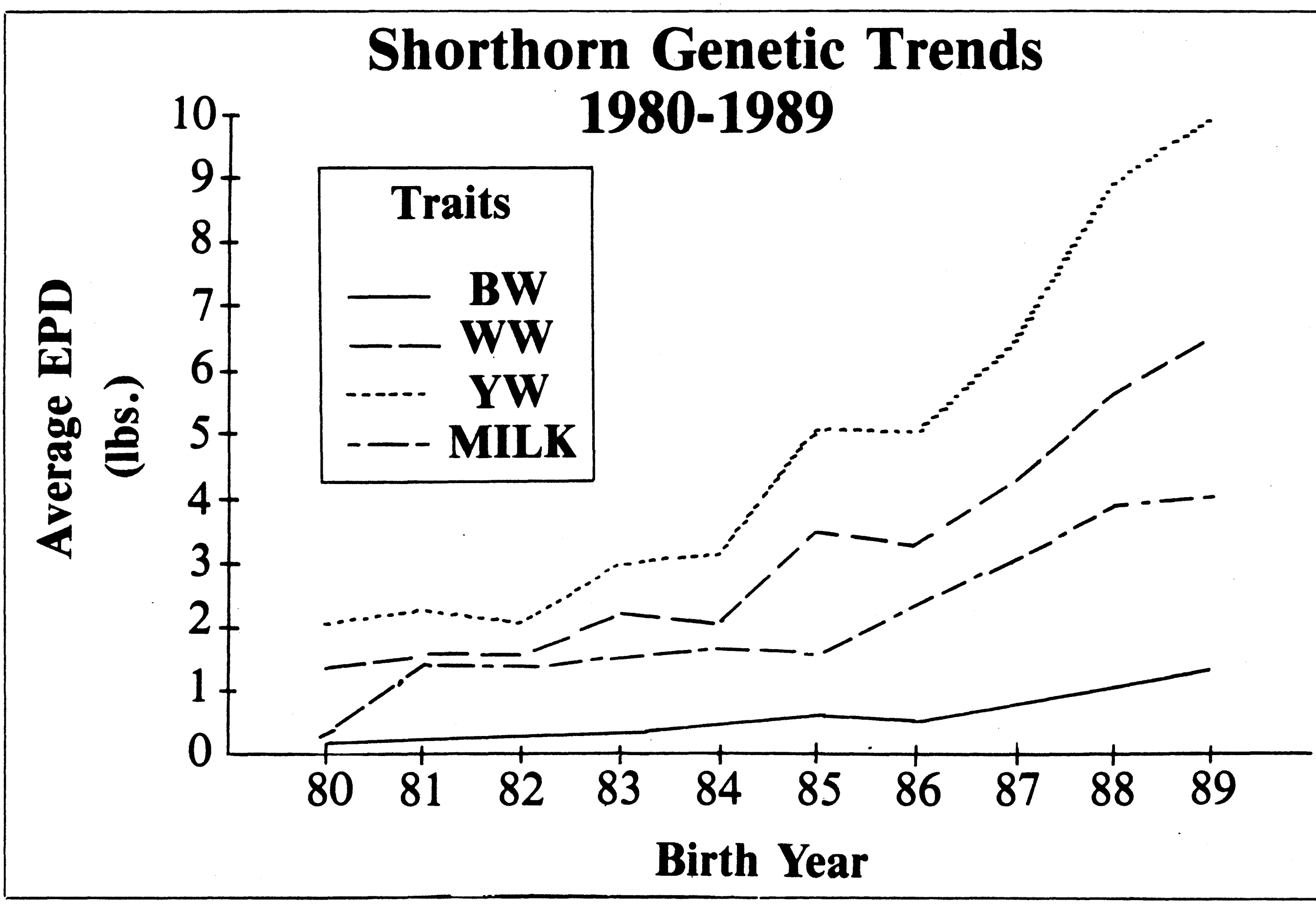
PERCENTILE BREAKDOWN OFEPD's FOR SIRES IN GENETIC INDICATOR SUPPLEMENT

Percent of Sires	Birth Weight	Weaning Weight	Yearling Weight	Maternal Wean Wt.	Maternal Milk
5%	−2.4	+16.6	+20.4	+15.3	+11.3
10%	−1.8	+13.0	+15.6	+12.3	+8.6
15%	−1.3	+10.6	+13.1	+10.1	+7.7
20%	−1.0	+8.0	+10.7	+8.5	+6.2
25%	−0.7	+7.0	+7.3	+7.3	+5.2
30%	−0.6	+5.3	+5.1	+5.8	+4.5
35%	−0.4	+3.9	+3.2	+4.4	+3.6
40%	−0.2	+2.1	+2.0	+3.1	+3.1
45%	0.0	+1.1	+0.4	+2.1	+2.0
50%	+0.1	+0.2	−1.3	+1.4	+1.3
55%	+0.2	−1.4	−2.6	+0.5	+0.5
60%	+0.4	−2.6	−3.6	−1.0	−0.3
65%	+0.6	−3.5	−4.7	−2.1	−1.2
70%	+0.7	−4.8	−6.5	−2.7	−2.2
75%	+0.9	−6.3	−7.8	−3.8	−2.6
80%	+1.3	−7.6	−9.5	−5.2	−3.2
85%	+1.6	−9.2	−11.4	−6.1	−4.7
90%	+2.2	−11.4	−15.6	−7.5	−5.6
95%	+2.8	−15.9	−21.0	−12.8	−8.5
Avg. EPD	0.2	0.4	−0.3	1.5	1.3
EPD Range	−6.4 to +6.9	−29.6 to +32.3	−50.4 to +40.9	−22.8 to +24.2	−14.9 to +16.2

Sire's Name Registration Number Birthdate	Bull's Sire Maternal Grandsire	Breeder's Name Owners	Progeny Herds	Birth Weight EPD ACC	Weaning Weight EPD ACC	Yearling Weight EPD ACC	Maternal Milk EPD ACC	Maternal Total EPD	DTGs
AF Deerpark Dividend 79 3705-885 3-20-79	S: Deerpark Leader 13th MG: Salterstown Pirate	B: George Alden O: George Alden Ronald Gooch 7M Polled Shorthorns	48 10	+2.0 .64	+6.4 .73	+9.2 .36	−5.9 .61	−2.7	23
AF Dividend 82 3743-780 1-19-82	S: Deerpark Leader 13th MG: Salterstown Pirate	B: George Alden O: Gordon Brockmueller	22 1	— —	+7.0 .63	— —	−5.0 .50	−1.5	13
AF Dividend's Impact 3723-191 3-2-81	S: Deerpark Leader 13th MG: Hub's Impact Two	B: Green Ridge Shorthorns O: Schrag Shorthorn Farms George Alden	386 22	+2.3 .87	+17.3 .88	+32.4★ .82	+2.9 .78	+11.5	99
AF Dividend's Robin 2nd 3703-846 1-4-80	S: Deerpark Leader 13th MG: Foxdale Favorite Robin	B: Ronald Irving Alden O: John W. Murray	108 4	+1.7 .76	+11.9 .81	+12.9 .51	+4.4 .69	+10.4	46
AF Improver 032 x3712-547 5-12-80	S: Deerpark Improver MG: Gallant Leader	B: Robert & Ronald Alden O: Walter J. Hoyt & Sons	75 1	+1.0 .70	+7.7 .75	+4.4 .44	+3.6 .52	+7.4	18
AF Improver 145 3734-858 5-11-81	S: Deerpark Improver MG: Salterstown Pirate	B: George Alden O: Mantua Farms Thomas Creek Shorthorns	43 2	+6.0 .75	−3.9 .76	−18.7 .64	+22.2★ .65	+20.2	37
AF Majestic Dividend 3727-250 10-6-80	S: Deerpark Leader 13th MG: Shannon Magnificent	B: George Robert Alden O: Walter J. Hoyt & Sons	30 1	+1.5 .59	+16.4 .69	— —	+2.1 .56	+10.2	24
AF Mountain Man 673 ET 3808-704 4-28-86	S: AF Mr. Prudential MG: Duke of Swisher	B: Alden Farms O: Alden Farms Cedar Curve Farms Brockmueller Shorthorns	19 1	+5.2 .51	+11.7 .51	— —	— —	—	—
AF Mr. Prudential 3765-085 1-9-83	S: AF Dividend's Impact MG: Tops 66 Casul's Model	B: George Alden O: M&H Cattle Company	199 17	+3.5 .84	+14.0 .85	+25.4★ .67	+1.1 .73	+8.1	53
AF Paramont 3776-038 9-5-83	S: Deerpark Leader 13th MG: Deerpark Improver	B: George Alden O: George Alden Robert & Jay Benham	53 6	+0.6 .55	+10.7 .67	+11.6 .35	+8.2 .35	+13.6	4
AF Printer 460 x3778-592 6-2-84	S: Mill Brook Printer 105 MG: Deerpark Improver	B: George Robert Alden O: Schrag Shorthorn Farms	44 1	−2.3★ .66	−5.0 .66	−8.7 .51	+9.9 .41	+7.4	8
AF Printer 519 ET x3793-136 1-22-85	S: Mill Brook Printer 105 MG: Salterstown Pirate	B: George Alden O: American Beef Genetics Mantua Farms George Alden	36 2	+3.1 .63	+10.6 .63	+26.2 .39	+9.0 .35	+14.3	6
AF Triple Play *3765-084 2-22-83	S: Deerpark Leader 16th MG: Deerpark Improver	B: George Alden O: George Alden & Sons Larry Kohlstaedt	43 6	+1.8 .61	+12.7 .62	+14.3 .37	— —	—	—
Abraham x3587-118-m 2-20-75	S: Columbus MG: Adam	B: Graham Land & Livestock O: Roger Steiger Dean Steck	28 4	−0.3 .66	−4.3 .66	−3.4 .42	+10.3 .52	+8.2	18
Alexander S3 ET *x3777-417 2-5-84	S: Ayatollah MG: Dividend's Image 76	B: Hugh and Carolyn Hoelzen O: Need and Family	56 15	+2.2 .66	+8.8 .67	— —	— —	—	—
Armageddon Trudeau 3640-694 1-2-77	S: Pomona MG: Tyler Farm's Sirloin 2nd	B: Nystuen Bros. O: Rolling Hills Shorthorns Lazy D/Richard H. Dolginow	5 3	−1.1 .45	+2.4 .54	— —	+15.0 .43	+16.2	11
Ar Su Lu Caesar x3700-277 5-2-78	S: Deerpark Leader 13th MG: Ball Dee Perfect Count	B: Arthur Bakenhus & Sons O: Arthur Bakenhus & Sons	41 1	+0.6 .66	+7.2 .73	+12.3★ .62	−0.2 .60	+3.4	26
Ar Su Lu Marksman x3780-610 3-3-84	S: Ar Su Lu Caesar MG: Deerpark Improver	B: Arthur Bakenhus & Sons O: Arthur Bakenhus & Sons	23 1	−2.0 .59	+6.9 .58	+4.2 .49	+3.1 .35	+6.6	5
Ar Su Lu Pipeline *x3797-633 5-15-85	S: Ayatollah MG: WO Deerpark Improver 28J	B: Arthur Bakenhus & Sons O: Arthur Bakenhus & Sons	41 1	+0.2 .63	+17.6★ .63	+31.2 .48	— —	—	—
Ayatollah *AR2336 11-7-79	S: Viking Valley Chief MG: Lago's Cache Winner	B: John Haugen O: Graham Land & Livestock	216 63	+1.0 .86	+16.5 .87	+44.9★ .74	+23.2★ .79	+31.4	91
Ayatollah High Rise *3793-259 3-23-85	S: Ayatollah MG: Hub's Western Prince	B: Scott's Shorthorn Farms O: Scott's Shorthorn Farms	37 1	— —	+9.0 .61	— —	— —	—	—
B 139 Jess 79 x3694-331 4-5-79	S: Mill Brook Ransom 139 MG: MC White Jester	B: Berg's Shorthorns O: Walter J. Hoyt & Sons	84 1	+1.6 .73	+4.6 .79	+6.4 .54	−3.3 .66	−1.1	43
B Golden Boy 81L x3735-168 7-4-81	S: Highfield Leader 78th MG: Weston Iron Horse	B: Berg's Shorthorns O: Jim & Alene McCollum	60 3	−1.2 .61	+4.2 .68	+5.2 .41	+8.1 .42	+10.2	5

EPD Means And Ranges For All Sires (1990)

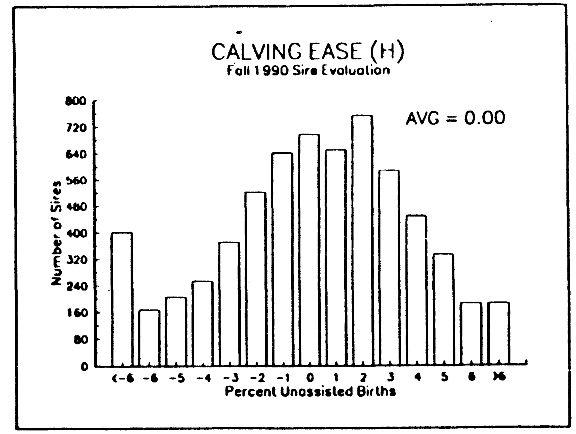
	Birth	Weaning	Yearling	Milk
Average EPD	+0.8	+3.6	+5.9	+3.2
High EPD	+6.7	+45.2	+57.9	+42.2
Low EPD	-4.7	-20.1	-27.8	-21.1
Number of Sires	907	1082	1082	1082

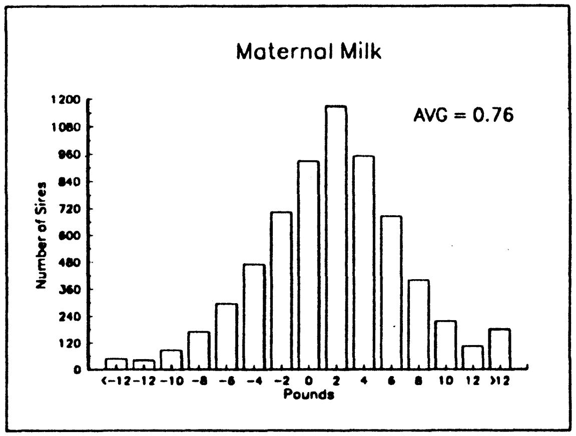


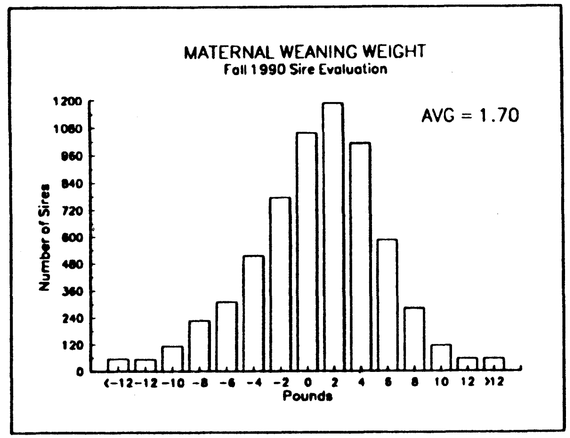
H P S	Name of Bull / Bull's Sire/Dam's Sire · Currently Registered to	Country	Bloodtype Status	ASA Number	Birthdate M-D-Y	Calving Ease Heifer EPD / ACC	Calving Ease Cow EPD / ACC	Birth Wt. EPD / ACC	Weaning Wt. EPD / ACC	Yearling Wt. EPD / ACC	Mat. Calv. Ease Heifer EPD / ACC	Mat. Calv. Ease Cow EPD / ACC	Maternal Weaning EPD / ACC	Maternal Milk EPD / ACC
P †	**7 W132 EAGLE**			1277893	03-30-87	2.2	.7	-2.9	-2.8	4.3	3.1	.9	-.9	.5
	EAGLE / ABR SIR ARNOLD G809 · WAYNE E & DONNA B MORIN, HEREFORD, OR					17	17	.37	.29	27	17	.17	19	18
P	**0618S**			1027600	04-10-84	-.3	.0	2.0	3.4	16.6	2.9	.8	3.9	2.2
	SWITZ POL BIG BUD / ALPINE POLLED CHALLENGER · ROBERT & MONICA DOYLE, MN					18	.18	.43	.41	.36	.18	.18	.23	.21
P †	**07U**			1180289	02-26-86	-.2	.0	2.0	5.3	5.8	3.8	1.0	3.1	.5
	PATTERN'S DESIGN 137M / SIGNAL · MACKLEY SIMMENTALS, ARNOLD, NE					18	18	49	43	.41	.17	17	20	19
P †	**10 KARET**			1003410	04-11-84	.6	.2	-1.1	-6.5	6.7	3.1	.9	3.3	6.5
	GENERATION III / SIGNAL · WOODBOURNE FARM INC, WARRENTON, VA					.17	.17	.43	.38	.37	.17	.17	.21	.20
P †	**108U**			1180301	04-21-86	-.3	.0	.7	24.0	43.5	3.7	1.0	1.7	-10.3
	RBR PAPILLON / SIGNAL · MACKLEY SIMMENTALS, ARNOLD, NE					19	19	57	50	48	.17	.17	21	20
H	**1516 SHEPBU 382P**			830741	03-31-82	1.5	.5	-1.6	1.9	6.9	1.7	.5	2.9	1.9
	ABRICOT / SIEGFRIED · FINNEY CATTLE COMPANY, SENECA, NE					.18	.18	.33	.42	.36	.17	.17	.24	.23
H	**1516 SHEPBU 630R**			924738	04-22-83	-10.0	-3.2	7.7	22.3	46.7	8.2	2.0	5.7	-5.4
	SIGNAL / SIEGFRIED · LOVELL RANCH, FRANKLIN, NE					19	19	.62	55	49	19	19	24	24
H	**166U**			1127750	03-15-86	-4.0	-1.1	2.1	1.7	4.8	1.4	.4	2.2	1.4
	DUDE / MR SBL GALANT 61K · HABETS LAND & LIVESTOCK, CONRAD, MT					15	15	.43	.31	.29	.14	.14	.17	.16
H	**170W**	FGN ANC		1269253	03-07-87	3.9	1.1	-1.6	-4.8	2.7	1.1	.3	1.8	4.2
	SWITZ POL BIG BUD / ABR SIR ARNOLD G809 · WEBB SIMMENTALS, MOVILLE, IA					17	17	36	.28	26	17	17	.18	.18
	199P	FGN ANC		899241	11-25-82	-1.1	-.2	3.3	-2.8	-2.1	-1.1	-.3	-.9	.5
	TRIPLE C'S GALANT / EXTRA · BAR HL RANCH, CUERO, TX					.11	.11	50	.43	.36	.11	.11	.20	.18
	21 BENIGN JASPERS PAL			874695	01-03-82	2.0	.6	-2.8	-3.2	1.7	.1	.1	1.4	3.0
	SHAWEST JASPER 4J / HAMLET · WALLACE FARMS, MENDENHALL, MS					.15	15	39	.33	.30	14	.14	.18	.17
H	**220R**			1000523	04-22-83	1.1	.4	-1.3	7.7	8.8	-6.4	-1.9	1.7	-2.1
	DBW ACHILLES 67F / SALZ · HIEGGELKE STOCK FARM, LISBON, ND					.17	.17	.33	.38	.33	.16	.16	.23	.21
P †	**246 ORBITER**			882589	11-04-82	-3.9	-1.1	2.6	17.2	28.7	3.2	.9	2.4	-6.1
	C P S / BAR 11 UELI · DELTA FARMS, CARTHAGE, MO					17	17	36	32	.30	17	17	22	22
P	**250U**			1241713	04-13-86	4.5	1.2	-2.2	2.2	7.5	1.9	.6	-1.9	-3.0
	SALUTE OF SIM-POL SP20K / GENERATION III · SHIRLEY CALVIN & CENTER MILK, IA					.18	18	43	.34	.31	.17	.17	.19	18
P	**2624 DUKE 13P**			841399	03-24-82	-2.1	-.5	-2.3	3.3	9.8	-9.5	-3.0	-1.4	-3.1
	DEUCE / NORTHSTAR · PECK FAMILY RANCH, KEOTA, IA					18	18	48	.40	40	18	.18	27	24
H	**2624 DUKE 16M**		PCB	648918	04-09-80	-6.3	-1.8	.6	-14.1	-16.7	-.8	-.2	3.1	10.1
	ABRICOT / LACOMBE ACHILLES · MOORE'S SIMMENTAL FARM, ROSE HILL, IA					.18	.18	.43	.36	35	.18	.18	.28	.25
H	**2J JR W157**			1244668	03-26-87	-3.9	-1.1	-.5	19.8	40.8	-2.2	-.6	6.1	-3.8
	2J POLL SIEGFRIED N75 / FUR LIKENESS · JOHN & JENNESS VAN DYK, THREE FORKS, MT					14	14	45	.37	32	12	.12	.16	15
P †	**2J POLL SIEGFRIED N75**		PCB	760099	03-03-81	-9.4	-2.9	1.3	24.3	59.3	2.6	.7	.5	-11.7
	POLLED SIEGFRIED J8004 / BAR 11 UELI · PIONEER SIMMENTAL BREEDERS, TX					.50	.50	.89	★ .85	★ .84	.40	.40	50	49
P †	**2J PROTO LAD U52 POLL**		PCB	1156239	02-27-86	4.6	1.2	-1.8	6.9	16.6	-1.6	-.4	7.2	3.8
	PNS PROTO LAD 646 / POLLED SIEGFRIED J8004 · NELSON LIVESTOCK CO, WIBAUX, MT					.24	24	69	55	.57	19	.19	22	20
P	**2J PROTO R07 POLL**			968123	02-18-83	-5.1	-1.4	1.0	-11.6	-2.3	1.8	.5	2.4	8.2
	ALPINE POLLED PROTO / POLLED SIEGFRIED J8004 · JOHN & JENNESS VAN DYK, MT					.20	.20	.49	.42	.37	.18	.18	.22	.21
H	**2J R176**			968130	04-28-83	-.8	-.1	-2.2	-8.7	-10.0	-7.9	-2.4	-1.0	3.3
	GW GALANT 070N / COPPER KING · SHEEP CREEK SIMMENTAL, LIMA, MT					.13	13	41	.32	29	.12	.12	.20	.17
H	**2J T-101**			1047266	03-19-85	-6.0	-1.7	-.1	5.2	8.2	-8.2	-2.5	4.5	1.8
	GW GALANT 070N / FUR LIKENESS · JOHN & JENNESS VAN DYK, THREE FORKS, MT					.12	.12	.53	.44	.37	.11	.11	.17	.16
H	**2J T-168**			1093614	04-06-85	.8	.3	-1.0	-3.8	-1.4	-5.0	-1.4	-.5	1.4
	GW GALANT 070N / SIGNAL · JOHN & JENNESS VAN DYK, THREE FORKS, MT					14	14	53	.43	36	12	.12	17	.16
H	**2J T-192**			1093615	04-18-85	-1.6	-.4	1.4	5.7	12.4	2.4	.7	5.4	2.6
	E J ABRICOT 52 / COPPER KING · JOHN & JENNESS VAN DYK, THREE FORKS, MT					12	.12	.62	.53	.43	.10	.10	.16	.15
	2S S10			1053067	03-15-84	-5.8	-1.7	-.2	-8.8	-12.3	5.2	1.3	3.7	8.1
	PRIDE OF PRICKLY PEAR / BEAT · HILLS RANCH INC, STANFORD, MT					18	18	57	52	.50	20	.20	27	.25
H	**3132 SHEPBU 165R**			924749	04-06-83	-9.5	-2.9	4.7	17.9	29.0	-1.4	-.3	9.4	.4
	C&B WESTERN / SHEPBU 895J · LOVELL RANCH, FRANKLIN, NE					.17	.17	.54	.46	43	.17	.17	.25	.23
P	**338P**			848061	04-04-82	-3.4	-.9	-1.4	-3.1	9.8	-7.1	-2.1	-7.8	-6.2
	RICH GOLD / MF POLL KAT I · DALE L SCHMEECKLE, GOTHENBURG, NE					21	21	67	60	.62	19	19	34	31
P †	**3C FAX 8459**		PCB	1308772	03-27-88	4.2	1.1	-1.8	-3.5	4.0	-5.6	-1.6	.1	1.9
	HIGH INTEREST / BUCK · NELSON LIVESTOCK CO, WIBAUX, MT					.20	20	.52	24	23	.16	.16	.17	.17
H	**3C MR HUNTER 11**			920715	02-01-83	2.8	.8	-.3	11.3	23.0	-4.3	-1.2	12.1	6.4
	LANGDON'S DOVEA HUNTER / KING ARTHUR · WOOD RANCH GLEN P WOOD, SHERIDAN, MT					18	18	23	42	37	18	18	.22	20
H	**3C PASQUE 6768 RIS**		PCB	1159078	05-05-86	1.7	.5	3.3	15.9	26.7	-2.0	-.5	10.9	3.0
	SIEGFRIEDS POWER / ZT ZAZOU 50F · NELSON LIVESTOCK CO, WIBAUX, MT					13	13	63	47	.48	13	.13	.19	17
H	**3C PASQUE 6772 RNK**			1159079	05-07-86	3.2	.9	-2.3	-7.4	-13.3	-.6	-.1	-1.1	2.6
	CAFFEE TATENHALL S9 / CESAR · SCOTT SCHOUN, NEW UNDERWOOD, SD					.09	09	50	43	42	09	09	.14	13
P/S †	**3C PASQUE 8773**		PCB	1308819	04-27-88	8.1	2.0	-5.2	-3.8	-4.3	-.8	-.2	4.6	6.5
	MR ABONDANCE / SIEGFRIEDS POWER · THE GARST COMPANY, COON RAPIDS, IA					.16	.16	.54	.23	.23	.13	.13	.16	.16
H	**3C PERRY 6509 SP**			1158972	04-04-86	1.5	.5	-.8	-1.9	13.3	.6	.2	4.6	5.5
	TATTENHALL ACHILLES / SIEGFRIED · CHRISTENSEN BROS SIMMENTAL, SD					17	17	47	43	43	17	.17	20	19
H	**3C TRUMP 5033BWF**			1086246	03-18-85	.8	.3	.9	-2.9	4.2	-1.1	-.2	-3.4	-1.9
	EXTRA BLACK / HIGH INTEREST · CHRISTENSEN BROS SIMMENTAL, WESSINGTON SPR, SD					.16	.16	.57	.50	.49	.16	.16	.22	.20
P.S	**3D POLLED PERFORMANCE**			1231407	02-24-87	5.7	1.5	-.1	3.5	15.5	-.6	-.1	3.5	1.7
	ALPINE POLLED PROTO / SALUTE OF SIM-POL SP20K · LYNN TOPP, GRACE CITY, ND					19	19	39	.33	.31	17	.17	19	18
H	**3D ZACK**			1008078	02-27-84	.2	.1	-.1	14.1	19.8	-3.1	-.8	12.9	5.8
	SINGLE NICK DOUBLETIME / ZT ZAZOU 50F · DONALD D DAVIS & SONS, RAVENWOOD, MO					.19	.19	.22	.36	.32	.19	.19	.21	.21
H	**3E 803W**			1207617	01-20-87	5.8	1.5	-1.6	-.3	2.4	1.5	.4	1.3	1.5
	GENERATION III / SHEPBU 636N · E E RANCH CO INC, SUTHERLAND, NE					16	16	41	.35	.32	.15	.15	.18	.18
P †	**3L JAZZ 51T**			1088874	03-25-85	.0	.1	.8	-2.6	5.7	-1.2	-.3	5.1	6.4
	PINEVIEW JAZZ / SHAWEST 10L · JOE LINGSCHEIT, REE HEIGHTS, SD					.19	.19	.54	.48	.42	.19	.19	.23	.23
H	**3R'S FRITZ**	FGN ANC	PCB	1090823	05-25-85	-.8	-.1	.1	17.2	24.7	-1.2	-.3	12.3	3.7
	SV BAVARIAN 7C / SIEGFRIED · WATSONS SIMMENTALS, HAZEN, AR					19	19	38	30	29	.19	19	22	21
H	**3R'S MEGAHERTZ**	FGN ANC	PCB	1201537	04-05-87	-.7	-.1	-.3	3.7	22.9	-.8	-.2	11.4	9.5
	HACKENBERG / SIEGFRIED · 3 R SIMMENTALS, MONTROSE, CO					21	.21	.71	.71	63	.14	14	.21	.19
H	**3R'S WILHELEM**	FGN ANC	PCB	1004083	04-22-84	.1	.1	.2	15.2	25.7	-3.6	-1.0	9.5	1.9
	C&B WESTERN / SIEGFRIED · JAMES M & SANDRA S RAY, MONTROSE, CO					17	17	42	36	32	17	17	19	19
H	**401S**	FGN ANC		995890	03-02-84	3.6	1.0	.0	-5.6	-7.8	-4.3	-1.2	-8.7	-5.9
	DOUBLE CONNECTION / EXTRA GG 10H · JEROME KVAMME & SONS, VOLTAIRE, ND					.17	.17	.41	.37	.37	.17	.17	.24	22
H	**460S**			985683	02-17-84	-2.2	-.5	1.5	1.8	-2.1	-10.8	-3.5	-7.0	-7.8
	SS GENERAL BARRISTER / SALZ · POPE SIMMENTALS, ST IGNATIUS, MT					15	15	.55	.31	28	.15	.15	18	.17
P	**470W**			1222507	02-11-87	-.9	-.2	-2.8	10.6	19.8	-5.2	-1.5	2.9	-2.4
	MR CLEAN / KING ARTHUR · HARRY E FURGESON, ANACONDA, MT					.17	.17	.44	.38	.34	.17	.17	.19	.19
P †	**476W**			1222508	03-07-87	-3.9	-1.1	-.1	3.1	9.9	-.8	-.2	6.5	4.9
	DD & E TAILOR MADE / KING ARTHUR · HARRY E FURGESON, ANACONDA, MT					13	13	.44	38	33	.13	.13	17	16

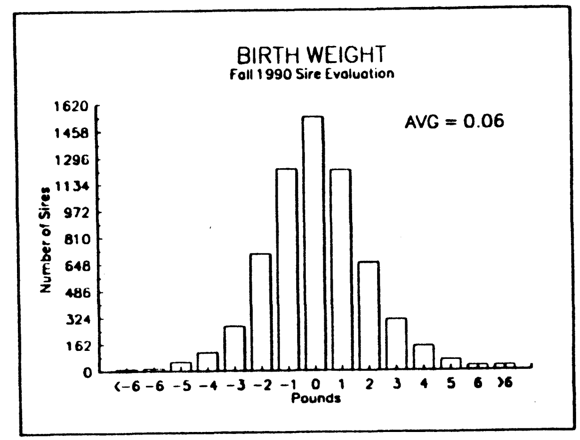
EPD RANGE FOR ALL SIRES EVALUATED		Calving Ease Heifer	Calving Ease Cow	Birth Wt.	Weaning Wt.	Yearling Wt.	Mat. Calv. Ease Heifer	Mat. Calv. Ease Cow	Maternal Weaning	Maternal Milk
	HIGH	13.2	3.0	9.0	79.7	124.9	11.0	2.5	41.1	23.4
	LOW	-28.9	-12.8	-11.6	-56.7	-80.0	-26.8	-11.5	-25.7	-26.2

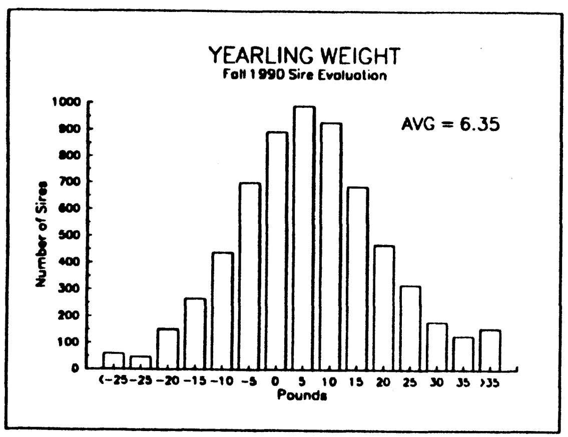
DISTRIBUTION OF EPDS FOR ACTIVE SIMMENTAL SIRES

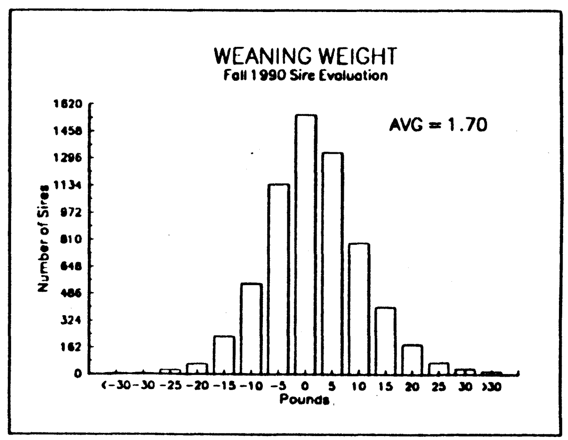


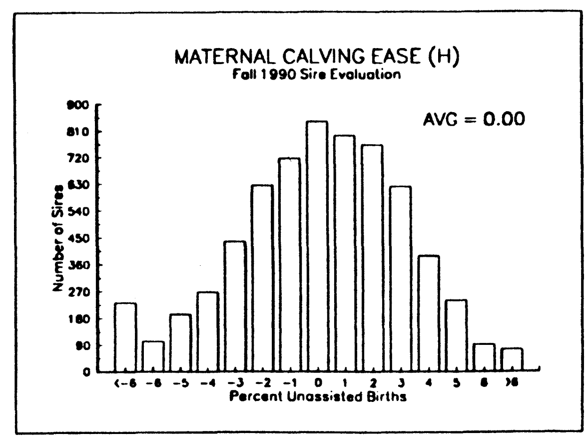












ASTOR'S JUPITER 661M M010968 (FULLBLOOD)
04/26/80 HORNED S: ZORRA BEAVER'S JUPITER
B: MAR-BET FARM, SULLY, IA
O: MAR-BET FARM, SULLY, IA
PAUL M SIEVERT, MEDINAH, IL

	BIRTH	WEANING	YEARLING	MATERNAL
EPD :	+2.7	+11.6	+10.3	-4.9
RANK:	F	A	A	E
ACC :	.49	.46	.35	.32
HRDS:	3	2	2	1

DFS: 9 DGTRS: 13

AZTEC ROCKER M010574 (FULLBLOOD)
04/23/74 HORNED S: EDMESTON ROCKER 18TH
B: BIG BEEF HYBRIDS INC, JOPLIN, MO
O: RIVER VALLEY RANCH, ST FRANCIS, KS

	BIRTH	WEANING	YEARLING	MATERNAL
EPD :	-0.1	-11.2	-25.1	-9.6
RANK:	C	F	F	F
ACC :	.55	.54	.54	.43
HRDS:	6	7	5	4

DFS: 5 DGTRS: 49

BOWTELL CHARLES 23H M010830 (FULLBLOOD)
05/14/76 HORNED S: DUNTERTON 252
B: BOWTELL FARMS, VERMILION, ALTA.
O: HORSESHOE RANCH, EDEN PRAIRIE, MN

	BIRTH	WEANING	YEARLING	MATERNAL
EPD :	+1.6	-6.1	-18.0	-2.7
RANK:	E	E	F	E
ACC :	.55	.53	.55	.34
HRDS:	2	2	2	5

DFS: 6 DGTRS: 24

CHR 9S PBM102462 (PUREBRED)
03/21/84 HORNED S: HHSD CHALLENGER'S FANCY
B: PINE SPRINGS RANCH, LITTLE FALLS, MN
O: KUNTZ & SONS, BROOKLYN, IA

	BIRTH	WEANING	YEARLING	MATERNAL
EPD :	-7.3	-3.8	+6.7	+12.3
RANK:	A	E	B	A
ACC :	.52	.48	.45	.38
HRDS:	8	7	6	2

DFS: 10 DGTRS: 4

COMMERCIAL 52ND M010677 (FULLBLOOD)
05/20/75 HORNED S: TREGOTHA COMMERCIAL 13TH
B: BIG BEEF HYBRIDS INC, JOPLIN, MO
O: DARYL & DENISE VAN WYK, SULLY, IA

	BIRTH	WEANING	YEARLING	MATERNAL
EPD :	+2.5	+3.0	+21.0	+0.5
RANK:	F	B	A	C
ACC :	.48	.45	.38	.36
HRDS:	6	6	3	5

DFS: 7 DGTRS: 16

CORNHUSKER JESTER M011080 (FULLBLOOD)
04/04/81 HORNED S: SR 40J
B: SCHAFFER RANCHES, EMMET, NE
O: SCHAFFER RANCHES, EMMET, NE

	BIRTH	WEANING	YEARLING	MATERNAL
EPD :	+1.6	+1.1	-10.7	-1.8
RANK:	E	C	F	E
ACC :	.55	.54	.52	.34
HRDS:	5	4	1	2

DFS: 6 DGTRS: 6

CROKERS FOREST KING 13TH M010520 (FULLBLOOD)
01/02/70 HORNED S: STRETCHFORD FOREST KNG 1
B: SCULLY ESTATES LTD PRTNRSHP, BEATRICE, NE
O: SCULLY ESTATES LTD PRTNRSHP, BEATRICE, NE

	BIRTH	WEANING	YEARLING	MATERNAL
EPD :	+4.5	+2.4	+10.8	-6.4
RANK:	F	C	A	F
ACC :	.49	.48	.44	.43
HRDS:	3	3	1	1

DFS: 5 DGTRS: 19

PROGENY PROVEN SIRES

Name of Bull Date of Birth	H P S	ATA Reg Number	Sire Dam Dam's Sire	%	Owner & Address	Birth Wt EPD ACC	Wean Wt EPD ACC	Year Wt EPD ACC	Milk EPD ACC	Total Mat EPD	CE Dir EPD ACC	Tot CE EPD ACC	# of Prog	# Cont Group	#DIP
* NONAME 00019652 3/26/80	H	19652	*HOURGLASS IKE* *MISS IRAK 10* *IRAK*	PB	Wandling Bros Box 97 Mabton, WA 98935	2.51 0.84	9.83 0.84	0.09 0.83	-9.74 0.82	-4.83	103.15 0.86	100.29 0.82	58	11	20
* NONAME 00019654 3/30/80	H	19654	*HOURGLASS IKE* *MISS IRAK 01* *IRAK*	PB	Wandling Bros Box 97 Mabton, WA 98935	2.40 0.87	-1.53 0.86	-1.49 0.86	0.04 0.85	-0.73	99.36 0.88	100.68 0.85	83	10	46
* NONAME 00019737 * Trait Leader * 3/17/80	H	19737	*ISIDORE* *123C-C357K* *ISIDORE*	PB	Johnson's J3 Tarentaise RR 1 Box 17 Heimdal, ND 58342	-0.54 0.87	8.27 0.87	6.59 0.86	-1.68 0.85	2.46	115.70 0.88	108.00 0.85	74	7	2
* NONAME 00019738 3/27/80	P	19738	*IF* *027 MISS DOCKTER 601K* *ISERAN*	PB	Collier Farm R R 2 Box 139 New Rockford, ND 58356	-1.13 0.83	2.40 0.83	6.91 0.82	4.51 0.81	5.71	102.99 0.85	101.84 0.81	52	8	24
* NONAME 00021617 3/30/81	H	21617	*OMEGA* *123C-C4K* *MONTANA 7-11*	PB	Mid Dakota Tarentaise RR 2, Box 125 Frederick, SD 57441	0.94 0.78	-3.98 0.77	-2.40 0.76	1.58 0.75	-0.41	96.19 0.80	100.00 0.74	26	6	19
* NONAME 00022124 4/11/80	H	22124	*RF BRICOLE 14J* *064 MRT ASTA K506* *ISTAMBUL*	PB	Roger Long RR Timberlake, SD 57656	1.63 0.74	-4.03 0.74	-1.85 0.73	2.18 0.71	0.17	97.59 0.77	99.15 0.71	20	4	0
* NONAME 00023177 4/ 8/82	H	23177	*ISIDORE* *MISS 14J M8* *RF BRICOLE 14J*	PB	Toms Tarentaise Ranch Inc HC 74, Box 7025 Baker, MT 59313	1.19 0.75	-10.54 0.74	-6.94 0.73	3.60 0.71	-1.67	94.91 0.78	98.95 0.71	19	4	3
* NONAME 00024088 11/26/82	H	24088	*IF* *MAMA VOGT M53* *IROUNE*	PB	H L Vogt Rt 2 Box 356C Yoakum, TX 77995	2.67 0.81	4.81 0.81	7.73 0.80	2.91 0.79	5.32	99.45 0.83	101.14 0.79	39	8	0
007 MR. T R157 2/13/83	H	26260	*IRAK* *221 B&Y N40* *BRUTUS*	PB	Shining S Cattle Company Rt 1, Box 32 Wallace, NE 69169	1.31 0.87	5.61 0.87	8.65 0.86	3.04 0.86	5.85	101.07 0.89	100.29 0.86	93	10	5
0216 043 MR. CLASS 4/ 8/86	H	155156	*0216 P06 DUSTY* *123 C-C 10N* *ISIDORE*	PB	Shy's Tarentaise 36394 Co. Rd. 125 Simla, CO 80835	0.51 0.76	-0.04 0.75	2.23 0.73	2.26 0.71	2.25	101.62 0.78	100.06 0.71	20	5	0
0216 P06 DUSTY 3/11/82	H	169	*151 PUPPE'S KINGO* *238 JAVA II* *BRICOLE*	FB	Becker's Diamond B Tarentaise RR 1, Box 139 Anamoose, ND 58710	1.55 0.83	-3.99 0.82	-0.92 0.81	3.07 0.80	1.07	100.08 0.85	97.98 0.80	46	12	13
0216 P27 MARCUS 3/24/82	H	170	*M61 BRUTE* *0216 L32 MISS CATHY* *IF*	FB	Puppe's Tarentaise Rt 1, Box 81 Castleton, VA 22716	4.10 0.75	-7.51 0.74	-1.53 0.72	5.98 0.71	2.22	90.99 0.77	95.11 0.70	18	7	2
0216 P38 POLLED EXPRESS 3/30/82	P	23558	*151 PUPPE'S KINGO* *0216 L17* *238 BRAVA*	PB	Vasichek Brothers Rt 1 Michigan, ND 58259	6.89 0.89	16.75 0.89	13.01 0.88	-3.75 0.88	4.63	91.98 0.90	96.77 0.88	122	27	14
0216 S14 SATIN 3/12/84	H	28821	*JVL SATURN 47N -457-* *M63 MISS SUZIE* *LUTIN*	FB	Taylor Four Square Ranch 393 N. 800 E. Box 108-3 Roosevelt, UT 84066	3.25 0.76	4.81 0.75	8.98 0.73	4.17 0.71	6.58	99.96 0.78	98.12 0.71	20	7	8
0216 T61 MR PRIDE 4/ 9/85	H	153138	*JVL SATURN 47N -457-* *ALPINE MISS VEE 322P* *ALPINE SIR VEE 222L-240-*	FB	Bear Creek Tarentaise RR 1, Box 126 Marion, ND 58466	1.72 0.77	20.54 0.76	25.01 0.75	4.47 0.73	14.74	100.06 0.79	98.06 0.73	23	3	6
0216 U03 MR. CLASS 3/ 8/86	H	157363	*SSR ALGERNON 10* *0216 S08* *JVL SATURN 47N -457-*	PB	LD Ranch Rt 2, Box 138 Sebeka, MN 56477	2.04 0.72	12.06 0.70	14.47 0.68	2.41 0.66	8.44	97.35 0.74	98.60 0.66	13	5	0
027 MR. DOCKTER 54R 4/ 6/83	H	25706	*IF* *238 MISS LOUISA* *ISERAN*	FB	David D. Dockter RR 2, Box 59 McClusky, ND 58463	-0.41 0.80	-11.18 0.79	-7.97 0.78	3.21 0.77	-2.38	101.41 0.83	101.73 0.77	35	7	2
064 BEAUFORT * Trait Leader * 4/22/77	H	31	*IROUNE* *TTT LIONNE 31 CTA 31*	FB	Obrecht & Eisenzimer RR 1 S.E. Box 138 Cascade, MT 59421	-1.23 0.84	0.37 0.84	3.91 0.83	3.54 0.82	3.73	100.37 0.86	97.05 0.82	57	11	19
064 MRT BOBO N967 4/18/81	H	23321	*FORTUNE* *064 MRT IRETA L967* *IGNACE*	PB	Wandling Bros Box 97 Mabton, WA 98935	-0.26 0.90	-8.83 0.90	3.78 0.89	12.61 0.89	8.19	102.47 0.91	103.42 0.89	148	33	28
064 MRT FRED M20 12/10/80	H	118	*IF* *064 MRT JAVA LYNN K1* *ALPIN*	FB	Mountain Range Tarentaise Tongue River Rt Miles City, MT 59301	2.35 0.92	-5.68 0.92	-11.40 0.92	-5.72 0.91	-8.56	98.47 0.93	95.65 0.91	262	43	57

INTERBREED EPDs: A STATUS REPORT

D. R. Notter
Virginia Polytechnic Institute and State University

Introduction

Since the discussion on interbreed EPDs began in earnest at the 1989 B.I.F. Meeting in Nashville, considerable evolution of the concept has occurred. The idea has caught the imagination of many cattle people, but serious misconceptions remain, and it is likely that the number of breeders who would regularly use interbreed EPDs is far smaller than the number that will use traditional, intrabreed EPDs. To some extent, the call for interbreed EPDs represents a backlash by some who find current EPDs confusing, do not truly understand them, and have become convinced that a single set of interbreed EPDs for the whole beef industry would make everything easier to understand. They are probably wrong in that conviction.

On the other hand, we see more and more breeders who are interested in potentially utilizing the full array of cattle genetic resources, both within and among breeds. For these breeders, sound predictions of breed performance are just as important as access to within-breed EPDs, and some form of interbreed EPDs becomes absolutely necessary to their breeding programs. These breeders also must acquire a thorough understanding of the genetics of crossbreeding, including such concepts as heterosis (and the extent to which it is retained or lost in different kinds of crosses), general combining ability (i.e., the average performance of a breed in crossing) and specific combining ability (i.e., the performance of a specific pair of breeds when they are crossed). Unfortunately, these concepts are not well understood by many cattle people.

The Perceived Problem

The generally sympathetic response to the concept of interbreed EPDs among commercial bull buyers suggests that we do have a problem as an industry with the presentation and interpretation of EPDs. These problems may not be perceived, and indeed may not exist (but probably do), for individuals working with a single breed. Each of the purebred sire summaries is, in general, readily interpretable to those willing to invest a reasonable amount of time and effort. The breed associations and the universities with which they work deserve commendation for their efforts to educate their breeders on the understanding and use of EPDs. Introductory materials prefacing the sire lists provide comprehensive statistics on genetic trends and distributions of EPDs which do much to clarify the positions of individual animals relative to current breed averages.

As an industry, however, we are increasingly presenting EPDs separate from the introductory material that is so critical to their interpretation. In bull test catalogs and other offerings of animals of multiple breeds, EPDs are regularly presented, but lack context or point of reference and largely presume that buyers can appropriately interpret the EPDs of the various breeds that they may wish to consider. Merchandising abuses are invited when poorly understood genetic bases allow substantial positive EPDs for animals that are well below current breed averages. Many A.I. organizations use supplemental classifications of their sires (e.g., "heifer bull", "for replacement females", etc.) to assist their customers in selection.

When commercial bull buyers are told that "a plus EPD doesn't necessarily mean an animal is above average" or, upon looking at bulls of two different breeds, are warned that EPDs provide no information to compare them, it is easy to sympathize with their frustration. It is also easy to understand why a system that would rank all the cattle together, within and across breeds, seems so simple and useful.

But such a system would create problems, even if it were computationally feasible. The implication would be that all cattle belong to the same population and that their likely performance in any system is adequately reflected by their arrays of EPDs. Breed characteristics not directly reflected in current EPDs, such as the leanness of the Limousin, or the subtropical adaptation of the Brahman derivatives, or the generally modest mature cow sizes of the British breeds would be devalued. The implication would be that any pair of animals with the same set of EPDs are the same, even if one were a Brahman and one were a Charolais. Designed crossbreeding programs would likewise be devalued, and haphazard crossing of animals of different breeds would be encouraged. Today, in my opinion, we see no support among thoughtful cattle people for a single, comprehensive national EPD listing of sires without regard to breed.

Yet the problems that suggested just such a quick fix remain and should be addressed. Their ultimate answer, of course, lies in education, but that plea has a hollow ring, especially as we move from the purebred breeders to commercial bull buyers. A more logical goal is for increased <u>standardization</u> of EPDs and accompanying information across breeds and for improved <u>communication</u> of this information to commercial cattle people. A standardized base for calculating EPDs for all breeds is being considered and would be a useful step, but if a fixed base is used, knowledge of within-breed genetic trends is still also necessary to interpret current EPDs. If current supplemental, interpretive information (trends, EPD distributions) could be standardized among breeds, that information could perhaps be combined into an annual B.I.F. Commercial Bull Buyers Guide. Such a publication would be useful even if it contained no direct breed comparisons.

The Real Problem

Behind all the confusion and perceived problems associated with interbreed EPDs, there does exist a real problem to be addressed. Simply stated, it is the question of <u>how</u> to use genetic variation <u>within and among</u> breeds in the design of breeding programs. If a breeder wishes to use, or to consider use of, animals of more than one breed, that breeder needs to have an accurate picture of the expected performance levels of the candidate breeds. If one opens an A.I. sire catalog, one finds relative performance rankings (EPDs) for all the bulls of breed A and for all the bulls of breed B, but no comparable estimate of the mean difference in performance between breeds A and B. Yet to the crossbreeder this information is fully as important as the within-breed differences among the sires. We readily recognize that within-breed EPDs have imperfect accuracies and may change somewhat from herd to herd due to genotype x environment interaction, but generally accept these EPDs as valid predictors of mean performance. Comparable breed EPDs, indicative of breed mean performance levels, are needed. The accuracy of such breed EPDs can be at least approximated in terms of the standard error, or possible change, of the breed means, and should be estimable with much greater accuracy than are within-breed EPDs. Genotype (breed) x environment interactions can be addressed when comparative breed information is obtained from several environments, but data for estimation of breed EPDs will admittedly be available in fewer management units than those used for within-breed EPDs.

A large number of breed comparison experiments have been conducted, and each can be used to derive at least some information on breed EPDs. The results of such experiments are much more valuable when the EPDs of the sires used in the experiment are known, in order to allow objective adjustment of experimental results for sire sampling and genetic trends. Existing efforts in this direction have been limited to single-location studies and need to be made more comprehensive. Field data sets will in general be less useful than experimental data sets for estimation of breed EPDs because of the structured crosses that are usually necessary for estimation of breed effects, although notable exceptions may exist and should be pursued. In particular, purebred data will likely be of limited value in calculation of breed EPDs due to confounding of direct and maternal effect. If breed EPDs are to be used in designing crossbreeding programs, estimation of additional genetic parameters required to predict crossbred performance will also be required. These include mean levels of heterosis as well as parameters involved in specific crosses. For example, breed EPDs for birth weight in Brahman crosses would have to specify if the Brahman was the maternal or paternal parent.

Interbred EPDs of some form will become especially important to individuals involved in the production of hybrid seedstock. Interest in hybrid and composite sources of germplasm is increasing, and such animals may be a valuable resource for the beef industry. For such animals to be appropriately used, it will be necessary to develop a mechanism to objectively compare then with other sources of germplasm. Such a comparison will necessarily involve consideration of breed and heterosis effects.

Plan of Action

A reasonable plan of action at the current time would appear to involve:

1. Consolidation of pertinent existing data (both university and industry) to allow prediction of breed mean performance levels. Critical voids in existing data should be identified and plans made to fill those voids.
2. Consolidate estimates of heterosis effects for major performance traits and conduct a critical assessment of the importance of general and specific combining ability in beef cattle.
3. Begin educational efforts on use of genetic resources (within and among breeds) in cattle production.

Postlude

It is important to appreciate that the current emphasis on within-breed EPDs in the U.S. is directly attributable to the paramount role of the breed associations in genetic evaluation. This model has, as a whole, worked well and he interests of the purebred breeders and of many of their customers have been well served. But a new clientele of commercial breeders and non-purebred seedstock producers is emerging with its own unique needs for across-breed genetic information. New structures may be needed to serve these groups and mechanisms to responsibly blend new and preexisting structures should be encouraged.

BEEF IMPROVEMENT FEDERATION
22ND MEETING
MAY 23 - 27, 1990
B I F
HAMILTON, ONTARIO, CANADA

the Register

SERVING THE SIMMENTAL AND SIMBRAH BREEDS

DECEMBER 1989

COMMENTS

ABOUT ACROSS-BREED EPDS

Over the past several months, across-breed EPDs have been widely discussed in the industry and well-publicized in the livestock press.

Interest was ignited and attention focused when, during the Beef Improvement Federation meeting in Nashville last May, the across-breed EPD concept was discussed as part of a symposium on new technology for genetic evaluations. Then, during the American Simmental Association Summer Conference in Lansing, MI, the ASA Board of Trustees endorsed the concept. And, just a few weeks ago, one day of the Genetic Prediction Workshop (the third of its kind sponsored by Winrock International for the beef industry) was devoted to discussion of the topic.

Discussion to date has raised more questions than answers, and since ASA members have been asking what across-breed EPDs are all about, let me update you on what actually has happened and let's also take a look at the concept itself.

In the last 20 years, the genetic evaluation of beef cattle has progressed from within-herd ratios to national cattle evaluation. Although they are relatively new, it is safe to say the industry has accepted the use of EPDs in within-breed breeding programs. Most of the beef cattle breeds in the U.S. have some type of cattle evaluation program providing EPDs, buyers of breeding stock are looking at EPDs when they make their purchases, and it appears they are discriminating against cattle without EPDs.

Also in the last 20 years, the commercial beef cattle industry has embraced crossbreeding as a means of increasing production, particularly for reproduction and survival. Depending on the crossbreeding scheme, several different breeds must be used, and commercial cattlemen are asking for ways to compare animals of different breeds. They are asking questions like, "If an Angus bull has a +25 weaning weight EPD, how does he compare to a Simmental bull with the same EPD?" The concept of across-breed EPDs would facilitate this comparison.

Then too, since they sell semen from bulls of different breeds, AI studs are interested in across-breed EPDs.

So...current methodology used to predict breeding values allows us to compare animals across herds within the same breed. And practical experience is telling us EPDs are useful tools, economically important in many programs. The next logical step would seem to be the comparison of genetic merit of breeding stock of different breeds—across-breed EPDs.

It won't be a simple step. Unlike the dairy industry which has essentially one trait to measure and one breed which cannot be surpassed in that trait, the beef cattle industry is segmented, and each segment is interested in different traits of economic importance.

There are some major considerations in adopting an across-breed EPD system.

First, the differences in genetic base between the breeds must be resolved.

Each breed's genetic base differs. The Angus and Hereford bases are somewhere in the early '60s, whereas the Continental breeds' bases are located at some point in the '70s. The base used in the National Simmental and Simbrah Sire Evaluation is the weighted average of all bulls evaluted in 1986.

A committee was formed at the Genetic Prediction Workshop to investigate the feasibility of defining some common genetic base across breeds.

Second, where will the data come from in order to compute breed and heterosis constants?

Probably the major requirement for across-breed EPDs is accurate estimates of breed and heterosis constants, i.e. do individuals from different breeds pass on their genetic traits in the same ways? Very little crossbred data can be obtained from commercial herds, so data will have to come from the Germ Plasm Evaluation Study at the U.S. Meat Animal Research Center (USMARC) and other crossbreeding projects at various agricultural stations across the country.

Third, the problem of genotype by environment interactions must be accounted for.

Different types of cattle react differently to different environments. How will an across-breed EPD system account for that?

Data must come from different environments, particularly the temperate and subtropical areas of the U.S. Regional tables may have to be developed, particularly for the Gulf Coast area.

Fourth, how and where will the across-breed tables be presented to the industry?

Who will be responsible—the Beef Improvement Federation or some other organization?

Not a lot of information exists yet. Drs. David Notter of Virginia Polytechnic Institute and Larry Cundiff of USMARC have been exploring the possibility of across-breed EPDs using data from the USMARC Germ Plasm Evaluation study, and that likely will be a starting point.

The table below (which comes from Notter) illustrates just one proposed idea for developing across-breed EPDs. These data are breed means for eight breeds used at USMARC and have been adjusted to zero EPD to allow for the across-breed comparison.

If you use this table to compare Angus and Simmental bulls for weaning weight breeding value, the differences between the Angus and Simmental means (+36 pounds) would be added to Simmental weaning weight EPDs.

At this time, though, across-breed EPDs do not exist; the table is merely a proposed idea. The questions here remain unanswered, but they certainly will stimulate industry-wide discussion.

The Genetic Prediction Workshop was a starting point for that discussion. It's likely the next major formal discussion will occur at the 1990 Beef Improvement Federation meeting in May in Toronto. It will be an interesting meeting.

What can Simmental and Simbrah breeders expect if across-breed EPDs become a reality? Probably confirmation of what we already know—that our cattle excel in growth and maternal traits.

-Dr. Bruce Cunningham
Director, Research and Education
American Simmental Association

BREED MEANS ADJUSTED TO A ZERO EPD

BREEDS	*BIRTH WEIGHT*	*WEANING WEIGHT*	*YEARLING WEIGHT*	*MATERNAL WEANING WT.*
Angus	73.8	432	812	424
Hereford	78.6	435	817	424
Polled Hereford	78.3	440	830	na
Charolais	84.6	464	885	450
Limousin	80.6	454	847	434
Simmental	83.4	468	898	471
Gelbvieh	84.9	470	885	476
Tarentaise	80.5	448	821	470

DETERMINING BULL FERTILITY

Nolan R. Hartwig, DVM
Extension Veterinarian
Iowa State University

Historically, bulls were evaluated almost exclusively by type and conformation. More recently, use of production data has become much more common. Too often, however, little attention is paid to the major function that the bull is asked to perform: "Can he breed cows?" Episodes of sterility are common. It is important that bulls will vigorously seek out females in heat, mate successfully, and deposit fertile semen in the vagina. Subfertile bulls can breed a few cows but will not cover the number of females in the time desired. The implications of infertility are most dramatic in the single sire herd, but are economically important to seed stock and commercial producers alike, regardless of herd size. Problems with infertility can be avoided by attentive management and by correctly performing breeding soundness examinations performed prior to the breeding season. Approximately 11% of yearling bulls are either sterile or subfertile at 12-14 months of age. Breeding soundness examinations show that 4% of proven sires develop serious fertility problems between breeding seasons.

The Guaranteed Breeder

Bulls are often sold as guaranteed breeders. This is, in effect, a warranty that a bull will perform satisfactorily. Several questions should be asked when a bull is sold with this guarantee, and this information should be in writing in case fertility problems do occur. Some of these questions are:

1. For how long is the bull guaranteed?
2. Is the guarantee valid if the bull breeds a few cows but is subfertile?
3. Who determines that the bull is an unsatisfactory breeder?
4. Did the bull have a Breeding Soundness Examination performed prior to sale?
5. Must a Breeding Soundness Examination be performed to prove that the bull has a fertility problem?
6. If the bull is unsatisfactory, is he replaced or is a cash settlement possible?
7. What happens if the bull develops problems a few weeks after purchase?

Most of these problems can be avoided if a Breeding Soundness Examination (BSE)is performed prior to sale. Buyers should insist on this. The statement "Guaranteed Breeder" means little without a BSE.

Libido Testing

Fertility requires that a bull is both physically capable of impregnating cows and has the desire, or libido, to do so. A breeding soundness examination will insure that a bull is physiologically fertile, and, when professionally done, will identify many physical deformities such as feet, leg, and other problems with the reproductive organs that would cause a bull to eventually stop mounting cows. Thus the breeding soundness exam does help identify those physical problems that can damage libido, but does not specifically identify or evaluate libido itself. Libido testing is possible by exposing bulls to several restrained heifers in heat and quantifying the frequency of mounting and general vigor of sexual activity. This procedure is very involved and is not practical in most situations.

The producer, however, can evaluate libido by observing bulls in the breeding pasture. This is especially important the first few days after a bull is turned out with cycling females.

Young bulls are often timid, but become more aggressive later. When several bulls are together, aggressive bulls may dominate more timid ones and actually breed almost all of the cows. Some bulls will "cover" a herd of cycling females very well, aggressively seeking out all females in heat. Others will identify one cow in estrus, following and mounting her frequently while ignoring other females in heat. At any time during the breeding season, bulls can develop problems such as feet and leg injuries, infections, or other problems that can cause either libido problems or directly affect fertility. Breeding activity, including date cows are mounted, vigor of breeding, repeat breeding on successive heats, and other factors should be observed and recorded throughout the breeding season.

The number of females that a bull can cover varies enormously between individuals. It should be remembered that in a given herd, about 5% of the females are in heat at any one time. Size of the breeding pasture, physical condition of both bulls and females, weather conditions, and other factors affect the number of cows each bull can cover. The following table of females per bull should only be considered as a guideline:

Females Per Bull in the Breeding Herd

Yearling bull	10-15
Two years old	15-20
Thrree years (mature)	30-35

The Breeding Soundness Examination

Veterinarians primarily receive requests to perform breeding soundness examinations on bulls from owners who have had reproductive problems in the past, prior to the upcoming breeding seasons, from prospective buyers and sellers, and when a bull is actually suspected of having a problem. Many producers request a "semen test". A breeding soundness examination is a complete examination of the animal, including, but not restricted, to evaluation of the semen. Just semen testing a bull and not performing a complete breeding soundness examination is misleading, results in a false sense of security, and is worse than not doing any examinatin at all. Producers should understand the basics of the BSE and insist that it is done completely, thoroughly, and professionally.

There are four major components of a BSE:

1. History
2. General physical examination
3. Detailed genital tract examination
4. Collection and analysis of representative semen samples

History

History is important as a predictor of fertility. Previous disease episodes and vaccination history should be recorded. Since sperm production is a continuous process, disease such as pneumonia can affect semen quality for several weeks. Bulls with damaged lungs from severe bouts of pneumonia lack stamina and are, in effect, subfertile. Subfertile bulls have the ability to breed some cows, but the capability for covering a herd of females and breeding them in a timely manner is significantly diminished. Technically such bulls are not sterile, but they are not satisfactory breeders.

The actual breeding history is of great value. The number and frequency of previous breedings, conception rates, and normality of offspring should be recorded. This information should be used to help interpret results of the actual examination.

Physical Examination

The physical examination may be more important in predicting the breeding potential of a bull than any other factor. Bulls with undesirable characteristics or abnormalities can be eliminated without collecting and analyzing semen. Masculinity, movement and gait should be observed carefully before the bull is restrained in a squeeze chute. Lameness may cause a bull to lie down a great deal, so that normal temperature regulation of the scrotum and testicles does not occur. It is common for lame bulls to have diminished semen quality. Bulls with foot, leg, or back pain will not mount and breed cows.

Permanent identification such as a tattoo of the bull is critical and is often overlooked. The veterinarian performing the examination should require this. If the owner refuses to allow permanent identification, this should be recorded on the examination form. This precludes the possibility of switching bulls by unscrupulous dealers.

The eyes are examined for pinkeye scars, cancer eye, or other lesions that can affect the vision and therefore the breeding potential of the bull. Bulls should have normal teeth. The coat is examined for evidence of hair loss, external parasites, and other abnormalities. The coat reflects the general health and management level of the herd. The feet and limbs are examined carefully. The hooves are examined for cracks, foot rot, evidence of founder, and other abnormalities. Extremely straight hocked (post-legged) bulls should be avoided. These abnormalities are noted on the BSE form.

Careful examination of the genital organs is just as critical as the semen examination itself. The sheath is examined carefully, often just prior to actual semen collection. Some polled bulls and most bulls with Brahman breeding have some natural prolapse of the sheath surrounding the penis. This should be noted if extreme, since injury to the sheath and subsequent infection can occur at pasture. The penis is palpated through the sheath for evidence of abscesses, hematoma (hemorrhage), and adhesions. Abscesses are circumscribed swellings that usually occur about halfway between the opening of the prepuce and the scrotum. Hematomas, or so-called broken penis, usually results in a larger swelling near the neck of the scrotum. Depending on severity and how long these conditions have existed, surgical treatment is possible but several weeks or even months is required before the bull is again a sound breeder.

The penis itself must be observed during the examination. This is usually done during the first part of the ejaculation process. Examinations where ejaculation occurs in the sheath result in contamination of the semen sample and are a poor indicator of breeding soundness. Failure to protrude the penis during the examination may be due to physical problems such as abscesses, hematomas, or adhesions.

Persistent frenulum occurs in young bulls, especially in the Shorthorns, Angus, and Santa Gertrudis breeds. This defect, which is the most common cause of the so-called deviated penis, can seriously affect entry into the vagina, but is easily corrected at the time of semen collection. Hair rings may surround the penis and have on occasion caused almost complete amputation without visible signs on the outside. This problem occurs most frequently in young bulls that ride each other a great deal. Warts are common and can lead to infection, pain, and reluctance to breed. Mature warts on a small stalk can be surgically removed, although large flat ones should be allowed to mature before removal. Such bulls should be checked at a future time. Adhesions, scars, and other serious defects of the penis may be found.

The scrotum and contents are carefully examined. The testicles should be symmetrical, nearly the same size, and freely movable in the scrotum. Small size or degeneration often affects one testicle only and is a serious finding. The consistency of the normal testicle is much like a firm rubber ball. Extremely hard testicles indicates infection (orchitis) and very soft ones indicate degeneration. Bulls that do not have two normal testicles properly positioned in the scrotum should not be used for breeding. The epididymides, the structure that surrounds the testicles and transports semen to the accessory sex glands are carefully palpated. Defects of this structure seriously affect fertility.

The neck or upper part of the scrotum is carefully examined. Intestines will be found in the upper part of the scrotum if severe inguinal hernia is present. This is most common on the left side. Sometimes large fat deposits in the upper part of the scrotum can resemble inguinal hernia, but these can be differentiated by rectal examination and palpation of the internal inguinal rings.

Palpating the internal genital organs of the bull should be the last part of the physical examination. It allows for evaluation of the internal genital organs, removes fecal material from the rectum so the electric probe is more effective, and acts as a pre-stimulation prior to ejaculation. Several important finding may become apparent as a result of rectal examination. The presence of inguinal hernia may be detected. Another common finding is seminal vesiculitis, or infection of the seminal vesicles. This condition occurs commonly frequently in bulls held in confinement. When this condition is present, there is usually pus in the semen sample. Infertility is common. Such bulls can often be treated by rest, (turning out to pasture is preferable), treatment with antibiotics such as the tetracyclines in the feed for a long period of time, and reexamination in 30-60 days. Severe cases may not respond to treatment.

Semen Collection

Semen is collected by three methods:

1. Rectal massage
2. Artificial vagina
3. Electro-ejaculation

Rectal massage usually yields a sample that is less representative of a bull's semen quality than when taken by the other two techniques. Many bulls urinate during collection by this method and contaminate the sample. It is also difficult to examine the bulls penis when the sample is collected by this method.

Semen samples taken with an artificial vagina are very representative of the bull's semen quality, and this method of collection offers some evaluation of a bull's libido. A trained mount animal and sizeable working area is needed for this technique.

The electro-ejaculator has made collection of large numbers of bulls feasible. It is relative quick and can be done in a small area. The major disadvantages of this method are that the volume of ejaculate cannot be accurately measured, and the process is not representative of the ejaculation process, as is use of an artificial vagina. Rarely, a bull will not respond to use of an ejaculator. Contrary to some opinions, however, ejaculation of bulls with this instrument is safe and does not constitute an undue hazard to the bull. Injury is very rare when the instrument is used properly.

The probe of the ejaculator is inserted into the rectum and held by an assistant, who may also have to help the bull protrude the penis by pushing on the sigmoid flexure which is located just behind the scrotum. The veterinarian carefully examines the penis and then proceeds with collection. Erection and ejaculation is accomplished by careful pulsation with the electro-ejaculator. Proper technique is a matter of training and experience. The operator must be able to differentiate between pre-ejaculate fluid and semen. The latter is normally creamy and thicker than pre-ejaculate fluids, so collection technique is important.

Breeding Soundness Examination Score

Bulls that pass the physical examination on the BSE are scored on three criteria and rated as Satisfactory, Questionable, or Unsatisfactory. The final rating system is:

Total Points on the BSE Examination

Total Points	Classification
60-100- - - - - - - - -	Satisfactory Potential Breeder
30-59- - - - - - - - -	Questionable Potential Breeder
0-29- - - - - - - - - - -	Unsatisfactory Potential Breeder

The three criteria on which this scoring system and points assigned to each are:

Criteria for BSE Scoring System

Criteria	Points Assigned
Scrotal Circumference- - - - - - - - - - - -	40
Sperm Morphology- - - - - - - - - - - - - - -	40
Motility- -	20
Total Points Possible- - - - - - - - - - - -	100

This scoring system has been determined by thousands of breeding soundness examinations and correlation with actual test mating of bulls to fertile heifers and cows. It has been shown that these three criteria correlate closely with fertility and in the proportion shown. This does not mean that a bull with large scrotal circumference, good sperm morphology, and high motility automatically passes a BSE. A bull with a high score but with an inguinal hernia or other serious physical defect can still fail a breeding soundness examination.

Scrotal Circumference

Large, round testicles correlate closely with fertility. Scrotal circumference is measured with a scrotal tape and recorded in centimeters. Scrotal circumference is measured by encircling the neck of the scrotum with one hand and pushing the testicles ventrally with enough force to remove wrinkles in the scrotal skin. The scrotal tape is positioned firmly but not tightly around the scrotum. The measurement is converted to a score which is adjusted for age. The correlation score is based on thousands of test matings.

Scrotal Circumference

Age (months)	Circumference (cm)		
<15	>34	30-34	<30
15-20	>36	31-36	<31
21-30	>38	32-38	<32
>30	>39	34-39	<34
Score	40	24	10

Concentration and Motility of Semen

Concentration of semen is not part of the official scoring system but should be considered by the practitioner. A very good sample should be creamy, white, opaque, and viscid, containing many tiny white flakes. Pus will cause the semen to appear dense, yellow, and almost clotted. White blood cells contained in pus will be easily detected when the semen sample is examined microscopically. Urine, which quickly kills sperm and would negatively affect the motility score, will give the semen a yellow color. Blood is also lethal to sperm, but is detected by microscopic examination.

Motility accounts for 20% of the BSE score and is an important indicator of fertility. Semen samples must be carefully protected against heat or cold shock between the time of collection and examination. Many veterinarians prefer to only do BSE on bulls in their own clinic so that such problems are easier to control. Water bath solutions set at the proper temperature are very important when conducting the BSE.

Motility is assessed based on gross motility and individual sperm motility. When evaluating gross motility, vigorous swirls and eddies, rapidly changing light fields, or the impression of a "blizzard" is an indication of good motility. Individual sperm are observed microscopically and evaluated for rapid linear movement, which is desirable. Motility is scored as follows:

Motility Evaluation

Gross	Rapid swirling	Slow swirling	General Oscillation	Sporadic Oscillation
Individual	Rapid Linear	Moderate Linear	Slow Linear	Very Slow Linear
Score	20	12	10	3

Sperm Morphology

Sperm morphology or structure is also closely correlated with fertility. Bulls in natural service usually display decreased fertility if more than 35 or 40% of their sperm is abnormal. Morphology is checked by preparing a stained slide of the semen sample, randomly counting sperm cells under the microscope, and recording the number of normal and abnormal cells. Sperm cells are recorded as either normal, have a secondary defect, or a primary defect. Primary defects generally occur within the testicle during spermatogenesis and are considered more serious than secondary defects. Examples of primary defects are: abnormal head shapes, midpiece abnormalities, proximal protoplasmic droplets, and tightly coiled tails. Secondary abnormalities occur as the sperm travel through the duct system or during ejaculation. These include distle protoplasmic droplets, detached normal heads, and simple bent or curved tails. Sperm morphology is examined and recorded according to the following table:

Scoring Sperm Morphology

Primary Abnormalities	<10%	10-19	20-29	>29
Total Abnormalities	<25%	26-39	40-59	>59
Score for Morphology	40	24	10	3
Classification	Very Good	Good	Fair	Poor

Bulls with a total BSE score of 60 or greater are rated as satisfactory potential breeders and can be sold and/or used with judicious observation. Bulls with a BSE score between 30 and 59 are considered questionable potential breeders and should not be sold. Sometimes young bulls will improve their score with age, depending on the reason for the lower score. Rechecking in 30-60 days may be advisable. Bulls that score as unsatisfactory breeders may be rechecked, although the prognosis for becoming a satisfactory breeder is much lower than for those in the questionable category.

Sometimes, special tests are required. It may be necessary to collect and stain a smear from the prepuce to check for trichomoniasis, a venereal disease of cattle. Repeated cultures of the same material may be required for vibriosis diagnosis. These two diseases are fairly common in mature bulls that have been previously used in other herds.

When doing breeding soundness examination on bulls for sale, tests for brucellosis, leptospirosis, and tuberculosis may be necessary. This depends on applicable state regulations and/or the desires of the buyer.

Bull Health Program

Bulls are susceptible to most of the same diseases and health problems as other classes of cattle. Vaccination of young bulls at six months of age and again as yearlings for IBR, BVD, PI-3, and the Clostridial group (blackleg and other causes of sudden death) are advisable. They should be treated for grubs and lice and wormed during the fall, and observed for health problems during the "off" season as well as during the breeding season. Bulls should have opportunity for exercise and not be allowed to become obese. During the summer, face and horn fly control should be practiced. Horn flies in particular concentrate in large numbers on bulls. They should be treated with an approved insecticide. Never use Dursban-44 on bulls, as it leads to a fatal and irreversible degeneration of the spinal cord.

Frostbite of the scrotum during extremely cold weather is, unfortunately, fairly common and leads to permanent sterility. Frost bite may not be grossly evident, as even slight freezing of the end of the scrotum may damage the tail of the epididymis, leading to permanent sterility. Providing deep, dry bedding during cold weather and a satisfactory windbreak will prevent most cases of scrotal frost bite.

Bulls should have a breeding soundness examination performed about 6-8 weeks prior to the breeding season, so that any problems found can be corrected prior to use. The feet should be trimmed at this time, if needed, and at any time of the year when excessive growth is evident.

Conclusion

The bull has been described as half of the herd. Catastrophic losses due to infertility are not uncommon. A professionally done, complete breeding soundness examination, careful observation during the breeding season, and good health management will prevent most problems of breeding bulls.

Reference

Elmore, R.G. Breeding Soundness Examinations of Domestic Male Animals. Veterinary Medicine, April-November, 1985.

20279

THE CORNHUSKER PRESS · HASTINGS, NE 68901

Society For Theriogenology

Association Bldg. 9th and Minnesota Hastings, Nebraska 68901

NCR PAPER - No Carbon Required.

Owner: Date: Case No.:

Date of previous exam.:

Case No. of previous exam.:

Classification:

Address

Bull:

Name

Birth Date:

Breed:

Reg. No.	Tattoo	Horn Brand	Ear Tag	Hide Brand	Other

Remarks relative to breeding history, calf production, breeding efficiency of family, herd management, etc.

Classification: Interpretation of data resulting from this examination would indicate, to the best of my knowledge, that this bull is a:

Satisfactory potential breeder______ Questionable potential breeder______ Unsatisfactory breeder______

Remarks: **Unless otherwise indicated below this bull has been examined only for physical soundness and quality of semen. No special diagnostic tests were made for possible venereal disease or other infection.**

____
Veterinarian

Member: Society for Theriogenology

BE SURE TO REMOVE BLANK TISSUE BEFORE FILLING OUT THIS SIDE.

49942

CHARACTERISTICS	Ejaculates 1	2	3
Scrotal Circumference cm.			
Morphology % Primary Abnormalities			
% Secondary Abnormalities			
% Total Abnormalities			
Spheroids/ H.P. Field			
Non-germinal Cellular Material			
WBC RBC Epithelial Cells			
Scrotal Circumference Score			
Morphology Score			
Motility Score			
TOTAL SCORE			

CLASSIFICATION of SEMEN QUALITY
Check One (✓)
Satisfactory ______
Questionable ______
Unsatisfactory ______

COLLECTION METHOD
Check One (✓) EE. ______
AV. ______ Massage ______
Erection ______
Protrusion ______
Ejaculation ______

Indicate final classification on front of card. Be sure to remove blank before filling out other side.

PHYSICAL EXAMINATION - REMARKS General Condition Check One (✓) Good______ Fair______ Poor______

Vesicular Glands

Inguinal Rings

Vasa Deferentia

Viscera and Omentum

Opthlalmic

Feet and Legs

Testes

Epididymes

Vasa Deferentia

Spermatic Cord

Penis

Prepuce

Other

CLASSIFICATION of PHYSICAL CONDITION
Check One (✓)
Satisfactory ______
Questionable ______
Unsatisfactory ______

OTHER TESTS IF USED

Libido

Mating Ability

Cytogenetic and Other Special Tests

Other

INFORMATION
TABLES TO BE USED IN COMPUTING SCORES

Scoring Criteria		Ver Good	Good	Fair	Poor
Scrotal Circum. by Age	12-14 mos.	> 34 cm	30-34	< 30	< 30
	15-20 mos.	> 36 cm	31-36	< 31	< 31
	21-30 mos.	> 38 cm	32-38	< 32	< 32
	over 31 mos.	> 39 cm	34-39	< 34	< 34
SCORE FOR SCROTAL CIRCUMFERENCE:		40	24	10	10
SEMEN MORPHOLOGY	Primary Abnormalities	< 10	10-19	20-29	> 29
	Total Abnormalities	< 25	26-39	40-59	> 59
SCORE FOR MORPHOLOGY		40	24	10	3
Gross Motility		Rapid Swirling	Slower Swirling	Generalized Oscillation	Sporadic Oscillation
Individual		Rapid Linear	Moderate Linear	Slow Linear To Erratic	Very Slow Erratic
SCORE FOR MOTILITY:		20	12	10	3

BREEDING BULL MANAGEMENT*

Don Hudson, D.V.M.
Extension Veterinarian
University of Nebraska

The beef industry is demanding better management today, especially pertaining to breeding bulls. The management of bulls is often seen as involving simply the breeding soundness examination (BSE). Most beef cattle management programs we deal with center around the cows and heifers. This focus can lead to disastrous oversights. A single bull or a battery of bulls controls 50% or more of such important considerations as fertility, disease, color, total weight of production, and pelvic size of replacement heifers.

This presentation considers the proper use of a breeding soundness examination as part of the total bull program. Management factors, including breeding and postbreeding season management as well as bull selection criteria, are discussed.

Providing clients with sound advice on breeding bulls requires more information than a semen evaluation disguised as a breeding soundness examination. Libido, often not tested in range bulls, deserves consideration because it directly affects bull-to-female ratio. Reproductive diseases, such as trichomoniasis and infection with vibrio, should be addressed at the time of examination. Body condition score is as vital for physical and physiologic success in bulls as it is in cows and heifers. Structural confirmation of a bull as well as the expected progeny differences (EPD) are important in predicting how successful the animal will be in a beef program.

Selection Recommendations

As a means of controlling disease, only virgin bulls should be introduced into a herd. Testing for brucellosis and tuberculosis before purchase should be routine. Visual evaluation of normal and abnormal confirmation characteristics of the rear limbs and hooves greatly contributes to a bull's longevity and usefulness. Faults include weak pasterns and being bowlegged, cow-hocked, sickle-hocked, or post-legged. Traveling ability in the breeding pasture is essential for large range operations.

Data on expected progeny differences are available for bulls of most breeds. The veterinarian should recommend that these production and performance records be used when selecting bulls. Such records are the only means of evaluating a bull's genetic background for growth, maternal, and carcass traits. These considerations control decisions about changes of direction within a beef operation. Significantly, however, 70% to 80% of the variation measured in the performance of weanling and yearling bulls is environmentally controlled. Considerations also include nutritional management, parasites, and the effects of weather.

---

*Edited by and reprinted with permission from Dr. James W. Furman and Dr. Mark A. Hughes, The Animal Center, Alliance, NE; from The Compendium on Continuing Education for the Practicing Veterinarian, Vol. 11(1), pp 95-98, January 1989.

Selection of bulls ideally is made at least 60 to 90 days before the breeding season. Appropriate vaccination, isolation, worming, louse control, nutritional acclimation, and breeding soundness examination should be included in the adaptation process.

Because spermatogenesis requires 60 days for completion, this is the minimum period allocated for preparing bulls for the breeding season. To facilitate establishment of a social pecking order among the sires, exposure to mates in the herd is essential before bulls are turned out together. If this pecking order is not allowed to develop before the breeding season, the first 21 days of the season can be consumed in establishing the pecking order rather than in servicing the cows. This criterion is too often overlooked and can be responsible for the reproductive failures that we are later asked to explain.

Breeding Soundness Examination

The breeding soundness examination can be totally misleading if the timing of the evaluation is not related to such information as previous health history, environment, origin, breed, and recent breeding exposure. Recent infection, disease, or frostbite of the scrotum might give false results concerning the breeding value of a bull. Also, various breeds of bulls respond differently to semen collecting techniques. These conditions can affect the morphology of the semen sample collected, which accounts for 40% of the examination score.

Physical evaluation of the external and internal genitalia is essential. Scrotal circumference varies between breeds and is subject to the age and weight of the bull. Scrotal circumference also accounts for 40% of the breeding soundness examination score and should be measured until the evaluator's measurements are repeatable (Table 1 and 2).

To clean the rectum of a bull before palpation, we use a dose syringe with a ball nozzle to give a warm soapy enema. This technique permits easier palpation of the vesicular glands as well as giving mild stimulation to the bull and facilitating better electrical contact between the probe and the rectal tissues. Pathology (disease) of the vesicular glands is almost exclusively restricted to hypoplasia and aplasia (developmental) and infectious conditions (which can be acute or chronic).

The remaining 20% of the examination score involves progressive motility of sperm. When semen leaves the environment of the bull's reproductive tract, it starts a rapid and progressive deterioration. Heat shock or cold shock as a result of poor equipment or marginal environmental temperatures can have dramatic effects on motility and morphology. This type of sperm shock can give false values to the examination score and can affect the projected breeding value of a bull.

Breeding soundness examination does <u>not</u> predict the fertility of a bull but simply determines that the animal has an adequate number of normal, motile spermatozoa as well as acceptable scrotum and testicles. Similarly, the practitioner cannot predict the semen picture at any other time, before or after the semen evaluation. Clinical evidence suggests, however, that if the semen is normal today, it will be normal in the short-term future if disease or testicular insult does not occur.

Knowledge of the herd status helps in evaluating vaccination and health recommendations that must be monitored or tested during the breeding soundness examination. In a closed herd, introduction of animals is restricted primarily to breeding bulls. In a modified open herd, (1) the addition of new animals takes place on a limited basis, such as by herd expansion or replacement with purchased additions; (2) individual animals are moved into and out of the herd, as with livestock exhibitions; or (3) adult animal-to-animal contact can occur with adjoining herds. An open herd is highly susceptible to viral and bacterial reproductive pathogens. Potential exposure arises from introduction of purchased replacements on a routine basis as a result of such management practices as direct interaction or commingling of the breeding herd with recently purchased, stressed stocker calves in pasture or pen situations.

Testing for trichomoniasis has become an essential part of the breeding soundness examination for all bulls introduced into a herd from outside. The disease is believed to be more prevalent in older bulls because of the epithelial crypt development of the glans penis and the prepuce as bulls age. Young bulls have tested positive in our practice, however. The liability of omitting this test while conducting breeding soundness examinations on positive bulls is yet to be determined.

Pelvic measurement is an evolving technology that is directly correlated with dystocia and that deserves consideration during the examination. Research demonstrates that yearling pelvic size is the most reliable factor indicating potential dystocia in heifers. Research indicates a 0.60 genetic correlation between male and female pelvic areas, suggesting that selection for pelvic size in bulls should result in increased pelvic size of female offspring. Purebred producers are beginning to report pelvic size of bulls at production sales, and commercial producers are asking for these measurements.

Breeding soundness examinations should be recommended annually and are required if a bull is being used alone on cows or heifers. Examination is especially important in evaluating bulls older than five years. An older bull is often dominant in the breeding pasture and will service as many as 80% of the cows. Older bulls also have a greater tendency to harbor trichomoniasis infection.

Breeding Season

The breeding season should be established with consideration for weather environment at the time of breeding and at calving. This consideration helps to ensure the best reproductive conception and minimal losses at calving. Other considerations include the ages of the bulls and the pasture sizes. Bull and cow fertility is affected by climate. Heat is especially detrimental to libido and sexual activity and can drastically influence the number of cows that conceive in a particular 21-day breeding cycle. Ideally, more than 60% of females will conceive each 21-day cycle. This is chief among the factors that have a significant effect on herd performance and profitability.

The use of yearling bulls is economically sound and has become common practice in our region. These bulls, however, require close management and should probably be used on a rotation system to provide a rest period every two to three weeks.

Recommendations for the ratio of bull to breeding females vary from 1:10 to 1:60. Under range conditions, with a limited breeding season, it is common to use a 1:25 ratio. If yearling bulls are used, the ratio can be 1:15 or 1:20.

The producer must continually observe bulls during the breeding season to monitor libido, settling rate of females, and servicing status of bulls. Social pecking order and physical incapability to serve (as a result of hematoma or spiral or ventral deviation of the penis) can be detected. Penile deviation develops in some three- and four-year-old bulls. After one to two years of satisfactory service, such bulls can develop deviations that prevent intromission. These defects and similar problems can be detected only by observing mating. Such observation gives the first indication of the success or failure of the breeding program.

We strongly recommend that clients leave bulls with the herd for 10 days to 2 weeks past the optimum breeding period. If necessary, late-breeding cows and heifers can be identified and removed from the herd at pregnancy examination time. This practice helps prevent too many females from being open because they were too young to cycle or because the postpartum period was too short to allow complete uterine involution before the breeding season started. Other causes also can delay conception in the herd.

Postbreeding Season

All bulls should be removed from the breeding pasture at the end of the breeding period. Aggressive bulls will continue to lose weight if left with females after they have conceived. The bulls must be fed so that they return to good body condition before winter. This involves isolating bulls in a pasture that prevents continued access to cows in estrus as well as feeding a buildup ration (similar to the feedlot ration) to ensure that the protein and energy requirements of bulls are met and that prebreeding weight is restored as rapidly as possible. Nutrition, a vital factor in bull performance, is discussed in the literature. As with the requirements of other classes of cattle, the nutrient requirements for bulls are described by the National Research Council.

Conclusions

Bull management is clearly a distinct and crucial consideration in successful production herd health medicine. Through proper genetics and breeding soundness, a few bulls can have a tremendous impact on an entire cow herd. It is therefore imperative to conduct regular individual bull evaluation in addition to the breeding soundness examination; such evaluation is at least as important to breeding success rate as is individual cow evaluation. The importance of proper bull selection and testing cannot be overemphasized as both factors are economically essential to today's beef industry.

Table 1. Scrotal circumference (in cm) of various breeds compared by age.

Age (mo)	Angus	Charolais	Horned Hereford	Polled Hereford	Simmental	Limousin	Santa Gertrudis	Average	Brahman[a]
Less than 14	34.8 (125)[b]	32.6 (240)	33.0 (244)	34.8 (15)	33.4 (65)	30.6 (68)	34.0 (71)	33.1 (828)	21.9 (73)
14 to 17	35.9 (73)	35.4 (294)	32.2 (44)	34.2 (75)	36.5 (9)	31.7 (13)	35.3 (27)	35.0 (535)	27.4 (34)
17 to 20	36.6 (271)	34.5 (226)	34.1 (62)	34.9 (181)	—	32.0 (3)	35.5 (72)	35.3 (815)	29.4 (260)
20 to 23	36.9 (125)	34.9 (66)	36.2 (9)	34.9 (71)	—	33.9 (5)	36.7 (63)	36.0 (339)	31.4 (16)
23 to 26	36.7 (161)	34.6 (55)	33.4 (79)	34.8 (57)	36.0 (2)	—	36.5 (40)	35.4 (394)	31.7 (21)
26 to 30	36.3 (9)	36.2 (19)	33.8 (10)	35.0 (15)	—	—	36.4 (15)	35.6 (68)	33.5 (2)
30 to 36	36.6 (55)	37.1 (15)	35.2 (85)	35.6 (12)	—	—	38.3 (12)	36.0 (179)	34.7 (9)
More than 36	38.2 (68)	38.1 (29)	34.0 (87)	36.4 (20)	37.2 (4)	35.5 (4)	40.5 (12)	36.4 (224)	36.7 (22)

[a] The Brahman breed is separated because the data were obtained from Texas A&M University, whereas the data on the other breeds originated at Colorado State University and the University of Missouri.
[b] Numbers in parentheses indicate number of bulls measured.

Table 2. Scrotal circumference (in cm) of various breeds compared by weight.

Weight (lb)	Angus	Charolais	Horned Hereford	Polled Hereford	Simmental	Limousin	Average
400 to 900	35.2 (5)[a]	30.4 (26)	30.8 (38)	30.9 (9)	33.5 (7)	29.2 (32)	30.6 (117)
900 to 1000	33.1 (10)	30.8 (22)	32.9 (41)	32.9 (7)	32.1 (24)	32.4 (14)	32.2 (118)
1000 to 1100	36.4 (37)	31.8 (65)	34.3 (28)	34.6 (13)	33.9 (25)	30.1 (4)	33.7 (172)
1100 to 1200	36.8 (75)	32.9 (85)	35.4 (12)	34.1 (56)	36.2 (7)	33.0 (2)	34.6 (237)
1200 to 1300	37.3 (122)	33.8 (106)	35.6 (22)	35.2 (108)	---	---	35.5 (358)
1300 to 1400	37.5 (77)	35.2 (64)	36.2 (13)	35.4 (89)	38.1 (4)	---	36.1 (247)
1400 to 1500	37.6 (30)	35.6 (43)	36.7 (5)	35.7 (21)	---	---	36.3 (99)
1500 to 3000	40.0 (8)	37.7 (39)	---	36.8 (9)	---	---	37.9 (56)

[a] Numbers in parentheses indicate number of bulls measured.

NebGuide

PUBLISHED BY COOPERATIVE EXTENSION SERVICE
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
UNIVERSITY OF NEBRASKA-LINCOLN

G80-536

Reproductive Tract Anatomy and Physiology of the Bull[1]

Gene H. Deutscher
District Extension Specialist (Livestock)

Good reproductive performance of a bull is necessary to obtain a high percent calf crop. A bull must be fertile and capable of servicing a large number of cows during a short breeding season for optimum production. Understanding the anatomy and physiology of the bull's reproductive tract is beneficial for proper management. A basic knowledge of the reproductive system will also help the producer to understand fertility examinations, reproductive problems and breeding impairments.

Anatomy and Physiology

The reproductive tract of the bull consists of the testicles and secondary sex organs which transport the spermatozoa from the testicle and eventually deposit them in the female reproductive tract. These organs are the *epididymis, vas deferens* and *penis,* and three accessory sex glands—the *seminal vesicles, prostate* and *Cowper's gland.* This basic anatomy is illustrated in *Figure 1.*

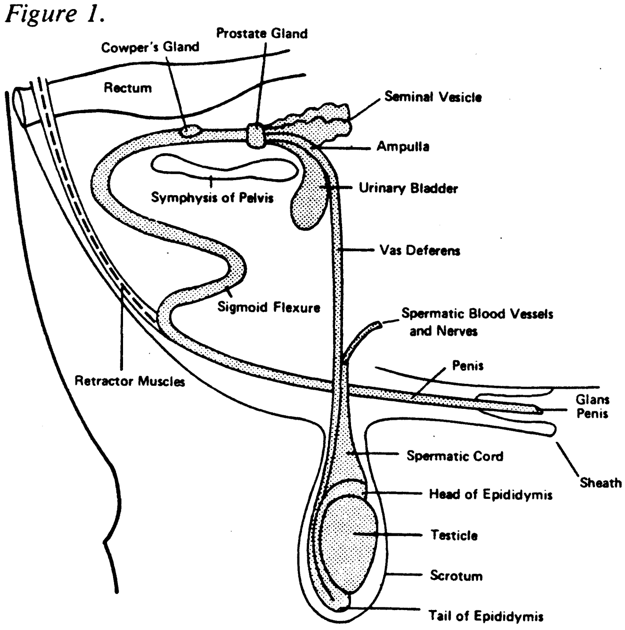


Figure 1. Diagrammatic drawing of the reproductive tract of the bull.

The testicle has two very vital functions: (1) producing the *spermatozoa,* and (2) producing the specific male hormone, *testosterone.* The testicles are located outside of the body cavity in the scrotum. This is essential for normal sperm formation which occurs only at a temperature several degrees below normal body temperature. However, very cold temperatures can also damage the testicle. The scrotum, therefore, helps to protect the testicle against both extremes of temperature. This is done by means of a temperature sensitive layer of muscle (cremaster muscle) located in the walls of the scrotum, which relaxes when hot and contracts when cold. Relaxation increases the relative length of the scrotum, thus moving the testicles away from body heat. In cold weather just the reverse happens—the scrotum shortens and the testicles are held close to the warm body.

One or both testicles occasionally fail to descend into the scrotum during embryological development, and are retained in the body cavity. Such males are referred to as *cryptorchids.* Since body heat can destroy sperm producing ability, no sperm are produced by the retained testicle. If one of the testicles descends into the scrotum, it will function normally and usually produces enough sperm so that the male will be of near normal fertility. However, since this condition appears to have a hereditary basis, such males should not be used for breeding. If both testicles are retained, the male will be sterile.

Hormone production is usually near normal in the cryptorchid testicle and the male develops and behaves like a normal male. If this retained testicle is not removed at the time of castration, the male will develop the secondary sex characters of an uncastrated male. This operation is not as simple, nor as safe, as removing testicles that are in the scrotum. Therefore, it is recommended to select against this trait by culling cryptorchid males.

[1] Adapted from Great Plains Beef Handbook Fact Sheet GPE-8450 by E. J. Turman and T. D. Rich, Oklahoma State University.

In addition to cryptorchidism, there are other circumstances which may cause sterility by raising the temperature of the testicle. These include excessive fat deposits in the scrotum; several days of very high fever; and exposing the males for extended periods to very high environmental temperatures. If the male was producing sperm prior to exposure to such conditions, and the period of exposure was not too prolonged, the resulting sterility is generally only temporary (6 to 10 weeks) and, if the conditions are corrected, normal fertility will eventually return.

The testicle contains many long, tiny, coiled tubes, the *seminiferous tubules,* within which the sperm are formed and mature. Scattered throughout the loose connective tissue surrounding the seminiferous tubules are many highly specialized cells, the *interstitial cells of Leydig,* that produce the male hormone.

There are many hundreds of individual seminiferous tubules in the testicle. These unite with one another until eventually some dozen tubules pass out of the testicle into the head of the epididymis.

The epididymis is a compact, flat, elongated structure closely attached to one side of the testicle. In it the dozen or so *vasa efferentia* from the testicle combine into a single tubule some 130 to 160 feet (40 to 49 m) in length, which is packed into the relatively short epididymis. This tubule eventually emerges from the tail of the epididymis as a single straight tubule (the *vas deferens)* and passes as part of the spermatic cord through the inguinal ring into the body cavity.

It requires 45 to 50 days for sperm to form in the seminiferous tubules and move through the epididymis where they mature for ejaculation. About one week of this time is spent in the epididymis, a period of time that appears to be necessary for the sperm cells to mature into fertile sperm. The sperm in the testicle are much more sensitive to damage from heat than are those that have already been formed and are stored in the epididymis. This may result in a slight delay between the time a male is exposed to some unfavorable condition and the time his fertility is reduced. However, this period of reduced fertility may then last for the 45 to 50 days required to produce a new sperm cell. This may explain why a male may settle females for a week or so after recovering from a high fever and then go through an infertile period of several weeks.

The epididymis is a single tube which serves as an outlet for all the sperm produced in the testicle and any blockage of this tube is a serious matter. Sometimes there is a temporary blockage due to swelling following an injury or infection *(epididymitis)* as shown in *Figure 2.* However, this swelling or infection occasionally results in the formation of scar tissue in the tubule, permanently blocking it and preventing the passage of sperm.

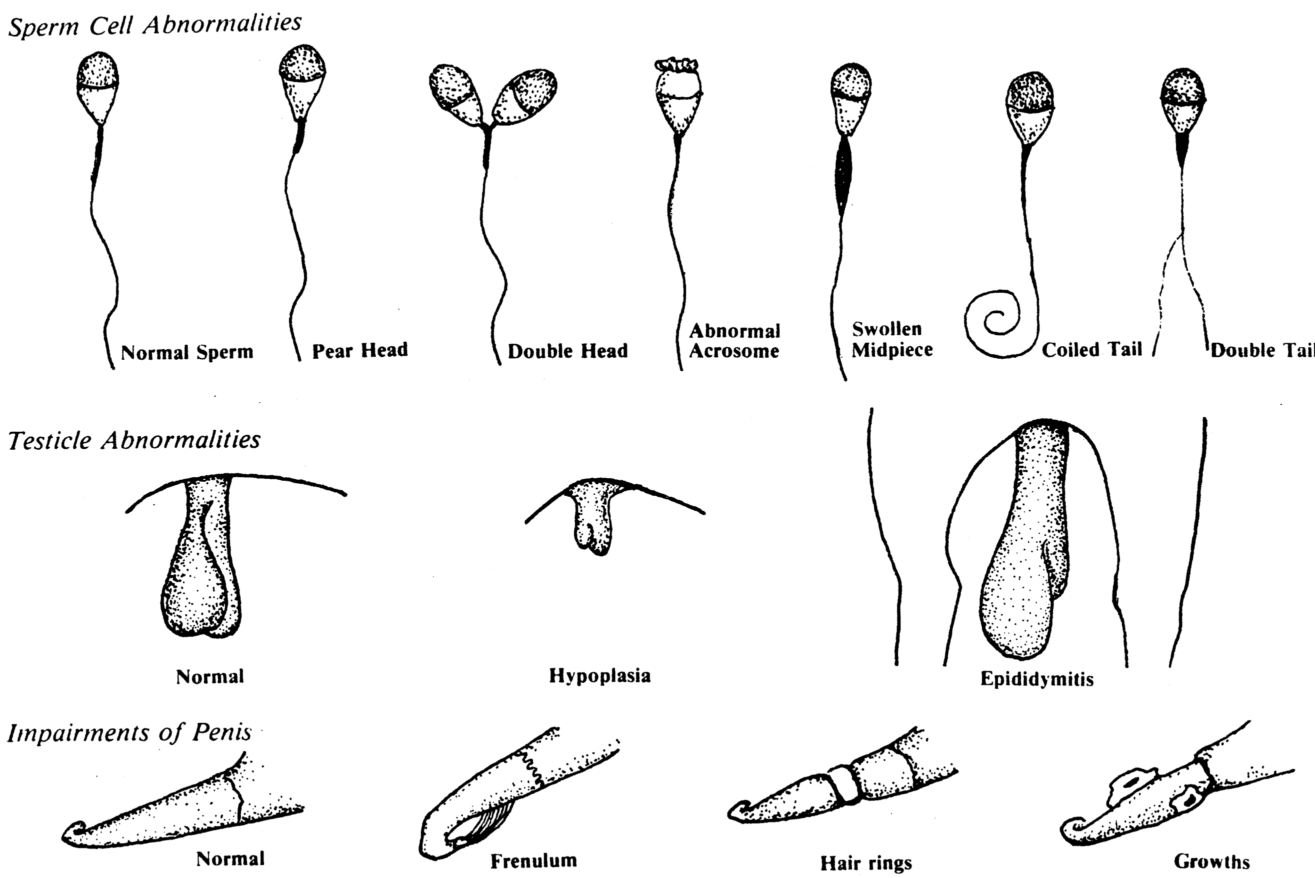


Figure 2. Diagrammatic sketches of some abnormalities and impairments of sperm cells, testicle and penis.

In addition to the vas deferens the spermatic cord includes the blood vessels and nerves supplying the testicle and the supporting muscles and the connective tissue. Males may be sterilized by an operation called a vasectomy in which the vas deferens are cut so that sperm cannot pass to the outside of the body. If only the vas deferens is cut, the testicle continues to function normally, producing both sperm and male hormone. However, if the blood vessels of the spermatic cord are cut or blocked, shutting off the blood supply, the testicle will stop functioning and waste away.

One of the weak spots of the male anatomy is the *inguinal ring,* the opening through which the spermatic cord passes into the body cavity. If it enlarges, usually as a result of an injury, a loop of the intestine can pass into the scrotum, resulting in a scrotal hernia. Since predisposition to injury at this point appears to have a hereditary basis, males with scrotal hernias should not be used for breeding even though they may be of normal fertility.

The two vas deferens eventually unite into a single tube (the *urethra)* which is the channel passing through the penis. The urethra serves as the common passage way for the excretory products of the two male tracts—semen of the reproductive tract and urine of the urinary tract.

Two of the accessory glands are found in the general region where the vas deferens unite to become the urethra. These glands produce the secretions that make up most of the liquid portion of the semen. In addition, the secretions activate the sperm to become motile.

The largest of these, and the one producing the largest fraction of the seminal fluid, is the *seminal vesicles.* They consist of two lobes about 4 to 5 inches (10 to 12 cm) long, each connected to the urethra by a duct. Another accessory gland in this region is the *prostate* gland, which is located at the neck of the urinary bladder where it empties into the urethra. The prostate is poorly developed in the bull and does not produce a very large volume of secretion.

The third accessory gland, the *Cowper's glands,* are small, firm glands located on either side of the urethra. It is believed that one of the chief functions of their secretion is to cleanse the urethra of any residue of urine which might be harmful to spermatozoa. The clear secretion that often drips from the penis during sexual excitement prior to service is largely produced by these glands.

One of the accessory glands may occasionally become infected, resulting in semen samples that are yellow and cloudy and which contain many pus cells. It is not uncommon in bulls for the seminal vesicles to be so affected *(seminal vesiculitis).*

The sigmoid flexure is an anatomical structure that provides the means by which the penis is held inside the body and sheath except during time of service. Strong retractor muscles serve to hold the penis in the "S" shaped configuration. Occasionally these muscles are too weak to function properly and a portion of the penis and sheath lining protrude at all times. This exposes the male to the danger of mechanical injury, particularly in rough, brushy country, or on ranges where there is considerable cactus and prickly pear.

The penis is the organ of insemination. In all domestic animals it consists of two cylindrical bodies called the *corpora cavernose penis.* The spaces of the corpora cavernosa become filled with blood during sexual excitement, resulting in erection of the organ. The end of the penis is the glans penis. The glans penis is richly supplied with nerves and is the source of the sensations associated with copulation. Impairments of the glans penis may exist *(Figure 2)* and should be corrected during a fertility exam.

Semen

Semen consists of the spermatozoa and a liquid composed largely of the secretions of the accessory glands. The volume of semen and the number of sperm ejaculated by different bulls varies considerably. However, most bulls will ejaculate 3 to 5cc of semen containing about 1 billion sperm per cc, or 3 to 5 billion sperm per ejaculate.

Once sexual maturity is reached in farm animals, sperm production is continuous throughout the remainder of their reproductive life. During periods of sexual rest old sperm in the epididymis die, degenerate and are absorbed. For this reason, the first sample collected after a long period of sexual inactivity may appear to have a high percentage of dead and abnormal sperm. Therefore, semen evaluation of a bull should not be made on one collection alone.

Semen evaluation is being practiced more and more. However, it should be realized that its primary value lies in detecting males that have very definite semen deficiencies such as no sperm, a very low number of sperm cells, poor motility, large number of abnormal sperm *(Figure 2),* a large percentage of dead sperm, and the presence of large amounts of pus. Males producing semen of this sort will usually be sterile or of low fertility. However, there is a wide range of semen quality in males of normal fertility, and it is difficult to predict the level of fertility in a male that does not have grossly deficient semen.

Hormonal Regulation of the Male Reproductive System

The normal functioning of the male in reproduction is largely controlled by hormones. Produced by a specialized gland called an endocrine gland, a hormone is a specific chemical substance which passes into the body fluids (blood and lymph) and is transported to various parts of the body where it produces some specific effect.

The testicle functions as an endocrine gland because of the production of the male hormone, *testosterone,* by the interstitial cells. Testosterone has several major effects:

1. It is largely responsible for the development and maintenance of the male reproductive tract.
2. It causes the development and maintenance of the secondary sex characteristics associated with "masculinity," such as the crest and heavily muscled shoulders of the bull, the spur and comb of the rooster, the tusks of the boar, and the growth of the beard and change of voice in man.
3. It is a major factor in normal sex drive and behavior of the male.
4. It increases muscular and skeletal growth.
5. It is essential for normal sperm formation.

The testicle is, in turn, under the influence of hormones produced by other glands in the body. The primary hormones regulating the testicle are the *gonadotropic hormones* produced by the anterior lobe of the pituitary gland. The pituitary gland is a small gland located under the brain at the base of the skull. The pituitary hormones regulating reproduction in both the male and the female (by stimulating the testes or ovaries) are called gonadotropic hormones.

Not only is the hormonal production by the testicle regulated by hormones released by the anterior pituitary but the reverse is also true. The level of testosterone in the blood regulates the secretion of the gonadotropic hormones by means of a feedback mechanism.

Purified preparations of gonadotropic hormones or preparations with a similar physiological action are available for use by veterinarians. They can be useful in treating some cases of reproductive failures, *but only if the problem is caused by a deficiency of that hormone.*

Because of the feedback mechanism controlling hormone release, normal functioning depends on a proper balance of the hormones and too much can be just as undesirable as too little. The use of hormone therapy should not be routinely carried out, and should be done only by qualified persons, with the expectation that they may not be of benefit.

EXTENSION WORK IN "AGRICULTURE, HOME ECONOMICS AND SUBJECTS RELATING THERETO,"
THE COOPERATIVE EXTENSION SERVICE, INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES,
UNIVERSITY OF NEBRASKA-LINCOLN, COOPERATING WITH THE COUNTIES AND THE U.S. DEPARTMENT OF AGRICULTURE
LEO E. LUCAS, DIRECTOR

File Under: BEEF
B-9, Breeding & Reproduction
Issued December 1980, 15,000

NebGuide

G88-895

Pelvic Measurements for Reducing Calving Difficulty

Gene H. Deutscher, Extension Beef Specialist

This publication discusses the importance and use of pelvic measurements in heifers and bulls to assist in reducing the incidence and severity of calving difficulty.

Calving difficulty results in a major economic loss to beef producers. This loss is estimated at $25 million annually in Nebraska.

Calving difficulty increases calf death loss, cow mortality, labor and veterinary costs; it delays the return of cows to estrus and reduces conception rates. It also lowers calf weaning weight and market value, which results from breeding practices of young heifers and cows due to bull selection for reducing calving difficulty.

Studies show calf losses of 4 percent within 24 hours of birth for calves born unassisted, compared to 16 percent for calves requiring assistance. Montana research indicates 57 percent of all calf losses were due to dystocia (calving difficulty).

Calving difficulty is becoming a greater concern for beef producers because of increased emphasis on rapid growth rates, heavier weaning weights and improving cow efficiency. As producers select bulls for more growth, larger calves at birth and more calving difficulty can be expected.

Importance of Pelvic Measurements

Many factors are associated with calving difficulty, including: small first calf heifer; large fetus; male fetus; small pelvic size of dam; long gestation; heavy birth weight sire; dam too thin or too fat, and abnormal fetal presentation at calving. Research indicates the major cause of dystocia is a disproportion between the calf size at birth (birth weight) and the cow's birth canal (pelvic area).

Figure 2 shows the relationship of calf birth weight and cow pelvic area to the incidence of dystocia in two-year-old heifers in a study in Montana. An Oklahoma study showed calves born unassisted were seven pounds lighter at birth, compared to those born with assistance. Heifers with small pelvic areas experienced an 85 percent difficulty rate compared to 31 percent difficulty for heifers with large pelvic areas. South Dakota research showed heifers with below average pelvic areas (less than 140 cm^2) had twice the incidence of dystocia as those with above average pelvic areas (49 percent versus 24 percent).

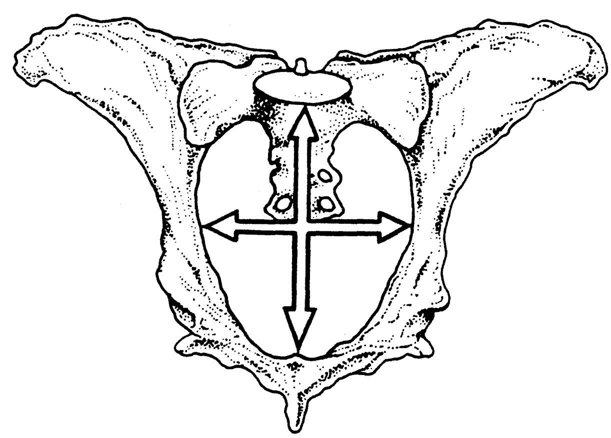


Figure 1. Vertical and horizontal measurements are obtained to determine pelvic area.

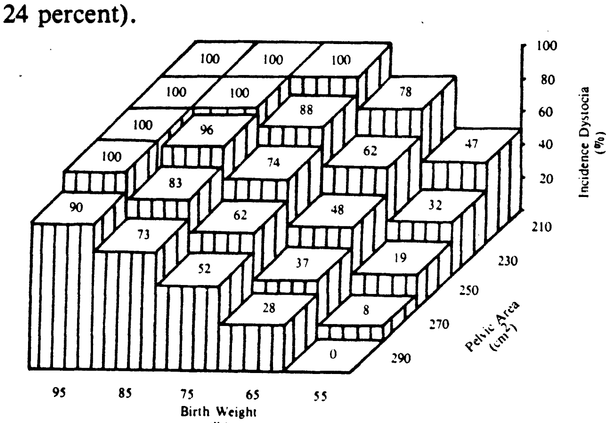


Figure 2. Relationship of heifer pelvic area, calf birth weight and incidence of dystocia in 600 two-year-old heifers. (Bellows 1983)

Large frame cows tend to have large pelvic areas, but also have proportionately heavier calves at birth, which offsets any advantage of less calving difficulty. Selecting on cow size alone seems ineffective.

A low relationship has been found between a heifer's pelvic area and the birth weight of her calf. Selecting heifers with a large pelvic size, rather than by body weight alone, should be advantageous and should not increase calf birth weight.

In general, heifer weight and age have a positive relationship to pelvic area, but weight is not always a good indicator. Two heifers of equal weights can have considerably different pelvic areas.

External dimensions such as width of hooks and length of rump are not good indicators of pelvic area or calving difficulty. Neither are slope of rump and pelvis structure. Research shows that pelvic area has the most influence on dystocia of all cow measurements evaluated.

The best time for identifying heifers with a high potential for dystocia is before breeding. Pelvic area has been found to be the most reliable yearling trait indicating potential difficulty. Studies show that pelvic area growth is linear from nine to 24 months in heifers calving at two years of age. Obtaining pelvic measurements on yearling heifers and culling those with small pelvic areas can reduce dystocia.

Pelvic Area and Calf Birth Weight Relationship

Research shows that calf birth weight in relation to the cow's pelvic area determines the degree of calving difficulty. Using research data from South Dakota and Nebraska, a pelvic area and calf birth weight ratio (factor) has been developed. The ratio was derived by dividing the heifer's pelvic area by the calf birth weight she delivered. *Figure 3* shows that as the ratios decreased, the degree of calving difficulty increased.

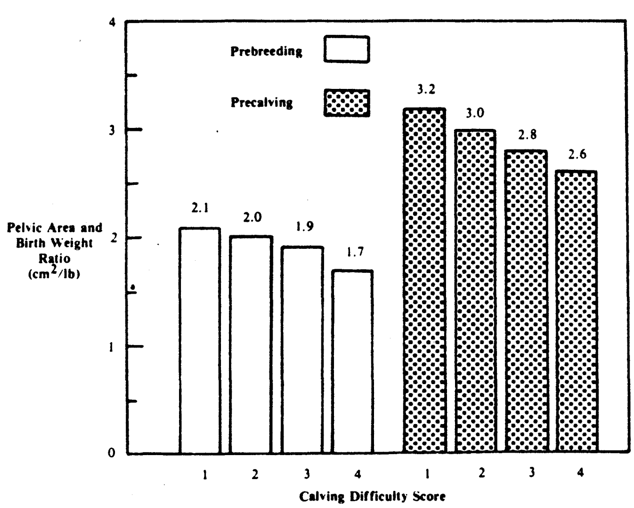


Figure 3. **Pelvic area and calf birth weight ratios prebreeding and precalving in relation to calving difficulty scores. (Scores were 1 - no assistance, 2 - slight assistance, 3 - moderate assistance, 4 - major assistance or C-section.) (Deutscher 1988)**

Heifers with ratios of 2.1 or greater before breeding had little or no calving difficulty, while heifers with ratios of 1.9 or less required substantial assistance using a calf puller. These ratios are useful in predicting which heifers may require assistance delivering a certain size calf.

Pelvic measurements can be obtained on a heifer before breeding and the pelvic area divided by a ratio (factor) of 2.1 to estimate the calf birth weight the heifer can deliver as a two-year-old without having substantial difficulty. For example *(Table 1)*, a 600 lb yearling heifer with a pelvic area of 140 cm^2 should be able to deliver, as a two-year-old, a 67 lb calf without difficulty ($140 \div 2.1 = 67$). Heifers with larger pelvic areas can deliver larger birth weight calves. However, a heifer with a smaller pelvic area such as 120 cm^2 probably would require a Caesarean to deliver a 75 lb calf ($120 \div 75 = 1.6$ ratio) as shown in *Figure 3*.

Pelvic measurements can be obtained at the time of pregnancy exam but the ratio (factor) of 2.7 should be used to estimate calf birth weight of 18 to 19 month old, 800 lb heifers *(Table 1)*. If heifers vary considerably in weight at the time of obtaining the measurements, different ratios should be used. *Table 2* shows the ratios (factors) to be used for various weights and ages of heifers. These ratios appear to be good indicators of dystocia, with an accuracy of about 80 percent.

Using Heifer Pelvic Measurements

If pelvic measurements are obtained before breeding, potential problem heifers with a small pelvic size can be culled from the herd. Heifers with a large pelvic area can be mated to bulls for larger calves. Since the larger, heavier heifers do not always have the largest pelvic area, all heifers should be measured and mated according to pelvic size.

Research indicates that a normal 600 pound yearling heifer should have a pelvis at least 11 cm wide and 12 cm high to deliver a 63 pound calf. Heifers with a smaller width or height dimension should be considered for culling.

Average pelvic area growth has been calculated at 0.27 cm^2/day from yearling to two years of age in heifers, and continues at a slower rate until the cow reaches maturity. Some producers may wish to adjust pelvic areas of heifers to a standard 365 days of age. This can be accomplished by using the growth factor of 0.27 cm^2/day.

However, in a group of puberal heifers, no adjustment is warranted, since all heifers theoretically could become pregnant early in the breeding season and have about the same number of days to develop before calving. Heifers with small pelvic areas as yearlings usually have the smallest pelvic areas at calving.

Pelvic measurements should be taken two to three weeks before the breeding season and can be incorporated into a total heifer management program. This pro-

Table 1. Using Pelvic Measurements to Estimate Deliverable Calf Size (Birth Weight)

Time of Measurement	*Heifer Age, mo.*	*Heifer Wt, lb*	*Pelvic Area, cm^2*	*Pelvic Area/ Birth Wt Ratio*	*Estimated Calf Birth Wt, lb*
Before breeding	12-13	600	140	2.1	67
			160	2.1	76
			180	2.1	86
Pregnancy exam	18-19	800	180	2.7	67
			200	2.7	74
			220	2.7	82

Table 2. Pelvic Area/Calf Birth Weight Ratios for Various Heifer Weights and Ages to Estimate Deliverable Calf Birth Weight

Heifer	*Age at measurement, months*			
Weight, lb	*8-9*	*12-13*	*18-19*	*22-23*
500	1.7	2.0	---	---
600	1.8	2.1	---	---
700	1.9	2.2	2.6	---
800	---	2.3	2.7	3.1
900	---	2.4	2.8	3.2
1000	---	2.5	2.9	3.3
1100	---	---	---	3.4

gram involves selecting heifers for breeding by size and type, obtaining pelvic measurements, palpating for ovarian development (puberty), and vaccinating for reproductive diseases, all during one processing through the chute.

Such a program helps ensure that a high percentage of the heifers are cycling and could become pregnant early in the breeding season, and should result in reduced incidences of dystocia. The program also would aid in an estrous synchronization and AI program by determining the percentage of heifers cycling, and assist in sire selection for reducing difficulty.

If heifers are measured at the time of pregnancy examination, small problem heifers could be culled, or aborted and sold as feeders. Bred heifers predicted to have a potential problem also could be marked for close observation at calving.

Heritability of Pelvic Area

Research estimates the heritability of pelvic area to range from 36 percent to 68 percent, with an average of 55 percent. These values indicate that pelvic area is a highly heritable trait and may be higher than the 45 percent heritability of calf birth weight. This means both traits will respond rapidly to selection. Birth weight does not appear to be correlated with pelvic area, so selection for pelvic size should not give a corresponding increase in birth weight. By selecting both bulls and heifers for pelvic size, a herd of cows with large pelvic areas could be developed.

Using Bull Pelvic Measurements

Pelvic size can be transmitted readily from the sire to the resulting progeny. In a Colorado study, a 0.60 genetic correlation was found between male and female pelvic areas, indicating selection for large pelvic size in bulls should result in increased pelvic size of daughter offspring.

Nebraska research on 915 yearling bulls indicated only small differences in average pelvic size among breeds, but a large variation existed among bulls within a breed. For example, two yearling Simmental bulls of similar age and weight had pelvic areas that differed by 60 cm^2 (160 vs 220 cm^2). Bulls of some blood lines appear to have larger pelvic areas than others.

Pelvic areas of bulls are smaller than heifers of the same weight and age. Yearling bulls weighing 900 to 1,100 pounds average about 150 to 170 cm^2 in pelvic area, which is similar to yearling heifers weighing 650 to 700 pounds.

Age and weight of bulls influence pelvic area. Estimates of pelvic growth rates have been 0.31 cm^2/day of age and 0.09 cm^2/pound of body weight in bulls ranging from 10 to 15 months old and 700 to 1,400 pounds. These values can be used to adjust a set of bulls to a given standard, but ***both*** age and weight adjustments ***should not*** be used on the same bull.

Pelvic areas should be adjusted to an average weight or age of bulls in the group so comparisons on genetic potential can be made. For example, if the average weight of a group of bulls is 1,000 pounds, then the adjusted pelvic area (PA) of a bull is: Adj. PA = actual PA + .09 x (1,000 minus actual weight).

Seedstock producers are beginning to report pelvic area of bulls along with other reproduction and performance traits. This information allows buyers to select bulls with various traits important to their herd, including pelvic area.

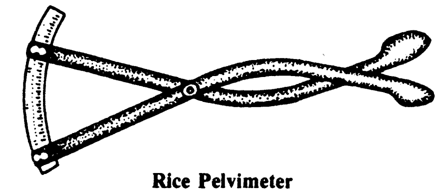
The best time to measure bulls is when they are yearlings, or at the end of their performance feeding test. The measurements can be obtained by a veterinarian in combination with the breeding soundness exam (fertility evaluation).

How to Measure Pelvic Area

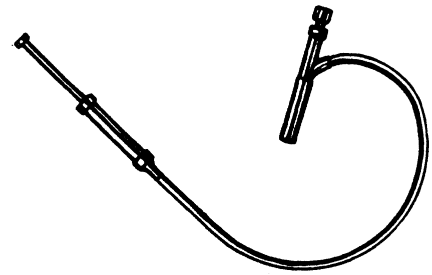
Pelvic measurements can be obtained with either of two instruments *(Figure 4)*. The Rice Pelvimeter is a metal inside-caliper-type instrument (Lane Manufacturing, 2075 So. Balentia St., Unit C, Denver, Colorado 80231) available for about $100. The Bovine Pelvic Meter (Jorgensen Labs, Inc., 2198 West 15th St., Loveland, Colorado 80538) is a hydraulic-type meter with a cylinder connected to a recorder by a flexible tubing. This meter costs about $275. Instructions for operating each of the instruments should be read and followed. Each instrument is designed to be placed in the rectum of the animal and the pelvic measurements are read on a scale outside the animal.

Measurements may be obtained by a veterinarian or experienced producer; a thorough understanding of the birth canal, pelvic structure and reproductive tract is needed. Practice and experience are necessary before accurate measurements can be obtained. Veterinarians in Nebraska are providing the measurement service for a nominal fee ($1.25 to $3 per animal, depending on size of group).

The general procedure is to restrain the animal in a chute with light squeeze. A comfortable, normal standing position is best. Feces should be removed from the rectum and the instrument carefully carried into the rectum with the hand. Use of undue force should be avoided during the procedure, since tissues can be torn or injured. Proceed forward with instrument to the pelvic inlet.



Rice Pelvimeter



Krautmann - Litton Bovine Pelvic Meter

Figure 4. Instruments to measure pelvic area in cattle.

Obtain the width of the pelvic inlet at its ***widest*** point, between the right and left shafts of the ilium (*Figure 1*, see page 1). This is the horizontal diameter of the pelvis. Then obtain the height of the pelvic inlet, between the dorsal pubic tubercle on the floor of the pelvis and the sacrum (spinal column) on the top *(Figure 1)*. Be sure to not slip off the pubic tubercle ventrad or miss the spinal column dorsad. This measurement should be the ***smallest*** dimension between these points and is the vertical diameter of the pelvis. The two measurements are read in centimeters and multiplied together to give the pelvic area in square centimeters.

Conclusion

The relationship of calf birth weight to heifer pelvic area is the major factor influencing the degree of dystocia. Heifers can be selected for large pelvic area to reduce the incidence of dystocia. Pelvic area is highly heritable so selecting breeding bulls with large pelvic areas can increase pelvic size of heifer offspring.

File under: BEEF
B-15, Breeding & Reproduction
Issued December 1988, 10,000

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture
Leo E. Lucas, Director of Cooperative Extension Service, University of Nebraska, Institute of Agriculture and Natural Resources.

Feeding Your Cows by Body Condition

Larry R. Corah, Kansas State University Extension Beef Specialist
(on sabbatical, Colorado State University)

Patricia L. Houghton, Area Extension Livestock Specialist
Kansas State University

Ronald P. Lemenager
Department of Animal Sciences and Industry
Purdue University

Introduction

Numerous factors influence the profitability of a commercial beef cattle operation. These factors can be grouped into four principal areas: (1) calf weaning weights, (2) percent of cows weaning calves, (3) cost of maintaining the cow per year, and (4) price of calves.

When the components of each of these four profit factors are analyzed, feed cost is one of the key items influencing profitability. Therefore, as we focus on low-cost production systems in the future, feed costs become a key component. An example of how feed costs influence profitability comes from Iowa State University through their beef cow business records system. Through the use of this system, researchers were able to compare the profitability of the top one-third of Iowa herds to the bottom one-third. When compared, higher profit producers had an average annual cow cost of $296.80 compared to an annual cow cost of $413.40 for lower profit producers. Of this $116.60 difference, 35 percent was due to differences in feed and pasture. In addition, these data pointed out that the more profitable cow herds produced an average of 121 additional pounds of calf per cow and had a 3.7 percent higher calf crop even though $40 less were invested in feed and pasture.

Nutritional Requirements of the Cowherd

Producers must recognize the nutritional requirements of cows and how these requirements change during the course of the year. Size of the cow, stage of production, level of production, environment, and body condition influence these nutritional requirements.

Cow nutritional requirements as currently published by the National Research Council (NRC) do a good job of taking cow size, stage and level of production, and environment into account. Unfortunately, little has been done up to this point to include body condition as a factor that influences cow nutritional requirements. Therefore this paper will address some key questions as they pertain to body condition.

What Are Body Condition Scores?

Body condition scores are numbers used to suggest the relative fatness or body condition of the beef cow. The most commonly used system in the United States is one that ranges from one to nine, with a score of one representing very thin body condition and nine, extreme fatness. A cow with a body condition score of five should be in average flesh and represent a target that many cattlemen strive for. The nine point body condition scoring system is described below.

Nine Point Body Condition Scoring System

1. Bone structure of shoulder, ribs, back, hooks and pins are sharp to the touch and easily visible. Little evidence of fat deposits or muscling.

2. Little evidence of fat deposition but some muscling in the hindquarters. The spinous processes feel sharp to the touch and are easily seen with space between them.

3. Beginning of fat cover over the loin, back, and foreribs. The backbone is still highly visible. Processes of the spine can be identified individually by touch and may still be visible. Spaces between the processes are less pronounced.

4. Foreribs are not noticeable but the 12th and 13th ribs are still noticeable to the eye, particularly in cattle with a big spring of rib and width between ribs. The transverse spinous processes can be identified only by palpation (with slight pressure) and feel rounded rather than sharp. Full but straight muscling in the hindquarters.

5. The 12th and 13th ribs are not visible to the eye unless the animal has been shrunk. The transverse spinous processes can only be felt with firm pressure and feel rounded but are not noticeable to the eye. Spaces between the processes are not visible and are only distinguishable with firm pressure. Areas on each side of the tail head are well filled but not mounded.

6. Ribs are fully covered and are not noticeable to the eye. Hindquarters are plump and full. Noticeable sponginess over the foreribs and on each side of the tail head. Firm pressure is now required to feel the transverse processes.

7. Ends of the spinous processes can only be felt with very firm pressure. Spaces between processes can barely be distinguished. Abundant fat cover on either side of the tail head with evident patchiness.

8. Animal takes on a smooth, blocky appearance. Bone structure disappears from sight. Fat cover is thick and spongy and patchiness is likely.

9. Bone structure is not seen or easily felt. The tail head is buried in fat. The animal's mobility may actually be impaired by excessive fat.

Why Are Body Condition Scores Important?

Body condition scores allow producers to sort cattle according to their nutritional needs, thus improving the efficiency of nutritional programs. For example, changes in body condition can be used as a guideline by cattlemen to accurately reflect the level of nutrition being received by cows without having to weigh the cows. This is possible because of the strong linkage between body condition and weight change. Thus, as body condition score drops or increases, corresponding weight changes will occur.

Body condition is also an excellent description of animals. For example, a body condition score three cow (this will vary by breed) will often weigh 925 to 975 pounds if of English breeding. Characteristically, she will show no fat cover as previously described; and, if slaughtered, her carcass would have approximately nine percent fat. In contrast, an English-bred cow with a body condition score of five will often weigh from 1,000 to 1,075 pounds and will have a carcass that would consist of eighteen percent fat. A similar cow with a body condition score of seven will be in the range of 1,200 to 1,275 pounds and would have a body fat content of twenty-seven percent.

Are Body Condition Scores Linked to Reproductive Performance?

Excellent research in recent years has linked the percentage of body fat of beef cows in specific stages of their productive cycle to reproductive performance and overall productivity. Since body condition scores reflect the relative level of fatness of beef cows, it stands to reason that body condition scores are also related to reproductive performance. Some of the original work that made this relationship evident was conducted in 1975, at Colorado State University, by Dr. Rich Whitman. Data in Table 1 summarizes this work and shows that cows in varying body condition at calving differ greatly in how long it took them to resume cycling once they had calved.

The relationship of body condition score at calving to reproductive performance is further illustrated by a 1986 Indiana study that used mature Angus-Charolais cows. Table 2 summarizes this work and indicates longer postpartum intervals for thin cows compared to average conditioned or fleshy cows.

How Can Cattlemen Effectively Use Body Condition Scores in Their Programs?

Keep in mind that it is extremely important to strive for a body condition score at calving time that will allow the cows in your operation to be reproductively and economically efficient. This won't be the same for every operation, nor will it be the same in different parts of the county. Nevertheless, research data indicates that, on the average, cattlemen should strive for a body condition score of five at calving in mature cows. In contrast, two-year-old, first-calf heifers may need to have a body condition score of 5.5 to 6.0 simply because they have an additional nutrient requirement for growth as compared to mature cows. This slight increase in condition in young cows can help compensate for the additional nutrient demand for growth and help these cows resume cycling activity in a timely manner.

Producers also need to consider time of calving when they decide on a target body condition score at calving. For example, early calving cows can be slightly thinner than late calving cows simply because they have additional time to recycle and rebreed. Recent research at South Dakota State University reinforces this concept and is summarized in Table 3.

These data clearly point out the relationship between body condition score, time of calving, and reproductive function. This relationship should encourage producers to sort cattle by body condition so that they might optimize nutritional and reproductive efficiency. Often times, this sorting may be done by age, which many cattlemen do anyway. In this case, two-year-old cows are separated from the mature cows so the younger cows can be fed a higher plane of nutrition to ensure that they rebreed. To further improve the efficiency of this system, some cattlemen are also sorting through their mature cows and putting those in thin condition with the two-year-olds. This gives thin, mature cows an opportunity at more, and higher quality, feedstuffs which will often result in improved reproductive efficiency of the cowherd.

Finally, body condition scores allow producers to formulate nutritional diets. For example, if a producer has a set of cows that are in a body condition score of four, 60 to 80 days prior to the start of calving, he needs to formulate a nutritional program that will allow those cows to reach average body condition by the time they calve (body condition score = 5 to 6). Most research has indicated that a cow will need to gain or lose 60 to 80 pounds of body weight to change by one body condition score. Table 4 illustrates this concept and shows the proper weight gain necessary for cows of varying body condition prior to calving. For example, the weight gain needed by cows in moderate condition 120 days before calving is 100 pounds or 0.8 pound gain per day. In contrast, thin cows, 120 days prior to calving, must gain 2.2 pounds per day or approximately 260 pounds.

Similar differences are seen in cows varying in body condition after calving. In order for thin cows at calving to be in moderate body condition by 80 days postpartum, they must gain approximately two pounds per day (Table 5). It is important to remember that cows are also nursing calves at this point. This creates an extra demand for dietary energy and makes rapid weight gain difficult for cows after calving. This further emphasizes the need for cows to be in moderate to near moderate condition at calving for optimal reproductive performance.

Although Tables 4 and 5 indicate the weight gain needed by cows to reach moderate body condition during the pre- and post-calving periods, they do not take into account the energetic efficiency of thin versus fleshy cows. Recent research conducted at Purdue University examines the role of energy in cow rations in lowering, maintaining, or raising cow body condition score. This system takes into account the initial body condition of cows and is based on the net energy system currently used in growing and finishing cattle. In this system, the energy requirements of cattle are expressed in megacals (Mcal). These energy units are usually expressed in two ways. First, as a Mcal of net energy for maintenance (NEm) and, secondly, as a Mcal of net energy for gain (NEg). These measurements are valuable tools in determining required energy levels; but, unfortunately, little has been done up to this point to apply these concepts in cow nutritional programs.

Therefore, an objective of the Purdue study was to identify and recommend specific energy supplementation programs that will achieve a specific amount of gain over time in beef cows. This study was conducted using Angus cows with calves. These cows were placed on four energy intake levels and were fed for 200 days with weekly measurements of gain and feed analyses. Diets were designed to achieve: (1) high energy, (2) maintenance high energy, (3) maintenance low energy, and (4) low energy rations.

Data from this study allowed the estimation of net energy necessary to change the weight of cows in varying body condition. For example, thin cows (body condition score = 3 to 4) only need 1.73 Mcal of energy per pound of weight gain, whereas fleshy cows (body condition score = 6 to 7) need 2.87 Mcal of energy per pound of weight gain. The reason for this variance is that a pound of gain on a thin animal is primarily made up of protein and water, whereas a pound of gain on a fat animal is predominately made up of fat. Since it takes 2.25 times more energy to put on a pound of fat than a pound of muscle, it stands to reason that the net energy for gain is higher for fleshy cows than thin cows. Requirements for other condition scores are in Table 6.

Table 7 summarizes additional data from this study and permits producers to calculate the energy needed to meet a targeted weight gain. These data permit the cross referencing of various body weights to condition scores. In addition, the table takes into account the energy needed for fetal growth during the last trimester of gestation and the energy needed for average to superior milk production during lactation.

Practical Application of the Net Energy System for Cows

The following information provides a step-by-step procedure for calculating the energy required to improve a cow's condition from moderately thin to average, which is the most desirable condition for optimal reproductive performance.

Situation:

- A two-year-old cow now weighs 1,000 pounds but needs to weigh 1,150 pounds at calving.
- Time to calving = 100 days.
- Body condition score = 4 (moderately thin).
- Desired body condition score = 6 (moderate).
- Weight difference between two body condition scores = 150 pounds.

Step-by-Step Procedure:

1. Determine the average weight of the cow for the 100-day period. Start with the 1,000-pound cow with a body condition score of 4. Add 150 pounds to improve two full condition scores to a 6 (live weight = 1,150 pounds). The average is (1,000 + 1,150 divided by 2) 1,075 pounds.

2. Calculate the average daily gain needed to change two full condition scores in 100 days. (150 pounds divided by 100 days = 1.5 pounds per day).

3. Determine the net energy for maintenance (NEm) requirement for a 1,075-pound cow from Table 7. This is the simple average between the 1,050 and the 1,100 pound columns (7.86 + 8.13 divided by 2 = 8.00 Mcal/day).

4. Locate, in Table 7, the net energy requirement for fetal growth (NEc; 2.15 Mcal/day).

5. Add the net energy for maintenance (NEm) and net energy for fetal growth (NEc) together. The net energy requirement of 8.00 from Step 3 and the fetal growth requirement of 2.15 from Step 4 equals 10.15 Mcal/day.

6. Determine the average net energy requirement per pound of gain from Table 7 for a cow going from a body condition score of 4 to a body condition score of 6 and average these two numbers (1.73 + 2.87 divided by 2 = 2.30 Mcal/day).

7. Now calculate the net energy requirement for 1.5 pounds of gain per day. (1.5 pounds of gain per day x 2.30 Mcal/lb = 3.45 Mcal/day.) This calculation factors in the length of time available to achieve the desired condition score (100 days).

8. Add the values obtained in Steps 3, 4 and 7 for the total Mcal/day requirement.

   Example:

Energy Needed	Mcal/Day
Maintenance	8.00
Fetal growth	2.15
For weight gain	3.45
TOTAL	13.60

9. Calculate the net energy for maintenance (NEm) and net energy for gain (NEg) values of the ration. These numbers are calculated by multiplying the NEm and NEg values (Mcal/lb) of each feed in the ration (using NRC, 1984 Feed Tables) with the corresponding amount (percent) of each feed in the ration on a dry matter basis. Sum the products of each feed in the ration and divide the resulting NEm and NEg values by 100. This calculation is identical to that used by the feedlot industry.

10. Using the calculated numbers from Steps 5 and 7, calculate the amount of ration needed per day to obtain the desired endpoint. Divide the net energy for maintenance (NEm) requirement (10.15 Mcal/day) by the NEm value (Mcal/lb) of the ration. This will give the amount of ration needed to maintain cow weight. Next, divide the net energy for gain (NEg) requirement (3.45 Mcal/day) by the NEg value (Mcal/lb) of the ration. This is the amount (lb/day) of the ration needed to produce 1.5 pounds of gain. The sum of the amounts needed for maintenance equals the amount of ration needed by the cow to reach a body condition score of 6 by calving.

A word of caution is in order. It may be necessary to reformulate the ration if the cow cannot, or will not, eat the amount of feed that has been calculated.

Summary

Cows should be sorted by body condition into thin, moderate, and fleshy groups and fed separately according to their specific nutrient needs. This requires the use of a consistent body condition scoring system at key points during the production cycle. Once cows are separated by body condition, flexible supplementation programs should be initiated to meet necessary weight changes for a group of cows based on environment, stage and level of production and age. Every effort should be made to have cows in moderate body condition by calving. However, if cows are *slightly* thin at calving, they may still have a good chance to conceive by 80 days postpartum if they are provided extra energy after calving.

Here are several key considerations for producers using a body condition scoring system:

1. Keep the system simple! Thin cows are very angular with a visible skeletal structure, whereas fat cows appear very square and smooth. Concentrate at first on separating thin, moderate, and fat cows from each other without getting too concerned about numerical body condition scores.

2. Be consistent! Since body condition scoring is subjective, your score may vary somewhat from your neighbor's scoring system. However, if one person is responsible for body condition scoring cows within a herd, relative differences can be consistently determined over a period of time.

3. Take into account pregnancy, rumen fill, and age of the cow when body condition scoring! Be sure you are evaluating body fatness when assigning a high body condition score. This requires that you become familiar with the normal appearance of your cowherd during each stage of production.

4. Be able to "look through the hair coat"! This is sometimes difficult when cattle have a long winter hair coat. If you don't feel comfortable visually appraising the body condition of cows with long hair coats, learn how to palpate for body fatness.

5. Use body condition scoring at key times during the production cycle! Key times would include the beginning of the last trimester of gestation, parturition, and at breeding.

6. Record body condition scores! If you take the time to condition score your cowherd, take advantage of the information available to you. If scores are recorded, you will be able to see how individual cows respond to varying levels of body condition or fatness in terms of nutritional and reproductive efficiency.

Table 1. Body Condition at Calving and Heat After Calving

Body Condition at Calving	No. Cows	% in Heat - Days Post-calving 60	90
Thin (1-4)	272	46	66
Moderate (5-6)	364	61	92
Good (7-9)	50	91	100

(Whitman, Colorado State University, 1975)

Table 2. Effect of Body Condition Score (BCS) at Parturition on Postpartum Interval (PPI)

Body Condition Score[a]	PPI, days
3	88.5
4	69.7
5	59.4
6	51.7
7	30.6

[a]Body condition scores have been converted from a 5 point system to a 9 point system.
(Houghton et al., Purdue University, 1986)

Table 3. **Effect of Body Condition Score on Percentage of Cows Cycling**

Body Condition Score	No. of Cows	% Cycling May	June	July
		Early Calving Cows		
March condition score (prior to calving)				
≤4	45	10.0	28.2	70.5
5	84	17.8	43.5	85.6
6	43	41.9	77.5	97.5
≥7	25	45.9	76.6	94.7
		Late Calving Cows		
March condition score (prior to calving)				
≤4	14	0.0	0.0	44.7
5	41	7.5	26.0	74.4
6	22	0.0	35.3	98.5
≥7	6	0.0	65.8	99.1

(Pruitt and Momont, South Dakota State University, 1988)

Table 4. **Needed Weight Gains in Pregnant Cows in Different Body Conditions**

Body Condition		Weight Gain Needed to Calving, lbs.				
At Weaning	Needed at Calving	Calf Fluids and Membranes	Body Weight	Total	Days to Calving	ADG Lbs.
Thin	Moderate	100	160	260	120	2.2
Borderline	Moderate	100	80	180	120	1.5
Moderate	Moderate	100	0	100	120	.8
Thin	Moderate	100	160	260	200	1.3
Thin	Moderate	100	160	260	100	2.6

(Wiltbank, 1982)

Table 5. Needed Weight Gain in Cows Suckling Calves in Different Body Conditions

Body Condition		Weight Gain Needed to Breeding, lbs.		
At Calving	Needed at Breeding	Body Weight	Days to Breeding	ADG. Lbs.
Thin	Moderate	160	80	2.0
Borderline	Moderate	80	80	1.0
Moderate	Moderate	0	80	0
Thin	Moderate	160	60	2.7
Thin	Moderate	160	40	4.0

(Wiltbank, 1982)

Table 6. Net Energy for Gain (NEg) in Cows of Varying Body Condition

Body Condition Score[a]	Mcal/lb of Weight Gain (NEg)
2	1.17
3 - 4	1.73
5	2.30
6 - 7	2.87
8	3.44

[a]Body condition scores have been converted from a 5 point system to a 9 point system.
(Lemenager et al., Purdue University, 1990)

Table 7. Net Energy Requirements of Mature Beef Cows

Cow Weight, lbs.	1000	1050	1100	1150	1200	1250	1300	1350	1400
NE_m,Mcal/d[a]	7.57	7.86	8.13	8.41	8.68	8.95	9.22	9.48	9.75
NE_c,Mcal/d for fetal growth[b]	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
NE_l,Mcal/d (average milk)[c]	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
NE_l,Mcal/d (superior milk)[c]	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80
Body condition score[d]	Net Energy (NE) Required for 1 lb. of Weight Change, Mcal/lb.								
2	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
3 - 4	1.73	1.73	1.73	1.73	1.73	1.74	1.74	1.73	1.73
5	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
6 - 7	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87
8	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44

[a] NE_m is calculated to be .077 Mcal/kg $W^{.75}$ which comes from .072 + allowance for activity.

[b] Energy required for the conceptus (products of conception) during the last trimester of gestation with a weight gain of .9 lb/day. This is added to NE_m during the last trimester of gestation.

[c] Energy required to support lactation. Average milk is 10 lbs. of milk production/day; superior milk is 20 lbs/day. Calculated as lbs. of milk x .34 Mcal/lb. This is added to NE_m during lactation.

[d] Body condition scores have been converted from a 5 point system; approximately 60-80 lbs. difference between condition scores.

NEBRASKA BULL SELECTION CLINICS

NAME ______________________________

RANCH/FARM NAME ______________________________

MAILING ADDRESS ______________________________

CITY/TOWN ______________ STATE __________ ZIP CODE ________

YES, PLEASE SEND ME A COPY OF THE SIRE SUMMARY FOR THE FOLLOWING BREEDS: (CIRCLE THE BREEDS FOR WHICH YOU WANT A SIRE SUMMARY)

ANGUS
BRANGUS
CHAROLAIS
GELBVIEH
HEREFORD
LIMOUSIN
POLLED HEREFORD
RED ANGUS
SALERS
SHORTHORN
SIMMENTAL
SOUTH DEVON
TARENTAISE

COMPLETE THE ABOVE INFORMATION, TEAR OUT AND GIVE TO JIM GOSEY AT THE CLINIC, OR SEND LATER TO:

JIM GOSEY
C204 ANIMAL SCIENCE DEPT.
UNIVERSITY OF NEBRASKA
LINCOLN, NE 68583-0908

OR, PHONE YOUR ORDER TO: JIM GOSEY AT (402) 472-6417.