PROCEEDINGS

BEEF IMPROVEMENT FEDERATION

RESEARCH SYMPOSIUM AND ANNUAL MEETING

BEEF IMPROVEMENT FEDERATION

29TH

B I F

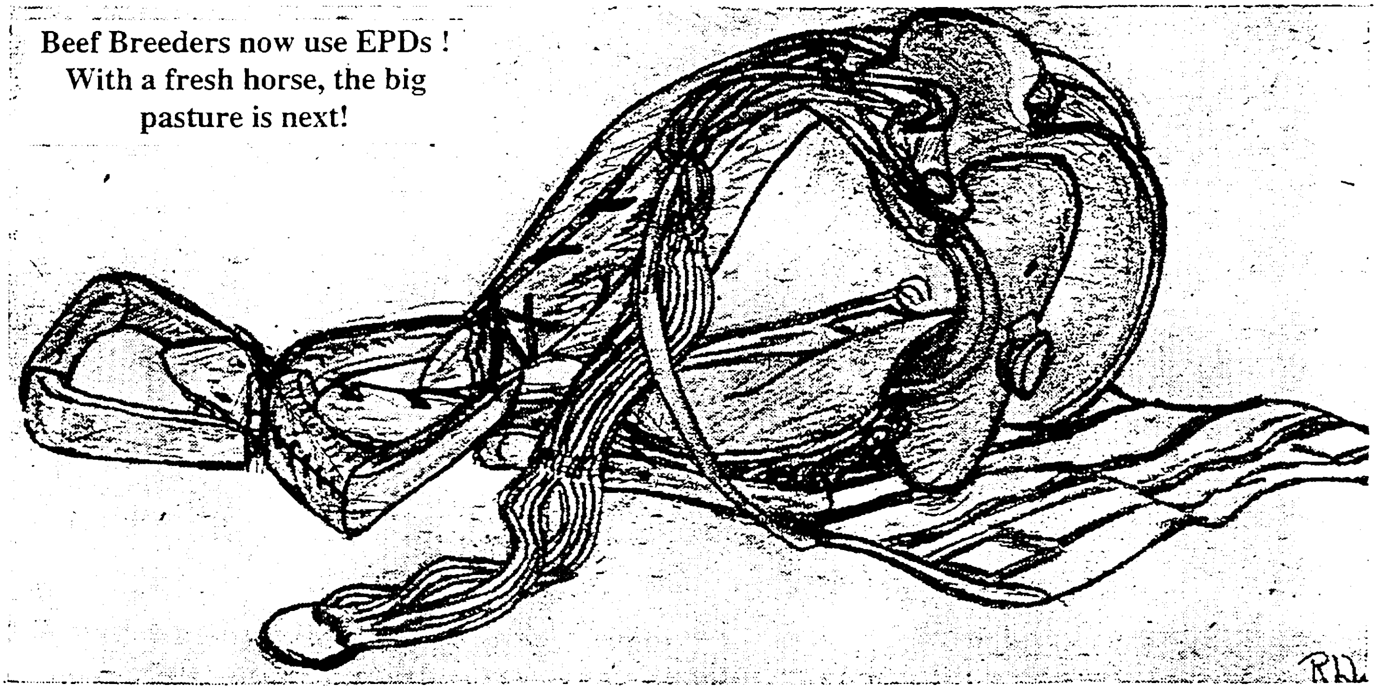
DICKINSON, NORTH DAKOTA

MAY 14-17, 1997

1997 BEEF IMPROVEMENT FEDERATION
BOARD OF DIRECTORS

NAME	YEAR TERM EXPIRES	REPRESENTING
Willie Altenburg	1999	Western BCIA
Kent Anderson	2000	Breed Association
John Crouch	1998	Breed Association
Jed Dillard	1998	Eastern BCIA
Jim Doubet	1999	Breed Association
S.R. Evans, Jr.	1999	Eastern BCIA
Galen Fink	1999	Central BCIA
Richard Gilbert	2000	Breed Association
Burke Healey	1998	At-Large
John Hough	1999	Breed Association
Roger Hunsley	1998	Breed Association
Gary Johnson	1998	Central BCIA
Roy McPhee	1998	Western BCIA
Connee Quinn	2000	Central BCIA
James I. Smith	2000	At-Large

Don Boggs	Central Region BIF Secretary
Ron Bolze	Executive Director
Larry Corah	NCBA
Larry Cundiff	USDA ARS
Ronnie Green	Western Region BIF Secretary
Herb McLane	Canadian Beef Improvement
Ronnie Silcox	Eastern Region BIF Secretary
Norman Vincel	NAAB
Richard Willham	BIF Historian



**This 29th
Beef Improvement Federation
Proceedings
is Dedicated to
Richard Willham**

1997 Beef Improvement Federation Conference
Hospitality Inn
Dickinson, North Dakota
May 14 - 17, 1997

Wednesday, May 14, 1997

2:00	Board of Directors Meeting
5:00	Opening Reception
7:00	National Association of Animal Breeders Symposium *Moderator: Roy Wallace, Select Sires*
	"General Reproductive Physiology & Capacity of the Beef Bull" *Larry Johnson, Texas A & M University*
	"The Testicular Thermoregulation Managment Interaction in the Beef Bull" *Glen Coulter, Agriculture and Agri-Food Canada*
	"Relationship of Bull Semen Characteristics to Fertility and Embryo Quality" *Richard Saacke, Virginia Polytechnic Institute & S.U.*

Thursday, May 15, 1997

Moderator: *Willie Altenburg, ABS Global, Inc.*

8:00	Welcome *Sharon Anderson, North Dakota State University*
8:30	"Cattle Traditions, Emotions and Business" *Tom Field, Colorado State University* *Bob Taylor, Colorado State University*
9:00	"Response by Mr. Tradition" *Steve Radakovich, Radakovich Cattle Co.*
9:15	"Your Business Plan for Survival" *Bill Patrie, North Dakota Association Of Rural Elec. & Tele. Coops*
10:00	Break
10:30	"The Business of Commercial Production" *Fran Dobitz, Cedar Valley Ranch*
10:45	Commercial Producer Nominees *W. Norman Vincel, Select Sires*
11:15	"The Business of Seedstock Production" *Steve Brooks, Brooks Angus Ranch*
11:30	Seedstock Producer Nominees *W. Norman Vincel, Select Sires*

12:00 Lunch

Moderator: ***Nancy Jo Bateman, ND Beef Commission***

"New Beef Products"
Mark Thomas, National Cattlemen's Beef Association

2:00 Committee Meetings

Genetic Prediction
Chairman - Larry Cundiff, USMARC-ARS-USDA

"Selection for Calving Ease"
Gary Bennett, USMARC-ARS-USDA
"Selection for Carcass Traits"
Keith Bertrand, University of Georgia
"Heritability of Ultrasound Measured Fatness Traits"
Doyle Wilson, Iowa State University
"Simmental Multi-Breed Evaluation Update"
John Pollak, Cornell University
Bruce Cunningham, American Simmental Association
"Across-breed EPD Updates"
Multibreeds: L.D. VanVleck, USMARC-ARS-USDA
Red Angus: Bruce Golden, Colorado State University
"Where Should Genetic Prediction Be Going-Priorities?"
Panel Members:
Dave Nichols, Nichols Farms
John Hough, American Hereford Association
Lee Leachman, Leachman Cattle Co.
Kent Anderson, North American Limousin Foundation

Emerging Technologies
Chairman - Ronnie Green, Colorado State University

"Sexed-Semen Technology"
George Seidel, Colorado State University
"BIF Biotechnology Fact Sheets"
Ronnie Green, Colorado State University

5:00	Reception in Historic Medora Host: *Dale Greenwood, President, ND Stockmen's Association*
6:00	Pitchfork Fondue - Medora
7:00	"Bully" - Medora

Friday, May 16, 1997

	Moderator - ***Jim Doubet, American Salers Association***
8:00	**"Whole Herd Reporting - The New Direction"** *Dick Gilbert, Red Angus Association of America*
8:45	**"Whole Herd Reporting - As a Profit Measure"** *Jim Oltjen, University of California-Davis*
9:30	**"The Newest Tool for Profits"** *Tom Jenkins, USMARC-ARS-USDA*
10:15	Break
10:45	**"EPDs and Beyond"** *Rick Bourdon, Colorado State University*
11:15	**Convention Update** *Ron Bolze, Kansas State University* *Kris Ringwall, North Dakota State University*
11:30	**Annual Meeting** *Burke Healey, BIF President*
11:45	**Regional Caucuses** *W. Norman Vincel, Select Sires*
12:00	Lunch (On Your Own)
2:00	**Committee Meetings**

Multiple Trait Selection & Whole Herd Analysis
(Joint meeting of these two committees)

"Restructuring the Integrated Genetic Systems Committee"
John Hough, American Hereford Association
Kent Anderson, North American Limousin Foundation
"Demonstration-Decision Support Application For The Cattle Industry"
Tom Jenkins, USMARC-ARS-USDA

Breakout for Individual Committee Meetings

Multiple Trait Selection

Chairman - Kent Anderson, North American Limousin Foundation

"Multiple Trait Selection in Practice"

Roy Wallace, Select Sires
Doug Frank, American Breeders Service
Donnell Brown, R.A. Brown Ranch

"New Concepts in Multiple Trait Selections"

Tom Jenkins, USMARC-ARS-USDA
Rick Bourdon, Colorado State University
Mark Enns, The University of Arizona

"Selection Indexes In Practice" - (A New Zealand Case Study)

Mark Enns, The University of Arizona

"The BIF Multiple Trait Selection Committee, Open Discussion: Determining Objectives"

Kent Anderson, North American Limousin Foundation

Whole Herd Analysis

Chairman - John Hough, American Hereford Association

"Producer Utilization of SPA"

Harlan Hughes, North Dakota State University

"Genetic Evaluation of Reproduction with Whole-Herd Reporting"

Bruce Golden, Colorado State University

"The New Direction - Discussion"

Dick Gillert, Red Angus Association of America

"As a Profit Measure - Discussion"

Jim Oltjen, University of California-Davis

"Discussion of Future Committee Directions"

John Hough, American Hereford Association

Live Animal & Carcass Evaluation

Chairman - John Crouch, American Angus Association

"Frame Score Predictions"
Sally Northcutt, Oklahoma State University

"North American Ultrasound Practitioners Association (NAUPA) Update"
Cindy Nagel, NAUPA President-Elect
Tommy Perkins, Southwest Missouri State University

"Calculating EPDs on Ribeye Area, Fat Thickness &Percent Intramuscular Fat"
John Hough, American Hereford Association

"Ultrasound Proficiency Certification"
Doyle Wilson, Iowa State University

5:00 **Awards Banquet**
Host: Ron Bowman, President, ND Beef Cattle Improvement Association

7:00 **National Intercollegiate Rodeo Association**
Final Great Plains Regional Rodeo - Dickinson State University Arena

10:00 **Western Dance**
Hospitality Inn

New Symposium Addition

Continuous Poster Session
Authors Present During Breaks and Lunch
Stop and View The Latest Data In Beef Improvement
Coordinator: Ronnie Green, Colorado State University

Saturday, May 17, 1997

On-Site Cattle Business Ranch Tour
Ron Bowman - Bowman Charolais
John Lee Njos- Angus& Simmental cow/calf operation
Roger Stuber - Stuber Hereford Ranch
Steve Brooks - Brooks Angus Ranch

Historic Western North Dakota Tour
HT Ranch
John Hanson - The Logging Camp Ranch

Special Tours Available
4-Bears Casino and Lodge
Assumption Abbey

TABLE OF CONTENTS

1997 DIRECTORS, BEEF IMPROVEMENT FEDERATION .... Inside Front Cover

PROCEEDINGS DEDICATION TO RICHARD L. WILLHAM .... *i*

PROGRAM FOR 1997 .... *ii*

TABLE OF CONTENTS .... *vii*

SYMPOSIUM: NATIONAL ASSOCIATION OF ANIMAL BREEDERS: IMPROVING REPRODUCTIVE PERFORMANCE

General Reproductive Physiology and Capacity of the Beef Bull
Larry Johnson 1

The Testicular Thermoregulation-Management Interaction in the Beef Bull
Glenn H. Coulter and John P. Kastelic 7

Relationship of Bull Semen Characteristics to Fertility and Embryo Quality
R. G. Saacke 15

SYMPOSIUM:

Emotion, Tradition and Business
T.G. Field and R. E. Taylor 24

The Business of Commercial Production
Fran Dobitz 36

The Business of Seedstock Production
Steve Brooks 39

SYMPOSIUM:

Whole Herd Reporting - The New Direction
Richard P. Gilbert 55

Whole Herd Reporting - As a Profit Measure
James W. Oltjen 63

The Newest Tool for Profits
T.G. Jenkins 68

EPDs and Beyond
Rick Bourdon, Bruce Golden and Brian Kinghorn 74

GENETIC PREDICTION COMMITTEE - (Larry Cundiff - Chairman)

Minutes of the Meeting 88

Selection for Calving Ease
Gary L. Bennett 90

Selection for Carcass Traits
J.K. Bertrand, D.W. Moser and W.O. Herring 93

Estimation of Genetic Parameters for Fat Composition Traits Measured in Live Beef Animals
M.M. Izquierdo, D.E. Wilson and G.H. Rouse 99

Across Breed EPD Tables Adjusted to a 1995 Base
L.D. VanVleck and L.V. Cundiff 102

1995 Average EPDs for Each Breed 118

Different BIF Accuracy of EPD for Including Records in MARC Analysis to Estimate Breed of Sire Differences
L.D. VanVleck and L.V. Cundiff 119

Differences in Breed of Sire Differences for Weights of Male and Female Calves
L.D. VanVleck and L.V. Cundiff 131

Predictable Power Genetics - Catch the Wave or Drown
J.David Nichols 139

Where Should Genetic Prediction Be Going?
John Hough 142

EMERGING TECHNOLOGIES - (Ronnie Green, Chairman)

Minutes of the Meeting 143

Current Status of Sexing Bovine Semen
George E. Seidel, Jr. 144

RESTRUCTURING OF THE INTEGRATED GENETIC SYSTEMS COMMITTEE
John Hough and Kent Anderson 150

MULTIPLE TRAIT SELECTION - (Kent Anderson, Chairman)

Minutes of the Meeting 151

Simplifying Multiple Trait Selection
Roy Wallace 152

Index Selection In Practice - A New Zealand Case Study
R.M. Enns and G.B. Nicoll 156

WHOLE HERD ANALYSIS - (John Hough, Chairman)

Minutes of the Meeting 167

IRM - SPA Has Arrived in Cow Country
Harlan Hughes 168

LIVE ANIMAL AND CARCASS EVALUATION - (John Crouch, Chairman)

Minutes of the Meeting 181

Frame Score in Brahman Cattle
Sally Northcutt and Glen Dolezal 182

Comparison of Four Real-Time Ultrasound Systems that Predict Intramuscular Fat in Beef Cattle
W.O. Herring, M.D. MacNeil, L.A. Kriese, J.K. Bertrand and J. Crouch 184

American Hereford Association Genetic Evaluation Program for Carcass Traits
John Hough 194

Beef Cattle Ultrasound Proficiency Testing and Evaluation
Doyle E. Wilson 195

Association of Animal Ultrasound Practitioners Report
Cindy Nagel 198

Association of Animal Ultrasound Practitioners Update
Tommy Perkins 199

FRANK BAKER MEMORIAL SCHOLARSHIP AWARD RECIPIENT ESSAYS

Age at Puberty in the Beef Herd and Subsequent Lifetime Reproduction
Robert Williams 202

Genetic Improvement for Sex-Specific Traits in Beef Cattle
Rebecca K. Splan 213

BIF POSTER COMPETITION ABSTRACTS

Estimates of Heritabilities and Genetic Correlations for Carcass and Yearling Ultrasound Measurements in Brangus Cattle
D.W. Moser, J.K. Bertrand, I. Misztal, L.A. Kriese and L.L. Benyshek 222

Additive Genetic Relationships Between Heifer Pregnancy, Subsequent Rebreeding and Stayability in Angus Females
S.P. Doyle, B.L. Golden, J.S. Brinks, R.G. Mortimer and R.D. Green 223

MINUTES OF BIF MIDYEAR BOARD OF DIRECTORS MEETING
Barclay Lodge, YMCA of the Rockies, Estes Park, Colorado
October 3 and 4, 1996 225

BIF FINANCIAL STATUS
January 1, 1996 to December 31, 1996 233

AGENDA-BIF BOARD OF DIRECTORS MEETING
Hospitality Inn, Dickinson, North Dakota 237

MINUTES OF BIF BOARD OF DIRECTORS MEETING
Hospitality Inn, Dickinson, North Dakota
May 14 - 17, 1997 238

BIF FINANCIAL STATUS
January 1, 1997 - May 14, 1997 247

BIF MEMBER ORGANIZATIONS 251

SEEDSTOCK BREEDERS HONOR ROLL OF EXCELLENCE 253

SEEDSTOCK BREEDER OF THE YEAR 260

THOMAS ANGUS RANCH & WEHRMANN ANGUS NAMED CO-WINNERS of the "1997 BIF OUTSTANDING SEEDSTOCK PRODUCER AWARD" 261

1997 BIF SEEDSTOCK NOMINEES 263

COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE 269

COMMERCIAL PRODUCER OF THE YEAR 275

MERLIN ANDERSON RECEIVES THE "1997 BIF OUTSTANDING COMMERCIAL PRODUCER AWARD" 276

1997 BIF COMMERCIAL NOMINEES 277

AMBASSADOR AWARD RECIPIENTS 282

BILL MILLER RECEIVES THE "1997 BIF AMBASSADOR AWARD" 283

PIONEER AWARD RECIPIENTS 284

LARRY V. CUNDIFF RECEIVES A "1997 BIF PIONEER AWARD" 287

HENRY GARDINER RECEIVES A "1997 BIF PIONEER AWARD" 288

JIM LEACHMAN RECEIVES A "1997 BIF PIONEER AWARD" 289

CONTINUING SERVICE AWARD RECIPIENTS 290

GLENN BRINKMAN RECEIVES A "1997 BIF CONTINUING SERVICE AWARD" 292

RUSSELL DANIELSON RECEIVES A "1997 BIF CONTINUING SERVICE AWARD" 293

GENE ROUSE RECEIVES A "1997 BIF CONTINUING SERVICE AWARD" 294

1997 BIF BOARD OF DIRECTORS 295

1997 BIF CONVENTION ATTENDANCE ROSTER 298

SPONSORS AND HOSTS OF THE 1997 BIF CONVENTION . . . . Inside Back Cover

General Reproductive Physiology and Capacity of the Beef Bull

Larry Johnson, Department of Veterinary Anatomy and Public Health
College of Veterinary Medicine, Texas A&M University
College Station, TX 77843

Introduction

The male reproductive system (Figure 1) consists of gonads (two testes), their excurrent duct system (efferent ducts, epididymis, ductus deferens, ampulla, ejaculatory ducts, urethra, and penis), and associated accessory sex glands (seminal vesicles, prostate, and bulbourethral glands or Cowper's gland). Testes produce sperm and male sex hormones: testosterone being the most important sex hormone in the male. Sperm in the testis pass from the seminiferous tubules (where they are produced) into the rete testes tubules to exit the testis. Then they pass into the efferent ducts which attach to a single epididymal duct. In the epididymis, sperm acquire the capacity for motility and for fertilizing ova, and matured sperm are stored in the tail of the epididymis. During sexual excitement, the penis becomes erect and fluid from the bulbourethral gland begin to leak out of the end of the penis as it cleans the urine out of the urethra prior to ejaculation. Stored sperm are moved from the tail of the epididymis through the ductus deferens and ampulla into the ejaculatory ducts where they are mixed with fluids from the prostate and washed out through the prostatic urethra and then penial urethra via secretions of the seminal vesicles. The sperm mixed with the secretions of the accessory sex glands constitute the ejaculated semen.

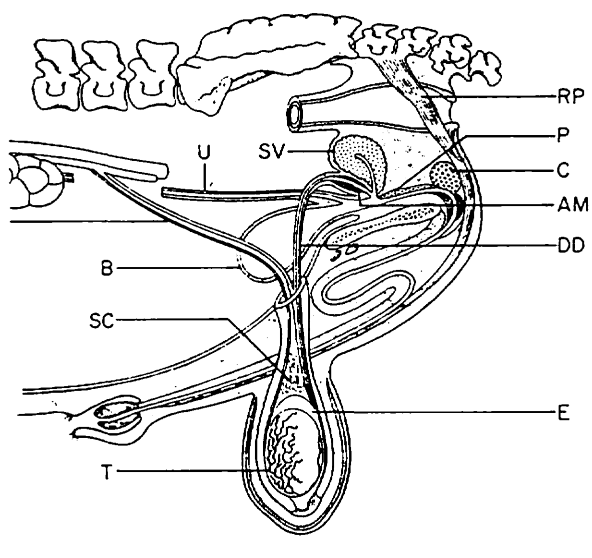


Figure 1. [From B.P. Setchell]

Development of the Reproductive Tract in the Bull

By mid-gestation, testicular descent has occurred in fetal male calves. The testes have passed individually from the peritoneal cavity through the inguinal canal into the scrotum. A vaginal process, a peritoneal sac extends toward the scrotum and through the inguinal canal prior to descent of each testis. By 24 weeks of age, seminiferous tubules of the bull testes have primary spermatocytes and spermatids/sperm by 32 weeks. By 40 weeks, sperm are in the tail of the epididymis and in the ejaculate by 42 weeks. By 150 weeks, bulls are considered to be sexually mature.

In adults, seminiferous tubules contain three cell types. These include the myoid or peritubular cells of the limiting boundary tissue as well as Sertoli cells and germ cells of the seminiferous epithelium. Germ cells are of three types: spermatogonia, spermatocytes, and spermatids. Somatic cells in seminiferous tubules are Sertoli cells and myoid cells.

Sertoli cells are important in spermatogenesis as they have multiple functions. Sertoli cells function in a) structural support and nutrition of germ cells, b) spermiation of mature spermatids, c) movement of young germ cells, d) phagocytosis of degenerating germ cells and residual bodies left by released sperm, e) secretion of luminal fluid and proteins, f) formation of the blood-testis barrier, and g) cell to cell communication. Sertoli cells also secrete lactate, a necessary energy source for developing germ cells, and mitogenic polypeptides which possibly function to stimulate germ cell or Sertoli cell proliferation.

Number of Sertoli cells in young animals increases to adult values, stabilize, and then tend to decline with advancing age. Holstein bulls at 16, 20, 24, 28, and 32 weeks of age have 2×10^6, 202×10^6, $3{,}520 \times 10^6$, $7{,}927 \times 10^6$, and $8{,}862 \times 10^6$ Sertoli cells per testis, respectively. Sertoli cell numbers per testis after completion of Sertoli cell formation in Holstein bulls (7×10^9 to 9×10^9) is similar to the value reported for Normandy bulls (6×10^9 to 8×10^9).

In short, the Sertoli cell number is important in determining testicular size and the number of germ cells that can be sustained by the testis. Success in enhancing the rate of sperm produced will likely include augmentation of the Sertoli cell number.

Spermatogenesis

Spermatogenesis occurs in the tubules of the testis called seminiferous tubules. The word spermatogenesis is derived from Greek where sperma = seed, kytos = cell, and genesis = production. It is a lengthy (61 days in the bull), chronological process by which stem cell spermatogonia divide by mitosis to maintain their own numbers and to cyclically produce primary spermatocytes that undergo meiosis to produce haploid spermatids which develop into sperm. In short, spermatogenesis is the sum of the events that occur within the testis that produce sperm.

Spermatogenesis is divided into spermatocytogenesis, meiosis, and spermiogenesis. These characterize the development of spermatogonia, spermatocytes, and spermatids. Each division takes about one third the duration of spermatogenesis in any given species. In the bull, these divisions take 21, 23, and 17 days, respectively for a total duration of 61 days. During spermatocytogenesis, stem cell spermatogonia divide to produce other stem cells that continue the lineage throughout the adult life of males. Stem cell spermatogonia give rise to other spermatogonia that cyclically produce committed spermatogonia which proliferate and develop into primary spermatocytes that undergo the second division of spermatogenesis or meiosis. Meiosis allows exchange of genetic material between chromosomes of primary spermatocytes and the production of spermatids with half the DNA material. During spermiogenesis, the third and final division of spermatogenesis, spermatids change from cells with nuclei into mature germ cells shaped like sperm for that species with flagella and compressed head containing an acrosome with its enzymes and the male genome in the nucleus.

Considering the epididymal transit time is 8 to 11 days in the bull and spermatogenesis takes 61 days, testicular insults (heat stress, elevated temperature, drugs, etc.) on germ cells at specific steps of development will not immediately show up as abnormal sperm in the ejaculate. The duration of this latency in the appearance of abnormal sperm in the ejaculate can be used to determine which germ cell and step of development in the testis is affected by the testicular insult. It is important to note that testicular insults will not show up as poor seminal quality until sometime (days) later. Likewise, poor semen quality will persist temporarily after the testicular insult has been removed.

Measure Sperm Production Capacity

Daily sperm production is the number of sperm produced each day by a pair of testes and measure of spermatogenesis. The efficiency of spermatogenesis is the number of sperm produced per gram testicular parenchyma. There are breed differences in daily sperm production and daily sperm per gram parenchyma (Table 1).

TABLE 1
DAILY SPERM PRODUCTION IN BULLS

		Daily Sperm Production	
Breed	Weight of Paired Testes (g)	Per g (10^6)	Per Bull (10^9)
Hereford	650	10	5.9
Charolais	775	13	8.9
Dairy Breeds	725	12	7.5

Bulls have lower efficiency of spermatogenesis than most other species who produce 18-24 x 10^6 per g per day, but it is higher than that for humans at 4-6 x 10^6. Larger bulls have a higher daily sperm production at about 6-9 x 10^9 for both testes combined. The size of testes greatly influence the daily sperm production. In bulls, the testicular weight is about 0.05% of the body weight.

Number of Sperm in the Epididymis and Number in the Ejaculate: Effect of Ejaculation Frequency

In a sexually rested bull with a daily sperm production of 7.5 x 10^9, the number of sperm in the atypical ejaculate is 12 x 10^9, and 23.5 x 10^9 are available for ejaculation (stored in the tail of the epididymis, Table 2).

TABLE 2
NUMBER OF SPERM IN THE EPIDIDYMIS AND DUCTUS DEFERENS/AMPULLA IN BULLS (10^9)

		Epididymis		**Ductus/ Ampulla**	**Total Tract**
Breed	Head	Body	Tail		
Hereford	11	1	21	6	40
Charolais	18	4	35	7	64
Dairy Breeds	20	5	39	8	72

However, in sexually active males (one ejaculate each day for two days), the number of sperm in the ejaculate is reduced to 7.3×10^9 in 3-5 ml of semen, and the number available is reduced to 18.0×10^9. In bulls, the epididymis (especially in the tail of the epididymis) does not reach a maximum capacity for storage of sperm until sometime after puberty. The number of sperm capable of being stored in the epididymis (Table 2) influences the epididymal sperm transit time (Table 3).

TABLE 3
TRANSIT TIME OF SPERM THROUGH EPIDIDYMIS IN SEXUALLY RESTED BULLS (DAYS)

Breed	Epididymis	
	Head and Body	Tail
Hereford	2.0	3.6
Charolais	2.5	3.9
Dairy Breeds	3.1	5.2

Dairy bulls have a larger storage capacity and a longer epididymal transit time than beef bulls. The number of sperm in the head and body of the epididymis (Table 2) does not change with ejaculation frequence as it does for the tail of the epididymis. Multiple ejaculates (77/6 hr. period) will not remove all sperm from the tail of the epididymis. This may reflect a reduced efficiency of sperm removal from the tail of the epididymis when sperm numbers are reduced, but it may reflect a species survival trait to insure that at least some sperm will be available for the next cow to be bred regardless of the number of cows that preceded her. However, the number of sperm in the epididymis (and available for ejaculation) is a function of age of the animal, daily sperm production of the attached testis, and the ejaculation frequency. Also, season or temperature will influence the number of sperm produced, stored in the epididymis, and found in the ejaculate.

The number of sperm in the ejaculate is only one measure of seminal quality. Characteristics of sperm in the ejaculate are important toward fertility of the bull. These characteristics includes progressive motility, morphology (shape), acrosomal integrity, and the ability of sperm to undergo the acrosomal reaction, to penetrate the zona pellucida, to penetrate the egg, form a pronucleus, and produce a live calf from the fertilized egg. Seminal quality also is influenced by age, season, temperature, exposure to testicular insults/toxicants, and proper handling procedures in AI programs.

Male Reproductive Anatomy and Thermal Regulation of the Testis

The scrotum, covered by skin, encloses two scrotal sacs which are outpockenings of the peritoneal cavity and contain the two testes with their attached epididymides. The two sacs are enclosed in a smooth muscle coat (tunica dartos). The tunica dartos is responsible for the variation in the position of the testes according to temperature. It holds the testes close to the abdominal cavity in cold conditions or allows the testes to hang further away (down) from the abdomen in hot weather. The skin covering the two peritoneal sacs is thinner than elsewhere on the body, as it has no subcutaneous fat storage and a thin dermis. Also, the skin of the scrotum is less covered with hair.

The testes descend into the scrotum, but the point of origin of the testicular artery does not change. Hence, the artery elongates to accommodate descent of the testis. Also, the artery becomes convoluted so that several meters of artery are coiled up into a cone structure about 10 cm long. The venous drainage runs mostly on the surface of the testis in bulls. When the veins reach the dorsal pole of the testis, they divide again to form a plexus of small veins called pampiniform plexus. This plexus surrounds the coiled artery. The testicular artery, pampiniform plexus, the ductus deferens, lymphatics, connective tissue, nerves, and cremaster muscle form the spermatic cord from which the testis is suspended. The pampiniform plexus and coiled arteries are effective to counter current heat exchanges. It cools the arterial blood from the body temperature to that of the subcutaneous scrotal temperature before the blood reaches the testis. This is accomplished as the venous blood leaving the testis absorbs the heat and heats up to the body temperature by the time it reaches the inguinal canal.

The wall of the scrotum consists of the skin (epidermal surface and dermal connective tissue), tunica dartos (smooth muscle), connective tissue, the parietal and visceral layers of the vaginal process, and the tunica albuginea (capsule surrounding the testis).

Interactions of Hormones

The brain produces hormones or chemical messengers (LH and FSH) that are carried by the blood to stimulate the testis (Figure 2). In turn, the testis produces testosterone (some estrogren) and inhibin/activin that influence the production of LH and FSH, respectively.

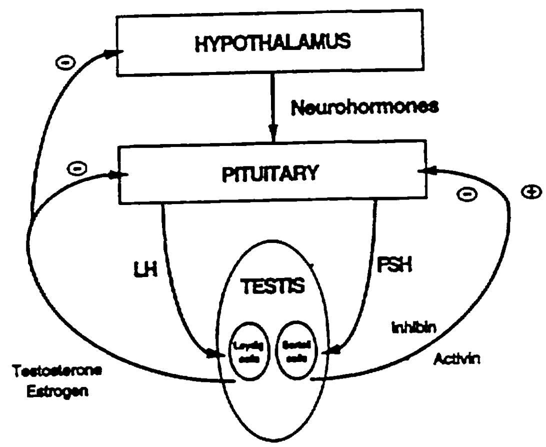


Figure 2

Under the influence of LH from the pituitary, Leydig cells (located between seminiferous tubules) produce testosterone, the male sex hormone. Testosterone is important for development of the male reproductive tract in the fetus, important in the robust shape of males, and important in spermatogenesis and sexual behavior of the male. Sertoli cells are nurse cells that nourish the developing germ cells in the testis. They are stimulated by FSH and produce inhibin that inhibits FSH secretion by the pituitary. Also, Sertoli cells produce activin that stimulates FSH production to enhance germ cell development.

Conclusion

The male reproductive tract in beef bulls consists of testes (for production of sperm), excurrent duct system (for maturation, storage, and delivery of sperm), and accessory sex glands (for seminal volume). Testes produce sperm and sex hormones.

Testicular characteristics are reflected in quantity of sperm in the ejaculate, but variation in semen quality cannot be explained totally by variation in number, ratios, or structure of testicular cells. Maturation and storage of sperm occurs in the epididymis.

Due to the lengthy duration of spermatogenesis and epididymal transit time, there is a latency in the appearance of reduced semen quality following a testicular insult.

Bulls have a lower efficiency of spermatogenesis than most species examined, but higher than that of humans.

Sertoli cell number is important in determining daily sperm production in bulls as well as in other species.

Spermatogenesis involves both mitotic and meiotic cell divisions and an unsurpassed example of cell differentiation in the production of a self-propelled, penetrative-enzyme-containing, male genome delivery system, namely the spermatozoon.

"The Testicular Thermoregulation - Management Interaction in the Beef Bull"

Dr. Glenn H. Coulter and Dr. John P. Kastelic
Lethbridge Research Centre

Introduction:

Unlike the dairy breeder or feedlot operator, the beef breeder derives his or her entire income from calves born into the herd, making fertility unquestionably the most important trait to be considered in a breeding program. Economically, reproductive merit is 5 X more important to the cow-calf producer than growth performance and 10 X more important than product quality (e.g. carcass quality; 13), at least until value based marketing becomes a reality. These figures refer to the relative importance of these traits for the beef herd in total. When discussing the bull component alone, an additional aspect must be incorporated into the model, that of the male to female ratio at breeding. Whether considering the 1:10,000 plus ratio of the artificial insemination sire or the 1:25 to 1:40 ratio of the herd bull used for natural service, fertility is much more important in the bull than in any individual female. This is adequate justification to place much greater emphasis on the fertility of our beef bulls. When selecting beef bulls, fertility must be given first and foremost priority.

Bull Management:

Beef bulls, used predominantly for natural service throughout the world, are exposed to a greater range of environmental and management factors than dairy bulls that are reared and maintained under relatively consistent and more optimum environments in bull studs. Most environmental or management practices that can and often do diminish the inherent seminal quality of a bull are mediated through either temperature-sensitive or hormonal mechanisms. Little is known about the basic mechanisms involved in the interaction between supporting Sertoli cells and dividing and differentiating germ cells. Somewhat more is known about the effects of the environment and management practices on seminal quality in beef bulls. A general premise that applies is that the ***degree of injury to the testes is proportional to the severity and duration of the environmental or management mediated insult.*** Exposure of the testes and/or epididymides to a minor but prolonged insult can have a detrimental effect on seminal quality. Such an insult may not be easily identified.

Nutrition. Nutrition of the beef bull is one factor that may have prolonged effects. Diets adequate in protein, vitamins, minerals and energy appear to hasten the onset of puberty in beef bulls. However, the feeding of high energy diets to post-pubertal beef bulls is of no benefit to reproductive capacity, including seminal quality, and may result in substantial harm to reproductive potential. This statement is supported by studies conducted at the Agriculture and Agri-Food Canada Research Centre, Lethbridge. Feeding a medium-level of dietary energy (limit fed alfalfa/straw cubes; 70:30 ratio) to Hereford and Angus bulls from weaning (6 to 7 months of age) to 12 months of age (3) resulted in 52% greater (P = .01) total epididymal sperm reserves than for bulls fed a high-energy diet (60% barley, 10% oats, 10% beet pulp and 20% alfalfa/straw cubes). Similarly, Hereford and Angus bulls fed a medium-energy diet from weaning to 15 months of age

(4), when bulls might be used for breeding as yearlings, had a 12% greater ($P < .01$) daily sperm production per gram testicular parenchyma than bulls fed a high energy diet. Bulls in the medium-energy diet groups, at 15 months of age, had 76% greater ($P < .01$) caput-corpus epididymal sperm reserves for Herefords in year 1, and 89% greater caput-corpus epididymal sperm reserves for both breeds in year 2, and 52% greater ($P < .01$) cauda epididymal sperm reserves than high-energy diet bulls . Seminal quality was not assessed in this experiment. Experiments were also conducted on Hereford and Angus bulls fed medium- or high-energy diets from weaning through 24 months of age (5). In the first year, Hereford bulls fed the medium-energy diet had 300% greater ($P > .01$) total epididymal sperm reserves than bulls fed the high energy diet. Angus bulls did not differ. In the second year, Hereford and Angus bulls fed the medium-energy diet had 55% and 16% greater ($P < .01$) total epididymal sperm reserves than for comparable groups of bulls fed the high energy diet. Seminal quality of bulls fed the high energy diet was inferior to that of bulls fed the medium-energy diet, particularly with respect to progressive sperm motility and the incidence of spermatozoa in which a crater defect of the head was present.

In a study conducted in Kansas (9), three different levels of dietary energy were fed to Hereford and Simmental bulls for a 200-day period followed by 10 days adjustment to a roughage diet, 38 days on pasture and then reproductive capacity was assessed. No effect of dietary energy was observed on semen characteristics or serving capacity of either breed. However, it should be noted that although there was no significant effect of level of dietary energy, the proportion of progressively motile spermatozoa (29.2%), the incidence of morphologically abnormal spermatozoa (54.4%) and aged acrosome (36.3%) in the Herefords suggest that all Hereford bulls may have been affected detrimentally by the diets fed. The mean back fat thickness for the three Hereford dietary groups (9 bulls each) were 6.1, 7.2, and 10.4 mm. The mean back fat thickness for Hereford and Angus yearling bulls of similar age fed medium- and high-energy diets in the Lethbridge study were 0.5 ($n = 61$) and 7.1 mm ($n = 42$), respectively (no breed differences were observed). Although seminal quality was not assessed in the Lethbridge study, clearly the medium-energy diet fed was substantially lower in dietary energy than the lowest energy level fed in the Kansas study. This may account for the apparently conflicting results.

Table 1. Depression of sperm reserves in bulls fed high vs. medium energy diets.

Age (mo)	Bull Breed	Year	Dietary energy Medium	High	Percent reduction in sperm reserves[a]
24	Hereford	1978	37.3[b]	9.3[b]	75
		1979	35.7	23.1	35
		1983	40.6	19.8	51
	Angus	1978	33.4	29.2	13
		1979	33.1	28.6	14
15	Hereford	1980	33.3	22.1	34
		1981	30.9	17.9	48
	Angus	1980	28.2	25.5	10
		1981	34.3	17.9	48
12	Hereford	1982	9.3	5.5	41
	Angus	1982	10.4	7.5	27

[a]Percent reduction in sperm reserves in bulls fed high compared to medium energy diets.
[b]Mean sperm reserves x 1 billion.

In a three-year field study (6) of multiple-sire breeding under range conditions, 277 crossbred beef bulls were examined prior to the breeding season and the effects of physical soundness, testicular development, seminal quality, and both sexual and social behavior on fertility were determined. A regression model was developed that accounted for 29% of the total variance in fertility. One of the five traits making a contribution ($P < .01$) to the model was backfat thickness. The mean backfat thicknesses for 1-, 2- and 3-year-old bulls were 1.6 (n = 116), 1.5 (n = 126), and 1.9 mm (n = 35), respectively (range 0 to 7 mm). Even with these relatively low levels of backfat thickness, a negative relationship ($P < .01$) was observed between backfat thickness and beef bull fertility under multiple-sire, range breeding conditions. As backfat increased, fertility declined. Most evidence indicates that feeding high energy diets to young beef bulls reduces sperm production, seminal quality, and ultimately bull fertility.

The exact mechanism by which the feeding of high-energy diets affects seminal production and quality is not known; however, circumstantial evidence indicates the probable involvement of impaired thermoregulation, and possibly a stress-induced hormonal imbalance. It appears that the decreased fertility is due to the deposition of fat both within the scrotal tissue overlying the testes/epididymides, and fat deposited in the neck of the scrotum over the pampiniform plexus. Unpublished data (1) suggest that although the feeding of high versus medium levels of dietary energy to young beef bulls has no effect ($P > .05$) on the amount of lipid present within testicular parenchyma, bulls fed the high-energy diet had 34% more ($P < .01$) total scrotal lipid than bulls fed the medium-energy diet (13.7 vs 10.2 mg lipid/g scrotal tissue). The correlation coefficient between total scrotal lipid and epididymal sperm reserves was -.26 ($n = 55$, $P < .05$). The corresponding coefficient between backfat thickness and epididymal sperm reserves was -.38 ($n = 55$, $P < .01$). As highly insulative lipid is deposited within the scrotal tissue, it may reduce the radiation of heat from the scrotal surface, thereby increasing testicular temperature. This may reduce sperm production and in some cases seminal quality. One study (1) indicates that yearling beef bulls fed high- versus moderate-energy diets have a higher average scrotal surface temperature (28.7 vs 28.3°C; $P=.06$) as measured by infrared thermography.

Deposition of lipid or fat in the neck of the scrotum immediately over the pampiniform plexus may have an even greater detrimental affect on normal scrotal/testicular thermoregulation. The pampiniform plexus is generally associated with testicular thermoregulation as a counter current heat exchange mechanism. In the normal bull it also facilitates the radiation of heat energy from the surface of the neck of the scrotum. Deposition of fat within the neck of the scrotum, which is very common in beef bulls fed high-energy diets, may dramatically impede if not virtually eliminate this component of the thermoregulatory mechanism. Again, this will result in increased testicular temperature. The adverse affects of elevated testicular temperature on sperm production, seminal quality and fertility are well documented (7, 11,12,14,15).

An additional mechanism that may impair testicular function in bulls fed high-energy diets is through stress. In obese bulls, the stress from extra body weight and its effects on feet and legs may increase corticoid production that may suppress the production or release of gonadotrophin-releasing hormone (GnRH). A lack of GnRH prevents the release of luteinizing hormone (LH) that is essential to testosterone production from the Leydig cells. Very preliminary data comparing LH and testosterone levels in fat vs thin bulls suggests that a hormonal mechanism plays a role in reduced fertility (1). Other stresses such as the trucking of bulls over long distances, or the foreign environment of the show circuit may also have a similar influence on the bull's endocrine system, thereby resulting in reduced seminal quality.

Other Environmental Factors. Scrotal frostbite, scrotal sunburn, severe attack of the scrotum by biting arthropods, severe dermatitis, and numerous diseases or infections that result in increased core body temperature can have a detrimental effect on testicular function and seminal quality. These conditions result in increased scrotal/testicular temperature that cannot be compensated for through normal physiological, thermoregulatory mechanisms. Some of these factors can be prevented or at least mitigated through proper management practices.

Scrotal frostbite of bulls is a moderately common problem in cold winter climates. It usually occurs in bulls that do not have adequate dry bedding or protection from wind. Minor scrotal frostbite involving areas 1-2 cm in diameter at the very bottom of the scrotum is common and generally has only a short term detrimental effect on seminal quality. The more severe the frostbite and the closer it occurs to the onset of the breeding season the higher is the probability that fertility will be impaired. The primary insult to testicular function occurs as a result of the heat produced by the inflammatory response and not the cold itself. Moderate to severe frostbite affecting 10-30% of the scrotal surface requires between two and twelve months to restore

normal fertility if no adhesions occur between the testes and scrotum. If adhesions occur, the loss of normal fertility may be irreversible.

Scrotal sunburn is less common than frostbite and generally occurs in bulls with little or no pigmentation of the scrotal skin. Generally, it occurs when a late spring snowfall is followed immediately by a bright, sunny day. Sunburn is caused by prolonged reflection of sunlight off the snow onto the scrotum. The extent to which seminal quality is affected will be directly proportional to the severity of the insult. Sunburn is usually not a problem in bulls with moderate to heavy scrotal pigmentation.

In some range environments, beef bulls, including their scrotum, may be subject to severe insect attack. Insects such as black flies, horn flies, mosquitoes, lice and ticks can cause severe inflammation of the scrotal surface and reduce seminal quality. Cattlemen must be very careful when using pesticides to treat internal or external parasites of breeding bulls. Ensure that the product is approved for use on breeding bulls as some pesticides are known to have detrimental effects on seminal quality and therefore impair fertility.

Infections in the bull, particularly those that are prolonged and that raise core body temperature, can have a detrimental effect on fertility. One common infection of beef bulls that has a two-pronged, negative effect on fertility is foot rot. Not only does the bull have considerable physical difficulty in breeding estrous females, but the elevated body temperature associated with the infection tends to result in reduced seminal quality and impaired fertility. If treated immediately, impaired seminal quality is generally short lived, lasting only one to two weeks. Other conditions within the scrotum such as testicular tumor, abscesses, orchitis and varicocele will have a more dramatic, prolonged affect on testicular temperature. These conditions may result in irreversible damage to the testicles and permanently impair seminal quality. If recovery occurs, it will likely be over months or possibly even years. Some cattlemen believe that antibiotics can have a detrimental effect on seminal quality. However, to this author's knowledge, there are no antibiotics currently licensed for use in cattle in North America that have such an effect. The detrimental effect associated with antibiotic use is probably not the antibiotic, but the effects of the infection that the antibiotic is being used to treat.

Seminal quality in beef bulls can be improved by carefully selecting bulls within a herd or breed that have superior seminal quality and by using these bulls and their superior progeny in subsequent breeding programs. However, bulls having inherent superior seminal quality can only be identified if they are reared and maintained in a near-optimal environment facilitated by good management.

Infrared thermography of the scrotum: Infrared thermography (IRT) is a relatively new, noninvasive, radiological technique that provides a pictorial image of a viewed object's infrared emissions. To obtain a pictoral image (thermogram), a scanner converts electro-magnetic energy (heat) radiated from an object into electronic video signals. These signals are amplified and displayed as a grey-level image on a screen. Abnormalities are recognized by analysis of the thermograms and identification of areas of increased or decreased object surface temperature from the norm. This analogue signal can be stored on video tape, processed through an analogue to digital converter, or stored directly as digital data in some units, and image analyses conducted on a computer. This computer system has numerous functions including the ability to enhance the image with up to 36 colours, each representing a specific temperature range. Infrared thermography is presently being used for industrial, engineering, military, medical and veterinary applications. Medical IRT investigations of healthy men under a standard ambient temperature show that normal patterns of skin temperature exist for a given anatomical area. The presence of pathologic abnormalities may be associated with thermal abnormalities of either increased or decreased skin temperature providing the basis for diagnosis.

Scrotal IRT in human medicine gives useful information in the subclinical stage, for diagnostic purposes, and in clinically evident pathology in order to evaluate progression or regression after surgery. Most mammalian testes are kept cooler than the rest of the lower abdomen by losing heat through the scrotum and vascular cooling mechanisms. Spermatogenesis in mammalian species is disturbed by above normal testicular temperature. If the scrotum is not effectively radiating heat, impaired spermatogenesis will occur. Infrared thermography measurements have shown pathological conditions, including varicocele, influence the surface temperature of the human scrotum.

Maintenance of a specific temperature range within the testes of the bull is essential for normal sperm production. For this reason, the ability to monitor scrotal/testicular temperature would be expected to contribute to our understanding of, and ability to evaluate, scrotal/testicular function. Purohit et al. (1985) conducted a study establishing the normal thermographic pattern of the bull scrotum and its contents, and compared some clinical conditions for diagnostic differentiation of scrotal and testicular diseases. In the normal thermogram of a bull, a temperature gradient of 4 to 6°C occurs from the base to the apex of the scrotum with a constant, symmetrical thermal pattern. In pathological conditions, lack of symmetry has been observed in cases of unilateral lesions (2).

Results from a recent study by Lunstra and Coulter (1997) demonstrated that bulls with abnormal scrotal temperature patterns exhibited higher scrotal surface temperatures, a reduced ability to maintain an effective thermal gradient from the top to the bottom of the testes, and achieved lower pregnancy rates (68%) compared to bulls with normal (83%) and questionable (85%) temperature patterns when used for natural service. All bulls used in the study had been classified as satisfactory following a standard breeding soundness evaluation test.

Strive for fertility first!

References

1. Coulter, G. H. Unpublished data.

2. Coulter, G. H. 1988. Thermography of bull testes. Proc. 12th Tech. Conf. A.I. and Reprod. N.A.A. B. p. 58.

3. Coulter, G. H. and D. R. C. Bailey. 1988. Epididymal sperm reserves in 12-month-old Angus and Hereford bulls: Effects of bull strain plus dietary energy. Anim. Reprod. Sci. 16:169.

4. Coulter, G. H., T. D. Carruthers, R. P. Amann and G. C. Kozub. 1987. Testicular development, daily sperm production and epididymal sperm reserves in 15-month-old Angus and Hereford bulls: Effect of strain plus dietary energy. J. Anim. Sci.64:254.

5. Coulter, G. H. and G. C. Kozub. 1984. Testicular development, epididymal sperm reserves and seminal quality in two-year-old Hereford and Angus bulls: Effects of two levels of dietary energy. J. Anim. Sci. 59:432.

6. Coulter, G. H. and G. C. Kozub. 1989. Efficacy of methods used to test fertility of beef bulls used for multiple-sire breeding under range conditions. J. Anim. Sci. 67: 1757.

7. Kastelic, J. P., R. B. Cook, G. H. Coulter and R. G. Saacke. 1996. Insulating the scrotal neck affects semen quality and scrotal/testicular temperatures in the bull. Theriogenology 45: 935.

8. Lunstra, D. D. and G. H. Coulter. 1997. Relationship between scrotal infrared temperature patterns and natural-mating fertility in beef bulls. J. Anim. Sci. 75: 767.

9. Pruitt, R. J. And L. R. Corah. 1985. Effect of energy intake after weaning on the sexual development of beef bulls. 1. Semen characteristics and serving capacity. J. Anim. Sci. 61: 1186.

10. Purohit, R. C., R. S. Hudson, M. G. Riddell, R. L. Carson, D. W. Wolfe, and D. F. Walker, 1985. Thermography of the bovine scrotum. Am. J. Vet. Res. 46: 2388.

11. Ross, A. D. and K. W. Entwistle. 1979. The effect of scrotal insulation on spermatozoal morphology and the rates of spermatogenesis and epididymal passage of spermatozoa in the bull. Theriogenology 11: 111.

12. Setchell, B. P. 1978. The scrotum and thermoregulation. In: *The Mammalian Testis,* 1st edn. p. 90. Cornell University Press, Ithaca, New York.

13. Trenkle, A. and R. L. Willham. 1977. Beef production efficiency. Science 198: 1009.

14. Waites, G. M. H. 1970. Temperature regulation and the testis. In: *The Testis,* vol. 1, p. 241. A. D. Johnson, W. R. Gomes, N. L. Vandemark, Eds. Academic Press Inc., New York.

15. Wildeus, S. and K. W. Entwistle. 1986. Effects of scrotal insulation and unilateral vasoligation on ejaculate characteristics and sperm reserves in the bull. Anim. Reprod. Sci. 10: 11.

RELATIONSHIP OF BULL SEMEN CHARACTERISTICS TO FERTILITY AND EMBRYO QUALITY

R.G. Saacke

Virginia Polytechnic Institute and State University
Blacksburg, Virginia

Introduction

Our concepts involving assessment of bull fertility by evaluation of semen are changing rapidly. For many years, research has focused on enhancing our efforts to predict fertility of a male or dosage of artificially inseminated semen by simply examining the semen using laboratory tests. We have not met this objective. Many tests and combinations of tests were found to have significant correlations to fertility, but fell far short of being predictive of fertility. For example, it is not uncommon to find successful semen tests of fertility which may account for 30 to 60% of the variation in fertility among bulls or semen samples; however, it is clear that following such tests, the reciprocal of these values, i.e., 40 to 70%, fertility variation is still unaccountable by the tests. In this presentation of assessing bull or inseminate fertility I would like to review some of the pertinent concepts we now have as well as summarize portions of our work on accessory sperm and the ova/embryos from which they are taken, an effort that is giving us better insights to the complexity of male fertility. In the process, we will hopefully develop our current philosophy and capability in the assessment of reproductive capacity of the bull by semen evaluation.

Central to our current concepts in assessing male fertility or fertility of a semen dose used in artificial insemination is the relationship of semen quality to semen quantity. It is now clear that there are semen quality differences among males that are **compensable** in that fertility differences among such males can be minimized or eliminated by adjusting the quantity of sperm in the dosage (see differences between Bull A and B in Figure 1. On the other hand, there are subfertile males that cannot be brought to normal fertility by simply increasing the inseminate dosage (Bull C in Figure 1), thus rendering the semen traits or deficiencies of such males, **uncompensable.** Dutch researchers have recently shown that the rate at which bulls reach their maximum conception as sperm numbers in the inseminate is increased varies and that this variation is unrelated to the bulls maximum fertility (see Figure 2). Together, these two Figures (1 and 2) make us recognize that semen from a given bull or artificial inseminate may contain compensable factors, uncompensable factors as well as any combination of the two. Clearly, uncompensable factors would seem to be the most serious since they prohibit a male or inseminate from reaching the maximum fertility of the female population (herd). In order to relate semen characteristics to fertility, we must first understand what constitutes compensable vs uncompensable components in the semen. Work in several laboratories shed light on this aspect of semen quality by recognition that all sperm inseminated do not have the opportunity to compete for fertilization of the egg, many such sperm simply fail to reach the site of fertilization in the oviduct of the cow.

Semen quality vs barriers in the female reproductive tract

In cattle, major barriers of sperm transport to the site of fertilization are presented in Figure 3. The quantity of sperm reaching the site of fertilization is quite varied dependent upon factors related to both male and female, but is always relatively small in relation to that deposited by the male or artificial inseminator. A very rich literature, important to evaluation of semen, is now accumulating to indicate that the quality of sperm that reach the upper oviduct (site of fertilization) is enriched in both motility (viability) and normal morphology compared to that of the inseminate, which we evaluate in the laboratory. In addition, there is now strong evidence that the coverings of the egg itself offer final barrier(s) against penetration of sperm with certain abnormal characteristics. Thus, it is becoming most apparent that all sperm are not created equal and that there is a selection process in the female that permits a relatively small number of sperm with certain characteristics to engage the egg in fertilization. Obviously, if a given male or inseminate has a portion of sperm that cannot reach the site of fertilization or engage the egg, it would be important that there are also sufficient numbers of sperm deposited that can make contact with the egg such that fertilization rate is optimized. Variation in semen among males or inseminates that reflect this difference in ability of their sperm to access the egg would be considered **compensable** in that lowered fertility would only be encountered when insufficient numbers of sperm were deposited resulting in unfertilized eggs. In artificial insemination, such differences among males can be minimized by altering the sperm dose in the inseminate. On the other hand, if sperm of a male or inseminate could gain access to the egg, i.e., traverse the natural barriers in the female and fertilize the egg, but be abnormal in lacking the ability to sustain the fertilized egg and subsequent embryonic development, such sperm would not be compensable. Rather, these sperm would constitute an **uncompensable** component in the semen. Such a component would lower pregnancy rate and not normally respond to increased sperm dosage since the incompetent sperm would be competing with the competent sperm in proportion to their quantity in the inseminate. To distinguish compensable and uncompensable characteristics in semen and their relationship to pregnancy rates in cattle we have taken the approach of evaluating accessory sperm and the embryos from which they are taken.

The accessory sperm approach

Accessory sperm are those sperm that become entrapped in the outer covering of the cows egg (called the zona pellucida) following breeding. These sperm represent, in number, the availability of sperm in the inseminate at the time that the egg was receptive for fertilization. In quality, these sperm also represent those capable of traversing the barriers in the female tract as well as the zona pellucida of the egg. Certainly, only one sperm normally penetrates through this covering and becomes the fertilizing sperm; however, the accessory sperm represent those competing for the honor of being a fertilizing sperm in the short time the egg is receptive.

Our purpose in measuring the quantity and quality of accessory sperm as well as the associated fertilization status and embryo quality of eggs or embryo from which these sperm come is to better understand the compensable and uncompensable components of semen quality. Our evaluation of accessory sperm and the eggs or embryos is determined 6 days following insemination. At this time the embryo or egg is flushed non-surgically from the cows uterus as it would have been in an embryo recovery destined for transfer. The embryo (expected to be in the pre-hatching stage called a morula) is graded as excellent, good, fair, poor or degenerate or if fertilization did not occur as simply a UFO (unfertilized egg). The significance of this to pregnancy rates in cattle is simply that embryos classified excellent to good result in twice as many pregnancies as those classified fair to poor and of course, degenerate embryos and UFOs do not result in pregnancy. Thus, the bulls contribution to this spectrum of fertilization status and embryo quality is what really impacts the economic factor of "pregnancy rate".

Compensable semen traits

From research up to this time, it appears that the detrimental, but compensable traits of semen quality are those that characterize sperm incapable of traversing the barriers (Figure 3) and reaching the site of fertilization in the female reproductive tract. Such sperm would have little impact on fertility if inseminated with sufficient numbers of sperm competent in this respect. A difference in percent motility of semen samples would be reflected in expected performances of Bulls A and B of Figure 1 where fertility would not differ among these bulls unless numbers of sperm below the thresholds were inseminated. Motility of sperm has been shown to be required for access to the egg in the upper portion of the oviduct. Duration of sperm motility (or motile life-span) also appears important since cryopreservation methods resulting in a shorter sperm life impair the numbers of sperm that gain access to the site of fertilization in the oviduct. Fortunately, good contemporary methods of semen freezing, utilizing the straw package and liquid nitrogen, have resulted in numbers of sperm accessing the egg (accessory sperm) that are equal to fresh (unfrozen) semen. However, it has been my experience that occasionally semen from bulls with low motility are frozen at too high of a sperm concentration to provide adequate cryopreservation. Thus, there is a limit to that which we might consider a compensable semen deficiency and it is still comforting to know that the semen we put in a cow has good motility and that the cryopreservation was successful.

Several years ago investigators showed that differences among bulls in the minimum numbers of sperm required for maximum conception was also due to the generally higher levels of abnormal sperm in semen of below average fertility bulls. Several studies supporting this concept have shown that abnormal sperm are often blocked at barriers in the female tract and result in more perfectly shaped sperm gaining access to the egg in the oviduct. This is also depicted schematically in Figure 3. Our accessory sperm work also verifies this observation in that sperm qualifying for accessory sperm in cattle are considerably more perfect in shape than are those we or the bull inseminates. Recent work in the Cheetah (an animal heavily studied because of threatened extinction) shows that the deeper the accessory sperm are in the covering of the egg (zona pellucida) the more perfect they are in shape. This indicates that selection of sperm occurs even after they contact the egg. Thus, males with abnormal sperm can be partially compensated for by higher sperm numbers in the semen dosage delivered to the cow.

In contrast to motility however, where sperm gaining access to the egg are nearly 100% motile, the number of normal shaped sperm gaining access to the egg are quite far from this value. That is to say, while selection of sperm by shape occurs in the female reproductive tract, it is far from a perfect selection. Based upon our accessory sperm work in cattle, it appears that selection is based upon severity of the sperm in shape. Severely misshapened sperm do not show up in the egg; however, subtle forms of nearly every abnormal sperm type with the exception of tail deformities (affecting motility) do compete for fertilization. On this basis, it appears that abnormal but compensatory semen traits would be those involving the proportion of motile and severely misshapened sperm heads in the semen. This leads us to a discussion of the more serious uncompensable traits of semen.

Uncompensable traits of semen

There is now good evidence that incompetent sperm can reach and fertilize the egg. Males or semen dosages providing sperm capable of reaching the egg, initiating fertilization and embryonic development, but unable to sustain these events, could not be expected to improve in reproductive efficiency by additional sperm numbers in the inseminate. On this basis, the semen deficiency would be considered uncompensable. Although sire-related embryonic death in cattle is not new, it was historically thought to be of low magnitude and related to embryonic mortality characterized by extended estrous cycles. More recently, observations in a variety of species, including cattle, indicate that factors associated with lowered sperm quality, particularly poor sperm morphology, result in very early embryonic failure prior to maternal recognition of pregnancy. Thus, females cycling back to a male-related cause of embryonic death do so within a normal estrous interval. Such observations on our ranches and farms have erroneously suggested that the cow simply did not settle in the first place. We now recognize the reason for the failure to become pregnant to a service can be due to fertilization failure or embryonic failure, both occurring within a normal cycle and both situations could be due to the bull or semen quality.

Few observations are available regarding the characteristics of incompetent fertilizing sperm; however, from our accessory sperm work, we know that only the subtle misshapened abnormal sperm traverse the barriers in the female and have a chance at fertilization. Of interest is the fact that a male producing abnormal sperm usually produces the subtle as well as the more severely misshapened sperm. Thus, recognition of abnormal sperm, even if only 25% of the sperm in the sample, could reflect only the tip of the iceberg with respect to the proportion of sperm that are incompetent and uncompensable.

The superovulated cow

A comparison of accessory sperm in single vs superovulated cows indicates that the superovulated cow does not transport sperm to the site of fertilization as well as the single ovulating cow. This is based on the observations that the numbers of accessory sperm per egg in the superovulated cow is considerably less than the single ovulating cow. This translates into more unfertilized eggs due to low sperm numbers and less selection pressure on the fertilizing sperm. More recent data shows that the covering of the egg (zona pellucida) in the superovulating cow is softer and more permissive to sperm penetration than that of the single ovulating cow. Thus, selection of sperm at the surface of the egg is also thought to be impaired in superovulation. Both of these factors add up to the generally accepted concept that semen problems are magnified quite markedly in the superovulated cow and both fertilization failure and low quality embryos are the outcome. Optimum results in superovulation are best achieved when semen quality is maximized.

As you are aware from the preceding presentations at this meeting, sperm production in the testis requires temperatures 5-7 degrees below that of body temperature. In the past few years we have been able to obtain a variety of abnormal sperm types when we mildly insulate the scrotum of the bull for only 48 hours. Semen production is normal until a period beginning 10 days following insulation and lasting for another 30 to 40 days when sperm that were in the testis at the time of the thermal insult were in the process of being formed. Motility and numbers of sperm produced during this period of time do not really change with such a mild insult; however, the proportion and types of misshapened sperm vary markedly. We have used semen from these bulls before and after the appearance of misshapened sperm to breed superovulated cows and then judge the effect following recovery of the eggs 6 days later. These experiments were designed to reveal the impact of semen quality (particularly sperm shape) on fertility and embryo quality. Clearly, when abnormalities of the tail or tail movement were involved, the predominant effect was a depressed fertilization rate. However, when distorted sperm head shape was involved or errors in the DNA of the sperm head (apparent from vacuoles or openings in the sperm head), there was increased proportions of degenerate embryos and poor quality embryos along with a lower fertilization rate. Thus, we have gained some confidence in the concept that misshapened sperm heads in the semen sample signify existence of sperm able to fertilize but not sustain development of a normal embryo. Such incompetent sperm would be considered the uncompensable component of semen quality and like simple fertilization failure, constitute an important loss in pregnancy rate.

Interaction of uncompensable factors in semen with sperm numbers inseminated

Surprisingly, increased numbers of accessory sperm per egg or embryo is positively related to the fertility and embryo quality. In cattle, the average number of accessory sperm for the following conditions are: unfertilized eggs (0 sperm), degenerate embryos (1 sperm), fair to poor embryos (5 sperm) and good to excellent embryos (7 sperm). This data has involved nearly a 1000 embryo recoveries from single-ovulating cattle. The cause of unfertilized eggs appears reasonably clear in that they are predominantly sperm hungry. However, why embryo quality should increase with increasing accessory sperm numbers is not readily apparent. Utilizing information from laboratory species, we have come to the conclusion that accessory sperm represent sperm competing for the honor of being the fertilizing sperm. This may be due to semen quality or conditions in the female. Because the egg covering (zona pellucida) is a major barrier to abnormal sperm, chances of fertilization by a competent sperm would be maximized only if competition occurred. Thus, the old adage that it only takes one sperm to fertilize is still true; however, if we are to maximize pregnancy rates in cattle, we should also consider conditions which optimize embryo quality.

Summary

What have we learned about semen quality from accessory sperm and the embryo or eggs from which they come?

1. Sperm motility is essential for sperm to access the egg at the site of fertilization in the upper portion of the female oviduct. However, % motile sperm in a sample of semen appears to be a compensable semen trait (adjustable by sperm dosage) within certain limits.

2. Sperm gaining access to the egg following insemination (accessory sperm) appear limited to those that are normal in shape or those with subtle distortions of the sperm head. Motile sperm with severe defects of the head or tail do not gain access to the egg. Use of semen with significant levels of motile sperm having abnormal shape should be avoided since such samples have the most likelihood of containing uncompensable semen traits.

3. Superovulated cows may be more vulnerable than single-ovulating cows to poorer quality semen due to their impaired sperm transport to the site of fertilization and greater permissiveness of their eggs to penetration by abnormal sperm. This vulnerability is expressed in both fertilization rate and embryo quality.

From the standpoint of improving reproductive efficiency to artificial insemination or natural service in our cattle based upon semen evaluation, we should first respect the fact that there is not a single semen test which is available to help us predict fertility. It appears that for best results we must consider tests that address both compensable and uncompensable semen traits, recognizing that a given bull may have one or both of these components and in different proportions. Clearly, in range bulls, the uncompensable traits should be given major priority. In semen destined for artificial insemination, both compensable and uncompensable traits should be addressed with the highest requirements exerted for superovulated cows.

Finally, for both AI and natural service, we should strive to recognize the uncompensable traits in semen and eliminate from use males chronically producing semen with such traits.

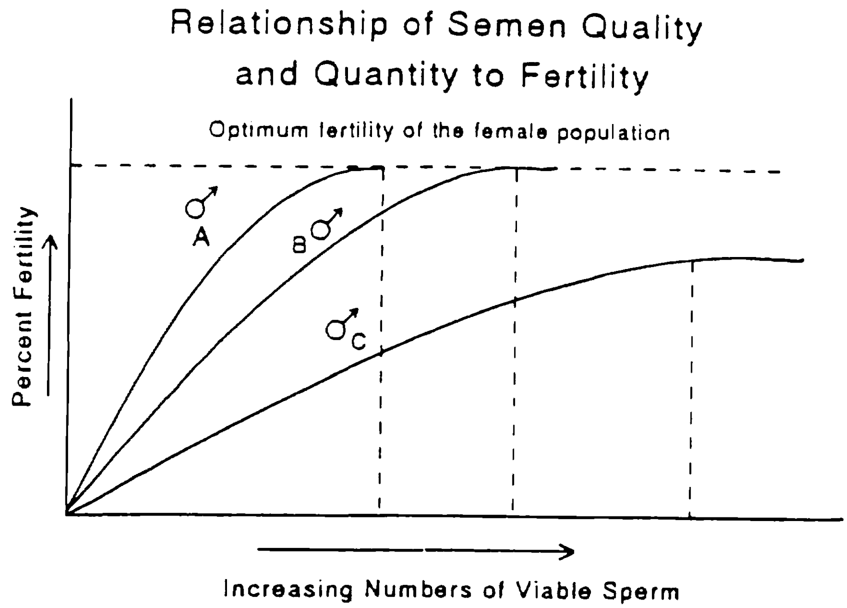


Figure 1. Bulls differ in the minimum number of viable sperm required for maximum conception (compensable factors in semen, difference between Bull A and B) and in the ultimate level of fertility of which they are capable (uncompensable factors in semen, if below the optimum fertility of the female population, Bull C).

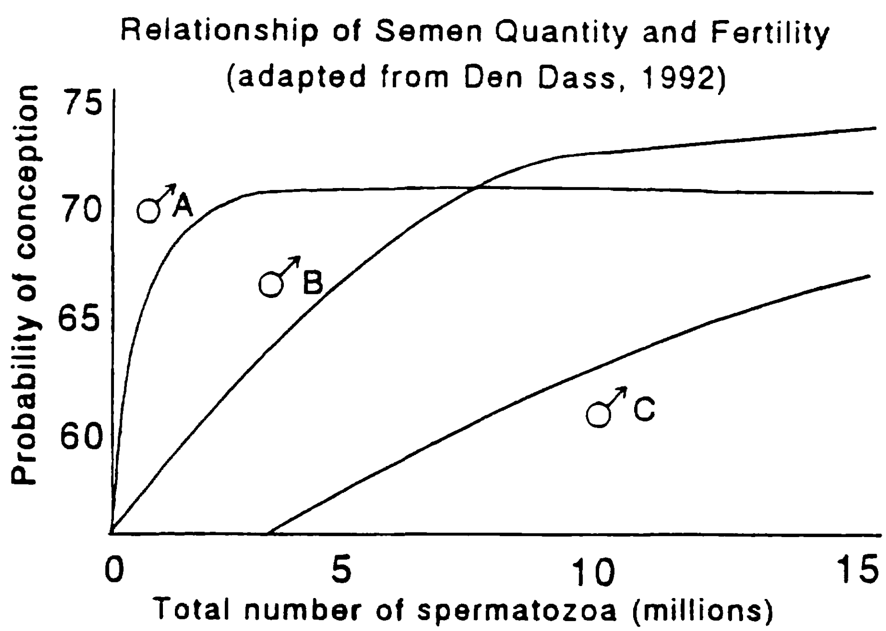


Figure 2. Relationship between non-return rate and the number of spermatozoa inseminated. The semen of different bulls varies in the maximum non-return rate and in the rate at which the maximum fertility is achieved with increasing sperm dosage.

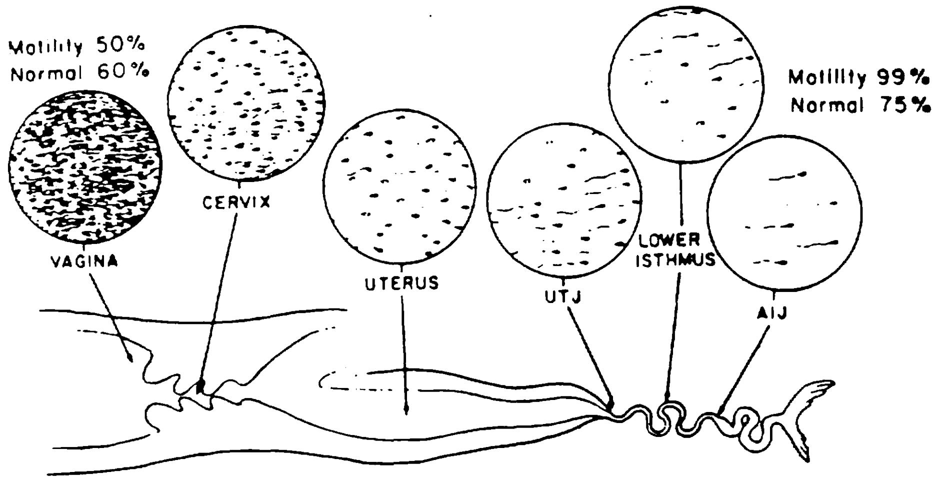


Figure 3. Schematic summarizing work in many laboratories regarding the major barriers to sperm transport in the female tract. Numbers of sperm reaching the egg at the AIJ (ampullary-isthmus junction) are relatively small in relation to those inseminated; however, they are enriched in quality, particularly viability and to a lesser extent, morphology

EMOTION, TRADITION AND BUSINESS

T.G. FIELD AND R. E. TAYLOR
COLORADO STATE UNIVERSITY

There are more things in heaven and on earth than are dreamt of in your philosophy.
- William Shakespeare

The assumption is often made that the removal of emotion and tradition from an industry will equate to a profitable business. Unfortunately, a careful evaluation of the business literature does not support this assumption. "Companies that enjoy enduring success have core values and a core purpose that remain fixed while their business strategies and practices endlessly adapt to a changing world", wrote Collins and Porras (1996).

"You almost have to be a true believer to be competitive...a true believer in your product, a true believer in your industry. Of the hundreds and hundreds of world class companies from around the world that I studied, an enormous proportion were privately owned or run by some maniac who had spent the last twenty years of his life on a crusade to produce the best product", wrote Michael Porter (1990). Words like MANIAC, CRUSADE, and TRUE BELIEVER are hardly the stuff of quantative analysis. However, they speak to the basic need of humans to have a great adventure or vision before them to engage their whole-hearted dedication.

In their landmark paper, Building Your Company's Vision, Collins and Porras (1996) advocate the need for organizations to establish core ideology by defining their core values and purpose. Core ideology - "the enduring character of an organization" - transcends market cycles, shifts in consumer attitude, and development of new technologies. The authors go on to describe core values as the "essential and enduring tenets of an organization." These values are timeless in the sense that they provide the foundation upon which the long term strategies of the organization rest (Table 1). Collins and Porras (1996) began their paper with the following quote from T. S. Eliot's Four Quarters which asks us to revisit the foundations upon which our business and endeavors are positioned.

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.

Core purpose is in essence the motivation for people to achieve an organization's purpose. Not to be confused with strategic plans or target objectives, core purpose gets at the emotional/spiritual reasons for the organization to exist - it is the process of "capturing the soul of the organization" (Collins and Porras, 1996). Examples of core purpose are provided in Table 2.

In the end, core ideology is the spark that generates the spirit and enthusiasm for people to achieve greatness. Core ideology is not a program, a tool, or a technique (Collins and Porras, 1996). Rather, it is the heart and soul of an organization. "Listen to people in truly great companies talk about their achievements - you will hear little about earnings per share," conclude Collins and Porras (1996).

Table 1. Examples of Core Values.

MERCK
- Corporate social responsibility
- Honesty and integrity
- Profit from work that benefits humanity

NORDSTROM
- Never being satisfied
- Being part of something special

SONY
- Elevation of Japanese culture and national status
- Being a pioneer

WALT DISNEY
- No cynicism
- Creativity, dreams, imagination
- Preservation and control of the Disney magic

Source: Collins and Porras, 1996

Table 2. Examples of Core Purpose.

CARGILL - to improve the standard of living around the world.

3M - to solve unsolved problems innovatively.

NIKE - to experience the emotion of competition, winning, and crushing competitors.

FANNIE MAE - to strengthen the social fabric by continually democratizing home ownership.

Source: Collins and Porras, 1996

We suspect that the beef industry will not be well served by removing all emotion and tradition from the process. Rather what is required is a delicate balancing act that incorporates the central mission of generating long term profits via superior business skills, a passion for excellence (emotion), and sustaining appropriate traditions.

Without a sense of emotion the concepts of good stewardship and careful husbandry are not possible. Without an understanding of tradition we cannot build effective communities. Without stewardship, husbandry, and community the business of beef production would be less worthy of the investment of our time, energy, and resources. However, as the following story illustrates, blindly relying on traditional or emotional approaches without re-thinking business strategies can lead to serious mistakes.

During World War II, a young officer in the British army was assigned to oversee an artillery unit. On his first day he observed that each battery was manned by several men, one of whom did nothing but snap to attention before each firing. Since this violated the young officer's sense of efficiency, he questioned the NCO as to the soldier who seemed to have no function. The NCO responded that he had no idea but that was the way he had been trained to train the men. The young captain then questioned the training officer who also had no idea as to the soldier's function. As he questioned subsequent ranking officers, he still found no answer. Then one night in a small pub he encountered an elderly veteran of the Boer War. Upon being questioned, the old man retorted that the answer was quite simple. "Obviously he is there to hold the horses."

One of the most difficult challenges in life is sorting out the practices, concepts, and philosophies which ought to be preserved and which should be abandoned. In these days, when the speed of information exchange literally outpaces our ability to utilize the data, we must seek the appropriate balance of maintaining and disposing of traditional approaches to the business of agriculture.

Those of us who are naturally drawn to an organization like BIF find a good deal of comfort and hope in concepts such as objective evaluation, numeric estimates of genetic worth, and the application of technology/science to the problems of the day. We like cold, hard facts. Yet, our long-term success is not dependent on technology, programming skill, or better estimates. Rather our success lies in the perception, talent, faith, and curiosity of people - our partners, customers, and consumers.

An analysis of the challenges which confront the beef industry will likely yield a mix of issues that include biological, economic, sociological, and technical aspects. The primary barriers to profitability in the beef industry might best be described as:

1. Too much commodity orientation
2. Information hoarding between and within firms
3. Boring products
4. Ignored customers
5. Lack of accurate financial and biological records
6. Slow acceptance of new concepts and technologies
7. Distrust of other segments in the production and marketing chain

"For years companies have been trying to sell new products with new techno-this, or new techno-that. People take technology for granted these days. What they want are warm, friendly products - something to seduce them", says Phillipe Starck, designer for Thomson Consumer Electronics (Peters, 1994). The consumer market place is a dynamic, competitive, and quirky arena. It takes more that just good products, success in the long term takes **special** products and services (Table 3).

Table 3. Examples of Excellent Product/Service Design.

✓ Great tractor seats.

✓ Found equally on farms and in high fashion dress shops.

✓ The care with which winery logos are reproduced on wine-bottle corks.

✓ The guts to throw out today's winning product when you get a better idea.

✓ A waiter who serves a Caesar salad the way Placido Domingo sings the part of Rodolfo in La Boheme

✓ Things you can sense but not see.

✓ A truck stop where you feel at home.

✓ The passion with which the owner talks about the company's products/services.

✓ In the age of phones, faxes, and e-mail, a scrawled personal note from anyone.

Source: Tom Peters, The Pursuit of Wow, 1994

The point is this - the future for the beef industry lies in the opportunity to position a diverse set of products into the marketplace and to underwrite those products with impeccable service, quality, and perceived value. Simultaneously, producers will be most profitable when they are able to build cost effectiveness as a hedge against the cyclic nature of markets and climate.

As important as clearly defining the central mission of an organization is the need to eliminate those practices, paradigms, and techniques that no longer fit the business environment.

The needs and wants of commercial producers have continued to shift over time and if the individual firms that comprise the seedstock sector want to retain customer loyalty they will likely have to partner with competitors and customers to meet the genetic and information needs of the cow-calf client.

In the future,the seedstock sector will be driven by these needs:

1. Accurate financial and biological records coupled with improved information sharing.
2. Customer service of unparalleled levels as a means to accomplish product differentiation.
3. The willingness to adopt innovative ideas and technologies.

Furthermore, the services provided to customers will include (at the very least) production records systems; on-farm consulting relative to nutrition, health, and information management; historical and current trends for herd performance in reproductive, growth, carcass, and convenience traits (means and standard deviations) - these benchmarks will be considered invaluable; and joint venture opportunities to retain ownership of customer calves to an endpoint beyond the farm.

SYSTEMS THINKING

"Technology alone does not a communication revolution make. Economics trumps technology every time. People must be offered things they want at prices they are willing to pay. Many of the futurists who see a new day dawning are going to be disappointed by what they find at dawn's early light."

Douglas Gomery
Wilson Quarterly, 1994

The answers are not so much in the technology but in the creative application of tools to the problems at hand. Using cattle to harvest forage as a means to add value to the human food supply is risky business, particularly when both market and climatic conditions are highly variable. The assembly line or linear approach to problem solving is not adequate to deal with the complexity of agricultural systems. Agriculturists have had reasonable success in dealing with specific components of systems particularly when the socio-economic climate supported increased productivity and efficiency. In fact, agricultural industries have been very successful at increasing volume of production and individual animal efficiency. However, as Darrell Jensen, a pork producer from Iowa points out, "the problem in agriculture is that we don't know the difference between efficiency and cost effectiveness."

We have produced volumes of information from research projects that answer questions about pieces of the system. Unfortunately, not enough has been done to assimilate the myriad of available information into a format that can be successfully applied to systems kinds of questions. Many are calling this the age of the "information explosion". Effective collection, summarization, and application of information is the foremost challenge facing agricultural producers for the next decade and likely beyond. Dealing with the monumental amount of information appropriate to beef cattle managers is a major obstacle to the development of profitable systems that can be sustained for the long term. The speed of information creation is accelerating to the point of overwhelming most people.

What is needed are mechanisms for sorting information so that only the most relevant ideas are evaluated in detail. Furthermore, systems that provide meaning to the accumulated data must be developed and barriers that inhibit the rapid transfer of useful information must be removed. Possibly, BIF should expand it's improvement focus beyond genetics to include the forage, financial, and people resources that are so critical to the long-term success of the industry.

Putting the systems concept to work is a continuous experiment in creative problem solving. In our career we have been privileged to interact with people who embody the systems philosophy. The lessons they've taught us are summarized in Table 4. We think these are a few of the concepts that should be preserved.

FOCUS ON PEOPLE

"The flexible organization's leaders will put a disproportionate emphasis on the care and feeding of front-line people. Success in today's environment will come when those on the front line are honored as heroes, and empowered to act -- period."

- Tom Peters, 1994

Can this industry afford to stand still? Absolutely not. Many of the techniques and approaches that have served the industry well in the past must go the way of the dinosaur. Innovation, hustle, and responsiveness must be prevalent for the industry to survive. Furthermore, it is absolutely critical that industry leaders and managers tear down the barriers that have stifled the creativity and imagination of the front-line employee. We must always remember the foundation of resources in the industry (Figure 1).

Figure 1. Foundation of Resources for the Industry

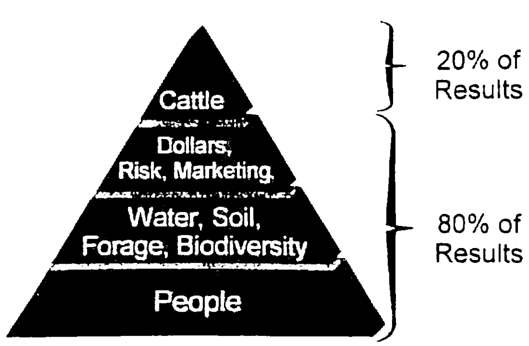


Table 4. Putting the management systems philosophy into practice.

- ❖ Short term economics usually involves linear thinking. Systems thinking also includes a long-term focus.
- ❖ Increase dependence on solar-driven resources, not on fossil fuels.
- ❖ When you wean was not one of the ten commandments.
- ❖ Let grass/forage availability dictate calving season.
- ❖ Don't count on land appreciation to stay in business.
- ❖ Make sure that record keeping yields information instead of data.
- ❖ Maximization/minimization is less important than cost effectiveness.
- ❖ Sustained low break-even prices may be a good measure of optimum performance.
- ❖ Technology is the icing, not the cake.
- ❖ The land's health is the basis for long-term success.
- ❖ Effects of changes made to suit the marketplace will impact the cow herd 4 to 6 years in the future - not all will be favorable.
- ❖ Profitability is the result of lowering production costs where appropriate while increasing or sustaining productivity.
- ❖ The beef industry must focus on both low cost production and increased consumer market share. Failure to do so will cause continued downsizing.
- ❖ Focus on renewable resources (the well-being of land and people).
- ❖ Nothing good ever happens except through the motivation of quality people.

Adapted from conversations with the following friends: Gregg Simonds, Jim Gosey, Bill Hopkin, Burke Teichert, Steve and Penny Radakovich, Jim Gibb, Frank Padilla, Jack Maddux, Doc and Connie Hatfield, Jack and Gini Chase, Jack Roberts, Jack Turner, Tom Elliott, James and Paul Bennett, Dave Daley, Bob and Judy Prosser, Bill Trampe, Ken Spann, Randy Blach, Gary and Laura Teague, Simon Gubbins, Alf Collins, and many others of the best ranchers on the planet.

The biggest weakness of the beef industry is the failure to recognize the huge value and influence of the human resource. The industry tends to measure performance in terms of shortfalls or failures as opposed to victories and success. Too often such an approach leads to an environment where the fear of failure paralyzes the organization. "The fearful organization is not a hustling organization. Fear is the chief enemy of urgent action and flexibility," writes Peters (1987). At the outset of this paper we suggested the need for organizations to understand their core purpose. The ability to clearly articulate that vision provides the security for people to undertake the challenges that confront the firms and businesses that comprise the beef industry. After all, "Companies are created, and exist, to serve people - insiders and outsiders. Period." (Peters, 1994).

Determining what must be preserved and what must be discarded is an ongoing process. When it comes to agricultural production we shouldn't be fooled into believing that an industry free of values, emotion, or tradition is a business activity worthy of our best efforts and investment. However, failure to incorporate the best business concepts and techniques would be equally short-sighted. Utah rancher Bill Hopkin's solution to the dilemma - "the two most important things cattlemen can do to protect their way of life is to be financially strong and become the best land managers possible."

Beef producers and industry organizations that have well written management plans (i.e. vision/mission statements, strategies/goals, core values, etc.) will have a clear focus on what traditions, emotions, and business principles to retain and which ones to omit. This management systems focus will yield an industry that has successfully integrated the past with the future.

LITERATURE CITED

Collins, J. C. and J. I. Porras. 1996. Building your company's vision. Harvard Business Review. Sept-Oct.. pg. 65-76.

Gomery, Douglas. 1994. In search of the cybermarket. Wilson Quarterly. Summer. p. 9-17.

Peters, Tom. 1987. Thriving on Chaos: Handbook for a Management Revolution. Harper & Row, NY.

Peters, Tom. 1994. The Pursuit of Wow! Random House, Inc., NY.

Porter, Michael. Sept. -1990. Have we lost our faith in competition. Across the Board. p. 38.

The Business of Commercial Production

Fran Dobitz *
Cedar Valley Ranch, LTD.

Good Morning. Welcome to North Dakota. Kris Ringwall asked me to give a short talk to the BIF Convention and I told him I am a rancher and not a speaker, but any of you who know Kris know, that he has a way of getting you to do what he wants. I started trying to write an outstanding speech because of the caliber of this audience, but soon realized that I am a rancher and I know cows and that is what I should talk about.

I am president and part owner of Cedar Valley Ranch, LTD., a family corporation located on the Cedar River in south central ND. The other people involved in the ranch are my wife and partner, Beth, my three daughters Kelly, Kim and Kori, and my mother Rosella. All of these people are very instrumental in the day to day operation of the ranch. We also have hired help.

My dad began ranching 43 years ago with 13 cows and a dream. We have grown from that point mainly with hard work and paying attention to details. My goal at Cedar Valley is to be a good person, be happy and sustain enough profits to sustain a quality life.

We have a cow calf operation, a farming enterprise and a small feedlot. 85% of our annual income is generated from the sale of cattle, so doing it right is very important.

These last 8 months have been a challenge. 108 inches of snow, an all time record, the coldest winter on record, beating the old mark by an average of 6 degrees per day. More blizzards than I care to remember. A flood this spring that people say was the worst they ever saw. And to top it off, an April blizzard that was the worst in 50 years, that occurred during the middle of calving season. We learned that we don't control near as much as previously thought. It has made me mad enough that I am just going to continue ranching.

With that decision made, I must look at our current operation, decide what we do well and find what we don't do so well. I would like to share a few of those things with you. One of the things we do is keep records. I probably started keeping records because of my bad memory as my wife will attest to. We began performance testing and using those records in 1962. At that time the average 205 day wt. was 420 pounds. Currently they have been ranging from 670 to 680. We were over 700 for a short time, but decided to moderate cow size and ease back on performance as a trade-off for better reproductive performance and lower nutritional needs. We decided this moderation would positively affect profits since 70% of maintaining a cow herd is feed costs.

Our stocking rate at one time was 25 acres per cow for one year. Of these, about 17 acres were allocated for summer grazing. With the aid of the IRM team, and range specialists Kevin Sediveg and Lee Manski, we are at 13 to 14 acres for summer grazing. We implemented a twice over grazing system on the ranch. I know the stocking rate can be increased by a more intense grazing system.

* BIF Outstanding Commercial Producer in 1994

However, at this time, we can't justify the time and labor involved to do so as some of the grazing units require a fair amount of travel from the headquarters.

Our breeding system is a rotational-terminal sire system. We currently rotate two maternal breeds, Angus and Hereford, with the one and two year old females, keeping replacement females from these progeny. The three year old cows and older are turned out with Charolais bulls as a terminal cross. About 30% of the females are in the rotational cross and the remaining 70% in the terminal portion. Therefore, about 70% of the calves are 3-way cross calves. After keeping replacement females from the rotational cross, the remaining calves that are marketed are 85% from the terminal sires. This takes some intense management, but works out well with the rotational grazing scheme and seems to be worth it.

We utilize the CHAPS program for obvious reasons. We also keep track of and chart conception rates, calves born by 21 days intervals (calving sequence analysis), death loss, pounds of calf per cow exposed, average calving interval and economic performance of the cow herd.

We utilize IRM to further analyze our records. A few stats from our last analysis shows pounds weaned per cow exposed of 527#, cost of production on cash basis of $0.49 per # on a steer calf equivalent, and cow feed costs of $199 per cow. We are working to improve these numbers without adversely affecting performance.

I was instrumental in forming a local IRM club called the Pretty Rock Management Club. This has been fun and quite a valuable management tool for all involved.

Some other tools we use are a computerized accounting program, least cost rations, a consulting nutritionist, good genetics, EPD's, being hungry for knowledge and a willingness to change.

I feel fairly good at gathering production and economic records. However, I am not yet good at analyzing them and then changing production practices. Although we have changed much, it is only the tip of the iceberg. As I mentioned before we like to pay attention to details. However, I really struggle with this as we expand in size. We do have hired labor and they are good, but there are days that I feel like we are losing control. I would like to sit down with someone who has worked through this situation and learn how they have handled this.

North Dakota extension people have been very valuable to us. I am grateful for their help thru the years and the ranch has prospered much because of them. Harlan Hughes always says you need an annual plan. I also think you must have a 5 year plan.

Some of the changes I see in the future that most of us will adapt to are:

1. **Technology.** In the next 10 years things will change more than in the last 20, so hang on. Telephones with pictures, computers on line, accessing research on any topic from your office, more use of a satellite dish. Five years ago, I did not think my office would have a copy machine, fax machine, computer and a DTN machine. But it does. Technology is needed to gather information and save time.

2. Genetics. Genetics will change for performance, improve carcass characteristics and solve inconsistency. Fewer cattle breeds will be used in the future, but more composites from these breeds. The pig people only have about 3 breeds and composites from them. This is where we will head. Cloning will come into use. The moral issues will be resolved somehow and cloning will become practical.

3. Consultants. The rate of technological advancement makes it impossible to keep on top of all the changes. Ranchers must be a jack of all trades and will need assistance. We will use specialists in their respective fields. Most of us use some now. Tax consultants, accountants, vets, extension specialists and attorneys. We will add to that list, nutritionists, range specialists and ag economic consultants.

4. Environmental Issues. We will have to deal with more environmental issues. Profit motivation can't be put ahead of maintaining and improving our natural resources. According to NCA charting in 1995, 46% of media issues mentioned environmental issues. The next closest was health and diet issues at 27%.

5. Size. Ranchers, we will continue to get larger. I remember when 100 cows would support a family, but not anymore. 1000 cow units will become common place, not the exception. The part time ranchers will also grow with the 200 to 400 head operations being put in a squeeze.

6. Grading System. Our Grading system will change. Our current system is basically unchanged since 1916. Our system is outdated and does not enable us to cut back inputs. Muscle is much cheaper to put on than fat.

7. Alliances & Partnerships. More alliances and partnerships will be formed. This will be done to gain more numbers, attract buyers, have more capital to work with, average expenses over more head and build reputations.

8. Carcass Data. Carcass data will be necessary. A time will come when there will be a discount for calves with no carcass data. Packing plants have the technology in place now to track cattle performance and carcass data. It's a small step from there to relate the info back to the rancher who wants to sell his calves next year.

9. Records. Better and more intense records will be kept. Enterprise analysis will be a must. We must know what a pound of calf costs us, each pound of gain and our return on investment.

In general, ranchers of the future will be time, technology and labor managers. The ones who do this well will be successful. I think good times are ahead. A profound statement that Pat Feeney, a long time cowman from Pierre, South Dakota, says, is: "The only thing worse than being in the cattle business when times are bad is not being in it when it's good".

The Business of Seed Stock Production

Four main areas of raising seed stock:

◆◆ **A.Breeding**

◆◆ **B. Management**

◆◆ **C.Merchandising**

◆◆ **D.Involvement**

◆◆ A. Breeding

UNDERSTAND and have a goal for the type of cattle you are trying to breed:

1. What type of cattle will work for the potential customer base you are looking for?

☛☛ a. Cow/calf

☛☛ b. Feed yard

☛☛ c. Packer

☛☛ d. Consumer

quality, size, taste, leanness

◆◆ A. Breeding (Continued)

2. How do I produce and what tools do I use to breed this type of cattle?

☛☛ a. Sire summary

☛☛ b. Pedigree

☛☛ c. Actual weights and measurements

☛☛ d. Trial and error

☛☛ e. Strict culling on performance and fertility records

☛☛ f. Proven sires

◆◆ A. Breeding (Continued)

☛☛ g. Repetition of sires that work

☛☛ h. Balanced trait sires

☛☛ i. Old fashioned cow sense

☛☛ j. Make sure contemporaries are grouped right according to management

☛☛ k. Growth curve -- fast and short

☛☛ l. Short breeding seasons -- 45 to 70 days.

◆◆ B. Management

☛☛ 1. Breeding

☛☛ 2. Nutrition

☛☛ 3. Facilities

☛☛ 4. Personal

☛☛ 5. Money Management

☛☛ 6. Budget for profitability

◆◆ B. Management (Continued)

☛☛ 1. Breeding

a. Artificial insemination
b. Embryo transfer
c. Natural pasture bulls
d. Synchronization

◆◆ B. Management (Continued)

☛☛ 2. Nutrition

a. Cow herd -- adequate not extreme

b. Replacement heifers - 1.5 to 1.75 lbs/day

c. Yearling bulls -- 3 lbs/hd/day for 140 days for soundness and longevity

◆◆ B. Management (Continued)

☛☛ 3. Facilities

a. Adequate to get the job done
b. Presentable
c. Workable

◆◆ B. Management (Continued)

☛☛ 4. Personal

a. Knowledgeable about cattle

b. Understands goals for herd

c. Ambitious

d. Combination of veterinarian x mechanic x farmer x cowboy x nutritionist x carpenter x workaholic

◆◆ B. Management (Continued)

☛☛ 5. Money Management

a. Real estate -- own or rent

b. Machinery -- new - used - none

c. Operating expense

d. Advertising

e. New genetics

-- 1. Semen

-- 2. Bulls

-- 3. Females

◆◆ B. Management (Continued)

50

☛☛ 6. Budget for profitability

◆◆ C. Merchandising

☛☛ 1. Sales

a. Production sale

b. State and national organizations

c. Bull tests

d. Private treaty

◆◆ C. Merchandising (Continued)

☛☛ 2. Advertising

a. Yearly livestock annuals
b. Signs
c. Posters
d. Livestock papers
e. Catalogs
f. Repetition of advertising year round
g. Neighbors -- word of mouth

C. Merchandising (Continued)

3. Customer satisfaction

a. Delivery
b. Integrity and guarantee
c. Repeat customers
d. Help merchandise customer's cattle

◆◆ D. Involvement

- ☛☛ 1. Community
- ☛☛ 2. State Breed Association
- ☛☛ 3. State Cattlemen's Association
- ☛☛ 4. National Breed Association
- ☛☛ 5. National Cattlemen's Beef Association
- ☛☛ 6. Continue education of industry

WHOLE HERD REPORTING – THE NEW DIRECTION

Richard P. Gilbert
Red Angus Association of America
Denton, Texas

In July 1995, the Red Angus Association of America implemented Total Herd Reporting (THR), a combination of whole-herd reporting requirements and a breeding herd-based fee structure. The purpose of this paper is to describe the benefits of complete reporting systems using the Red Angus THR program as a model.

Background

The Red Angus Association of America was founded in 1954 with performance records required for registration. As the breed increased in popularity in the 1990's, there was a growing recognition of the need to collect performance records on all cattle in a contemporary group – not just those calves intended to be registered. Red Angus, as with many other breed associations, established a "compute" option to encourage reporting of performance records on calves not intended to be registered. Participation in the compute option varied substantially from one breeder to the next. The concept of some form of mandatory reporting of performance on all calves, as well as reasons why cows did not produce a calf, gained momentum. The idea of "Total Herd Reporting" was recommended by the membership in attendance at the 1992 Red Angus Convention. Implementation was a top priority in the Strategic Plan 2000 approved by the Board of Directors in early 1994.

As the details of the THR program were being developed in the spring and summer of 1994, it was clear that the calf-based fee structure used by virtually all breed associations to pay for registration services was at odds with complete reporting. What was needed was a breeding herd-based fee structure that removed the disincentive to submit data on marginal calves not intended for registration.

Principles of Total Herd Reporting

The awareness that the calf-based fee structure was an obstacle to complete reporting required a new way to bill for services. Albert Einstein is often quoted as saying "The significant problems we face cannot be solved at the same level of thinking we were at when we created them." Breed associations clearly had created the disincentive to total reporting by establishing calf-based fee structures. The "new level of thinking" lead to breeding herd based fee structure where each cow in the breeding herd is charged an "annual assessment." Payment of the assessment entitles the owner to register and transfer the calf born that year (with additional requirements for ET and multiple birth calves). The complete reporting requirement is fulfilled by submission of calf performance records or reasons why no calf was produced for each cow on inventory. Additional transfers of young animals and all transfers of animals in the breeding herd continue to be charged as in the past. In other words, only the first transfer is free in the THR program.

Another important issue for Red Angus Association members, and most likely members of any breed association, was the assurance that the fee structure change was "revenue neutral" to the association during the transition year. This meant that the revenues obtained under either fee structure (calf-based or cow-based) would be the same. For the Red Angus Association, this was accomplished by the relationship:

$$\text{Annual Assessment} = \frac{\text{Annual Revenues}_{old}}{\text{Current Inventory}}$$

where the annual revenues_{old} is the sum of the calf-based revenue accounts. In the Red Angus case, these were: a variable (per head) portion of the membership dues, promotional and marketing assessments (per head), registration fees, and (first-time) transfer fees. The key component in the equation is the current breeding herd inventory. Bulls at least 30 months of age and females at least 16 months of age on January 1 were counted. Our solution was to identify a range of possible assessment values based on projections of final herd inventory. A peculiarity of performance record keeping is that some breeders keep animals on inventory even though they are no longer in production. We estimated the annual assessment would be between $10.00 and $13.00 per animal and, in fact, the actual value came out to be $11.50.

Benefits

There are a number of substantial benefits to complete reporting programs and inventory-based fee structures. Some are only dependent on complete reporting, others on inventory-based fees. The Red Angus experience indicates that the combination is superior to either element alone. These benefits include:

Predictable Association Revenues (and Member Expenses). The Total Herd Reporting cycle begins with a herd inventory report sent to each member. Animals no longer on inventory are marked off using the appropriate disposal code. Replacements are added and the report is returned to the national office. Each member is invoiced for the product of the annual assessment times the total inventory. Both the association and the member know the amount due. Other, less routine services continue to be billed as needed (AI certificates, transfers of older animals, export documents).

Accurate Breed Inventory. Regular verification and assessment of each member's inventory assure that the breed inventory is accurate and up to date. Emotional ties to the memory of a favorite cow sometimes keep her on inventory long after the end of her productive life. Complete reporting requirements and assessment values in excess on one or two dollars keep only active cows on inventory.

One fee versus many for routine transactions. Simplicity is an important component of any fee structure. Seedstock producers are in business to sell registered cattle. One assessment that covers the most common expenses is clearly preferable.

Improved accuracy of the Stayability EPD. In 1995, the Red Angus Association introduced the Stayability EPD – a measure of sustained fertility (Snelling, 1994; Snelling et al., 1995). Several other breed associations have now added Stayability to their EPD lineup. Stayability is calculated as the probability that the daughters of a bull remain in the herd, given that they entered the breeding herd. Numerically this means that a cow must have at least one calf reported before she is six years of age and at least one calf reported after she reaches six. This rather loose accounting for progeny is necessary with incomplete reporting since there is no way to distinguish between calves that were never born and calves that were not reported. With complete reporting, the accuracy of the Stayability calculation will improve directly because all calves will be accounted for. In addition, records from cows less than six years of age can also be used in the Stayability analysis to further improve the accuracy.

Ability to estimate fertility EPDs. With incomplete reporting, it is impossible to distinguish between cows that did not conceive and cows who did not produce a registered calf. In the words of Dr. Bob Schalles of Kansas State University, "With complete reporting, the cow that has a 150-pound calf that kills both of them now gets credit for it." By incorporating disposal codes into the reporting requirements, it is now possible to estimate fertility and survivability EPDs. This will allow breeders and their customers to more fully evaluate the genetics of the cattle available.

Elimination of reporting bias. The biggest benefit to complete reporting is the elimination of reporting bias from performance records, especially EPDs. The effect of reporting bias on performance records can be demonstrated with a simple example. Consider a contemporary group of five calves as shown in Table 1. We will use ratios in the example, but the effect on EPDs is similar but with a more complex impact.

Table 1. A contemporary with complete reporting

Calf ID	Weaning Weight	WWT Ratio
A	600	120
B	550	110
C	500	100
D	450	90
E	400	80

With only the top three calves are reported, the ratios are negatively affected <u>for all calves</u> (Table 2). The reason is that the average of the reported group is higher than it would have been with all calves reported. Since the ratio calculation subtracts off the contemporary group average from each record, and since the average of the incompletely reported group is higher, the ratios underestimate the value of the calves that were reported. Incomplete reporting has a similar effect on EPDs, but because the EPD calculation uses information from all relatives of the calves in this contemporary group, all animals in the analysis are adversely affected.

Table 2. A contemporary with incomplete reporting

Calf ID	Weaning Weight	WWT Ratio	WWT Ratio
A	600	120	109
B	550	110	100
C	500	100	91
D	450	90	
E	400	80	

Reporting bias is easy to correct – records must be submitted on all animals in the contemporary group. In reality, all cattle are measured, but due to the disincentive provided by calf-based fee structures, not all information is submitted to the breed association. The solution is to remove the disincentive by placing the cost of these normal services on the breeding herd rather than the calf crop.

Another factor that enters into the disincentive of calf-based fees is the concept of "Sticker Shock." For a constant amount of revenue, with 50% reporting the cost per calf is double the cost per cow. With 25% reporting, a typical value for many voluntary performance reporting programs, the per calf cost of the same services is four times the cost per cow. No wonder breeders' checkbooks influence how many calves are registered or reported.

General Features of a Complete Reporting Program

Any whole-herd or complete reporting program provides its users with several important features:

A simple, intuitive concept. Cattle intended to produce *seedstock* are billed *one* fee to cover *routine* services. The simplicity and intuitive appeal of this concept are extremely important during the development and implementation any such program. The synergy provided by the combination of complete reporting and breeding herd-based fees cannot be overlooked and are extremely important to the long-term success of the program. However, the immediate appeal of the concept is a major factor in a successful changeover.

Better data. Elimination of reporting bias has immediate and long-term benefits to the quality of the data and the ability of the association to provide a more complete array of EPDs. Since producers have already collected the performance data on all their calves, the only additional effort required is the submission of all of the records.

New Opportunities. Not only does complete reporting ensure better data, but the ability to distinguish between calves that were not conceived and calves that died prior to some endpoint from calves that were not reported provides opportunities for new analytical procedures that are more sophisticated than current methods but more dependent upon complete reporting.

Promotes systems. Free initial transfers on young animals promote an accurate inventory of commercial customers. There is no disincentive to transfer ownership to the buyer. A complete list of buyers, including commercial producers, enhances targeted marketing efforts and promotes information flow throughout the beef production chain. Transfer records are an integral part of the traceback and verification processes of the Red Angus Association's Feeder Calf Certification Program (FCCP). The FCCP is a USDA approved Product Quality Control program that identifies the source and genetic makeup of all Red Angus influenced market cattle enrolled in the program. Links to the Seedstock SPA program provide for a production systems approach to the financial and biological evaluation of each participant's operation.

Is There a Downside?

Any change effort of this magnitude will and should stimulate plenty of discussion. Some uncertainties may arise. A number of questions seem to be common to those associations that have considered or are initiating some form of whole-herd reporting program. Some of the uncertainties expressed and the results experienced by the Red Angus Association include:

You will drive away members. The membership in the Red Angus Association was virtually unchanged for the three fiscal years before, during, and after the changeover to Total Herd Reporting. Some members did leave, but a similar number joined the Association because they were attracted to the THR program and the benefits described here.

You will pollute the breed with the inferior animals. It has always been the responsibility of the breeder to determine which animals will be sold as seedstock and which will be culled. Total reporting is not the same as total registration or total sales. Complete reporting benefits everyone involved. The cattle that are used as breeding stock are more completely and correctly characterized. Decisions to cull some animals are based on sound information and that same information is available to the national cattle evaluation.

THR benefits large breeders at the expense of small breeders. During the development of the Total Herd Reporting program, the relative percentage of calves reported per cow on inventory was examined for different sizes of herds. Herds were divided into the following categories: 50 head or less, 51 to 100 head, 101 to 300 head, or over 300 head of cows on inventory. Calf reporting percentage (number of calves reported divided by number of cows on inventory) was stratified by 25% increments (less than 25%, 26 to 50%, 51 to 75%, or over 75% of calves reported per cow). There were no important differences between size of herd and percentage of calves reported. The reality has been that under the old fee structure, there were members with all sizes of herds that benefited from association programs without paying for them. Under THR, members pay per cow in the program for services used per cow (the registration and transfer of each calf produced). Some members now pay less under THR, but only because they were subsidizing other members who were not paying their fair share under the old fee structure.

Prepayment of fees benefits the association at the expense of the members. Breed associations are not-for-profit organizations created and sustained for the benefit of their members. An imbalance in either direction cannot last. It is clearly much simpler to budget association revenues after implementation of breeding herd based fees because there is less volatility in herd inventory than in calf sales. Prepayment of fees does give the association some money earlier in the fiscal year, depending upon the payment options available, but it also allows members to better budget for the expense than to wait until registration time. In fact, flexible payment options may better coincide with a member's cash flow cycle.

Another extremely important issue for breeders (and associations) is to address their purpose in raising cattle. Each member should ask, "Am I a seedstock breeder or an opportunity breeder?" If I am a seedstock breeder (part-time or full-time is immaterial), I am in business to produce breeding cattle and recognize that those animals that don't meet my quality standards are part of my cost of doing business. I will still benefit from the information they contribute to my selection decisions. If I am an opportunity breeder, I am essentially a commercial producer who takes advantage of the opportunity to sell the occasional animal at a premium above commercial prices but I will try to avoid any extra costs not incurred by the rest of my cattle. Clearly, complete reporting and breeding herd-based fee structures are in harmony with the goals and objectives of seedstock breeders but not of opportunity breeders. Both kinds of breeders are honorable ways to make a living, but breed associations cannot tailor their programs and services to address the needs of both kinds of member.

Michael Gerber, in his book, *The E-Myth*, states, "You can't be everything to everyone. In fact, you can't be *anything* to everyone." Everyone in business must focus on a specific type of customer and design the products or services of their business to meet the needs of those target customers. The Red Angus Association, with its heritage of performance, has chosen to focus on performance-oriented breeders and customers. The Association's Strategic Plan 2000 targets members and customers who are progressive, performance oriented cattle breeders, regardless of the size of their operation (large or small) or their time commitment to beef production (full-time or part-time). Our objective is to provide the best objectively characterized cattle in the industry so that our customers can make the most informed decisions possible. The results of our efforts are reflected in the rate of growth of our annual registrations (Figure 1).

We encourage all breed associations to adopt some form of whole-herd reporting structure. To do so is in the best interests of their members, their customers, and the beef industry. We feel this change is most easily accomplished with a breeding herd-based fee structure, but other configurations are possible. Change is difficult, but if the outcome of change benefits all stakeholders, it is clearly worthwhile.

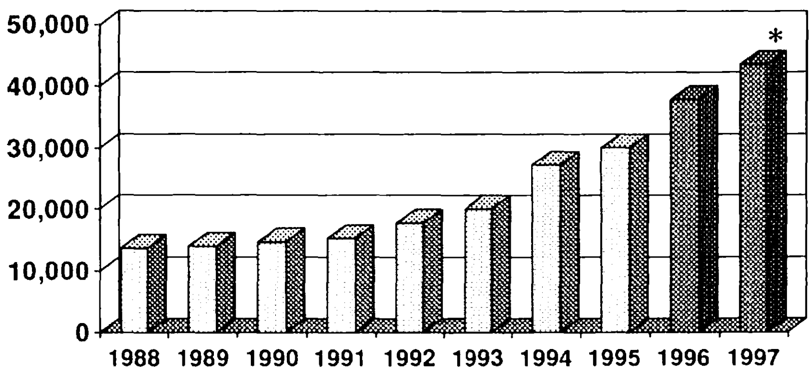
References

Gerber, M.E. 1995.The E-Myth Revisited: Why Most Small Businesses Don't Work and What to Do About It. Harper Collins, New York.

Snelling, W.M. 1994. Genetic Analysis of binary stayability measures of beef females. Ph.D. Dissertation. Colorado State Univ., Fort Collins.

Snelling, W.M., B.L. Golden, R.M. Bourdon. 1995. Within-Herd Genetic Analyses of Stayability of Beef Females. J. Anim. Sci. 73:993.

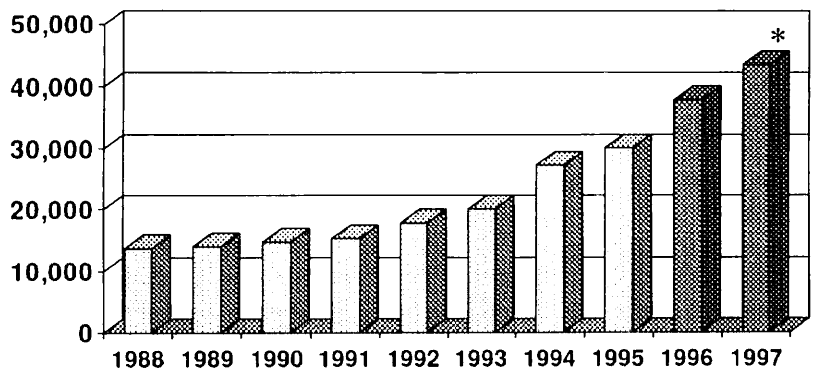
Figure 1. Red Angus registrations 1988 to 1997



* Estimate
Darker bars represent post-THR registrations

Snelling, W.M., B.L. Golden, R.M. Bourdon. 1995. Within-Herd Genetic Analyses of Stayability of Beef Females. J. Anim. Sci. 73:993.

Figure 1. Red Angus registrations 1988 to 1997



* Estimate
Darker bars represent post-THR registrations

WHOLE HERD REPORTING – AS A PROFIT MEASURE

James W. Oltjen

In our following the latest trend mentality in beef cattle breeding, it would have to be carcass traits today. Palatability and consistency, consumer satisfaction, carcass grid pricing, value-based marketing, alliances, retained ownership, and carcass EPD's are all part of this carcass quality trend. "The current reality is, however, that we are just not paid enough to offset the costs or corollary disadvantages associated with improved carcass traits", Burke Healey recently observed. This is particularly true the further we are from marketing beef carcasses in our businesses. What, then, is it we are paid enough for, or what are the advantageous traits to select for (and market)? My hypothesis is to select for profit itself, as directly as possible.

If you are going to select for profit, you have to measure it and its components. Profit is a composite trait, a real-world index. It varies with genetics and environment – it has a heritability. In mathematical terms, it is a non-linear combination of the primary SPA measures, plus a random term. We will look at herd productivity summaries and their relationship with profit later. Whole herd reporting begins to give SPA measures so that a level of herd productivity is calculated. Used correctly, it is a 'profit' tool for breeders, both for animal production and sales. This paper will look at those measures.

What is SPA? What are the measures? These standardized IRM tools, most simply, keep track of our cows and their production levels. Each cow does not exist in a vacuum; she is part of a herd and her relationship to the herd's productivity and the herd's productivity measure profit. It is not enough to know either the growth, or carcass, or reproduction traits alone to predict profitability. <u>And</u> neither is knowing the average herd measures for a seedstock producer – both are important. In the past, we have focused more on individual's growth traits, usually with a fair amount of ignorance of their carcass traits, and a great deal of ignorance of their reproduction traits (or level). To illustrate, how many bulls have you bought (or sold) that you knew the weaning rate for that animal (or the herd from which it came)? But you <u>did</u> know the weaning weight EPD and even the bull's own weaning weight. In the profit equation, how much variation (genetic and/or environmental) is due to reproduction? My reading of the literature is that profit variation due to reproduction exceeds that due to growth. To get at this, and breed associations will, we need to measure and report it. My strictly crude calculations are that bulls with one standard deviation for weaning rate above the mean are worth over $300 more.

Getting to the SPA measure themselves, they are given as both production and financial. Production measures include those associated with reproduction and growth. Financial measures include both costs and returns. To calculate the reproduction measures, Whole Herd Reporting is needed. As John Hough said, "Collection of accurate and complete herd inventories and animal disposal information is imperative. Breeders simply need to account for the production and disposal of every female in the herd each year."

How about our experience in collecting these data? We have more experience in commercial herds than in seedstock, ironically, but these folks recognized the need to measure profit and its indicators more directly. Much effort was made by McGrann and others in Texas to collect the data early in this decade. They developed two software tools, SPA-P and SPA-F, computer spreadsheet templates for use on widely available IBM compatible machines. Although arguably not very user-friendly, the software has proved adequate. However, the task of assembling the data for complete analysis has proved rather painful, requiring a day or two with an expert's help. In my opinion, two problems arose, partly due to the software. First, cattle inventory and cost/depreciation data are not routinely or accurately kept by most producers, and the software requires the producer to make complicated calculations on depreciation (e.g. changes in base value of cattle transferred into breeding cows). Secondly, the level of financial detail in the historical analysis of a production year is exaggerated and the "artificial" allocation of costs over a number of categories (grazing, raised feed, cattle, indirect expenses) confuses the attempt to get to the bottom line. Some other annoying issues arise such as having to enter the same number more than once and a lengthy and ever-changing instruction manual.

We have directly addressed these limitations in a newly released curriculum and software package from the University of California 'Back in the Black'. While I am not here to advertise it, let me at least suggest it to interested producers and consultants. Its simplified data entry, cattle valuation, and allocation of costs make it a useful alternative to SPA-F. Furthermore, it is integrated so that numbers are entered once, not like the former software where cattle sales, for example, are entered in both SPA-P and SPA-F. It provides a complete analysis, both in SPA economic measures and in terms of ranch enterprises.

So let's say we have the data – What good are they? How do we use them to predict profit? It seems that profit, or other collective herd performance variables, should be connected to SPA production and reproduction measures. Again, Burke Healey stated "animals with poor fertility or that are unsuitably adapted to a cattle producer's terrain will seldom, if ever, add enough of a premium to the selling price of their calves to offset their lowered production level." This should be measured by SPA variables, especially the reproductive ones. Furthermore, he hypothesized that "herds that faithfully reproduce at high rates with a minimum of feed and mineral expense will always be the most profitable." This argues for knowing the trends in reproduction as genetics change. Going too far from the genetics a land and management system supports will be reflected in poorer reproduction and survival indices. John Hough wrote "reproduction is by far the most economically important measurement a cattleman can collect." Let's look at the evidence relating reproduction, and other SPA measures, to profit.

Although a NAHMS study done on 35 producers in 1993 showed no relationship between weaning weight per exposed cow and profit, my summary of SPA data through 1996 with 468 herds showed that average weaning weight per exposed female increased for herds ranking in the lowest to highest net income quartiles (Table 1). Similarly, calves weaned per exposed cow increased as well. Perhaps more interesting is that the greater profit herds achieved this production on lower feed costs, from $88 to $155, for lowest to highest profit quartiles, respectively. Either they could supply their cows with feed cheaper or their cows prospered on less feed, or both. Average profit within the quartiles ranged from -$121 to $166. Looking at the SPA data another way, and dividing the country into East and West, and grouping costs into three groups, we see similar results except for weaning weights (Table 2). For either weaning weights, or pounds weaned per exposed female, producers in the East spent more and weaned heavier calves (502 vs. 474 lb), and lost more money. In contrast, the Western producers with lower costs weaned more pounds (539 vs. 490 lb) and made more profit. In both regions, lower cost and higher net income producers weaned more calves (.86 vs. .81 east, .85 vs. .83 west). Looking at correlations with net income (Table 3), it appears that feed cost and weaning weight per exposed cow are more highly related to profit than other SPA measures, but values are low. It is likely that year to year variation, probably due to calf prices, keeps the correlation coefficients low. The NAHMS study did show that three-quarters of the profitable herds had their replacements calve by 24 months, compared to less than one-half of the negative return operations. Data like these are difficult to find, but as more producers collect SPA measures, I believe it will emphasize the importance of spending fewer dollars on supplemental feed to support reproduction of well-adapted cows.

I would like to conclude by offering four observations or suggestions. First, cow-calf producers need to get to know their herds. What are their reproduction rates, their turnover, their feed costs, their profits, and the trends of these and other SPA measures over time? Secondly, breed associations can start this process by calculating as many SPA variables as possible in their own records. Whole herd reporting is imperative for this. Next, there must be a profit in selling animals with improved traits, especially reproductive. At least two things must happen. We must measure reproduction genetically and we must do further research to see what exactly it is worth (my crude estimates are not good enough). Finally, the entire industry must adopt the philosophy of whole herd reporting and identify and propagate cattle that reproduce and wean desirable calves in their given resource environment.

Table 1. Cow-Calf SPA Performance Measures Ranked by Net Income Quartiles*

	Quartiles			
SPA Measure	Low 25%	Second	Third	High 25%
Net Income per Cow	-$121	$14	$67	$166
Lb Weaned per Exposed Female	420	426	432	460
Calves Weaned per Exposed Female	.83	.83	.84	.86
Weaning Weight. Lb	505	513	511	528
Feed Cost per Cow	$155	$119	$99	$88

* Oltjen, 1997

Table 2. Production Levels by Region for High- and Low-Cost Thirds*

SPA Measure	Eastern U.S. High 1/3	Eastern U.S. Low 1/3	Western U.S. High 1/3	Western U.S. Low 1/3
Net Income per Cow	-$120	$143	-$51	$139
Lb Weaned per Exposed Female	432	384	407	458
Calves Weaned per Exposed Female	.81	.86	.83	.85
Weaning Weight. Lb	502	474	490	539
Feed Cost per Cow	$143	$107	$102	$84

*CattleFax in BIF, 1996

Table 3. Correlations with Net Income*

SPA Measure	r
Female Replacement Rate	.05
Weaning Weight. Lb	.11
Calves Weaned per Exposed Female	.14
% Calves Born During First 21 days	.14
Lb Weaned per Exposed Female	.18
Grazing Cost per Cow	-.15
Feed Cost per Cow	-.19

* Oltjen, 1997

Table 2. Production Levels by Region for High- and Low-Cost Thirds*

SPA Measure	Eastern U.S. High 1/3	Eastern U.S. Low 1/3	Western U.S. High 1/3	Western U.S. Low 1/3
Net Income per Cow	-$120	$143	-$51	$139
Lb Weaned per Exposed Female	432	384	407	458
Calves Weaned per Exposed Female	.81	.86	.83	.85
Weaning Weight. Lb	502	474	490	539
Feed Cost per Cow	$143	$107	$102	$84

*CattleFax in BIF, 1996

Table 3. Correlations with Net Income*

SPA Measure	r
Female Replacement Rate	.05
Weaning Weight. Lb	.11
Calves Weaned per Exposed Female	.14
% Calves Born During First 21 days	.14
Lb Weaned per Exposed Female	.18
Grazing Cost per Cow	-.15
Feed Cost per Cow	-.19

* Oltjen, 1997

THE NEWEST TOOL FOR PROFIT

T. G. Jenkins
USMARC-ARS-USDA
Clay Center, NE

> Humpty Dumpty once said "When I use a word,
> it means exactly what I choose it to mean,
> Neither more nor less."
>
> Lewis Carroll, 1867

A tool can be defined as a means to extend the effectiveness of methods and techniques. The difference between revenue and expenses defines profit. The title of this paper is short and simple; however, when considered in context of the definitions for tool and profit the term "newest" becomes the focus of interest. A grammarian would tell us this word modifies rather than demonstrates activity. Personally, extrapolating from Mr. Dumpty's rule, I suggest it does infer activity. It represents a relative measure describing forward movement, the evolution, of our understanding about the complexities of beef production system, and more important, strongly implies that this evolvement continues. It, "newest," implies a change in the processes applied to decision making. Objectives included for this presentation are a brief review of the problem resolution process applied previously by the industry, introducing factors influencing the goals of today firms and a new management tool.

Profit is a quantitative measure serving as an evaluator of decisions made by management concerning the allocation of resources. Historically, actions by participants at all levels in the beef cattle industry appeared to assume high correlation between revenue and profit. This allowed producers to ignore expenses, greatly simplifying the objective function. What appeared to be unlimited resources fueled the acceptance. The rate of acceptance was increased through application of a classical learning process (Figure 1). The learning process was continually re-enforced not only by the producers but also by industries having a self-interest. The learning process of observation, reflection, planning, and action throughout an extended period of relatively low production cost and high consumer demand increased the rate of acceptance with each revolution. Producers observed increased success of other producers relative to their own, contributed the success to increased revenue from greater output, developed a strategy to move productivity to a higher level, and carried out the plan. The fixation on increased revenues promoted a simplified objective function of maximizing output. Producer acceptance of this objective function did not occur immediately. Innovative cattlemen recognized opportunity, promoted and fostered acceptance by marketing their approach to success. Ancillary industries provided a stimulus by providing collaborative evidence lending support to the validity of the assumption. These industries marketed the concept that increased revenue generated by improving productivity through use of featured products improved profitability. The success rate realized by implementing this objective function was accelerated by the development of many tools - a means to an end, to affect a single component of the production system.

A tool provides a way to achieve a goal – that is the end to which a plan tends. For example, the primary tools to achieve the goal of maximizing output are quantitative genetics and abundant production resources. The path diagram in Figure 2 characterizes the evolution of many tools applied to production agriculture. The origin is based on theory – principles supporting a methodology. Methodology is an organized set of principles affecting attempts to manage real world problems. This methodology then evolves into a tool for application in attaining the stated goal. Alternatively, theory could lead to the recording of items not organized to convey specific meaning (data). Organizing this data, either by processing or direct application (information), allows it to serve as the basis for tool development or serve as a source of knowledge (organized and processed data that conveys meaning in context of the current problem). Tools developed from technology arise from knowledge and skills produced by research not directly related to the problem under consideration.

Acceptance of maximization of product output affected the approach to decision making adopted by the industry. Rather than considering interactive nature of components in beef cattle production cycle, a reduction's approach was adopted. This approach decomposed the total system into individual components, identified some constraining factors within a component, and transformed methodologies to tools for removing the localized constraint. Scientific disciplines involved with beef cattle production contributed a wealth of information contributing to the resolution of each localized problem. Tools designed to resolve constraints to increased productivity were contributed independently from the disciplines of genetics, e.g., mating systems, EPD; feeding, e.g., feed additives, energy and protein supplement programs; reproduction, e.g., AI, synchronization, etc. Each problem solution generated by production scientists resulted in new information or methodologies leading to new tools to be applied in the decision making process. Application of these tools created new problems to be addressed, many of these newer problems resulting from implementing decisions attained by applying tools previously developed.

Two endpoints resulting from the reduction approach to problem solving are an overloading of producers with processed or unprocessed data that may contribute to tool development (information overload), and creation of a vast information pool with potential for contributing to knowledge. Realization of the information pool's potential required the industry to redefine the objective function. As stated earlier, the primary paths to achieve the goal of maximizing revenue by maximizing output were quantitative genetics and abundant input resources. If the production scenario remained constant, this approach would remain effective. The scenario is changing. New sources of influence on today's producers encourage redefining the objective function. Today's innovative producers recognize that profit remains the goal, but profit does not equal revenue. Concerns providing the impetus to consider both revenue and expenses include resource costs, contamination control, falling consumer demand, market sensitivity to pharmaceuticals, and societal worries about the environment. Decisions implemented in one component of the firm affect processes in other components. The components are interrelated, varying inputs can vary outputs, maximizing a firm's output creates an opportunity for expenses to rise at a rate faster than revenue thus reducing profit. Coupling a culling policy of removing open cows at each palpation with a restricted breeding season could create a need to replace more breeding females each year. A gradual reduction in the age of the cow herd may occur by adhering to this strategy for an extended period. If the firm's primary source of revenue is generated from weaning weight, this strategy would lead to lower herd productivity, marketing of an increasing proportion of a lowered value product, and increased expenses resulting from increased cost associated with heifer development. Consideration of affect of both revenue and expenses to profit mandates a change in the philosophy of problem solving from a reductionist to systems approach. Initiating an action at one level of the system creates the potential for adverse reaction at another, i.e., risks.

Changing the philosophy of decision making redefines many tools previously employed by producers. A new tool is needed that can transfer to the producers knowledge created from the pool of information generated by scientists through the years. Features required of this tool include the ability for producers to organize, set priorities, and visualize potential management decisions and evaluate outcomes of these decisions. To satisfy these requirements, the biological and economical components of the system would be joined to allow the potential for processes contained within each component to affect each other, i.e., allow interactions to occur between components. The nature of the tool must promote application of the tool by producers. This latter point generates a need to incorporate technology into the management process. To fulfill all features, this new tool requires development of a software application for the beef cattle production system that incorporates biology and economics in a user-friendly package.

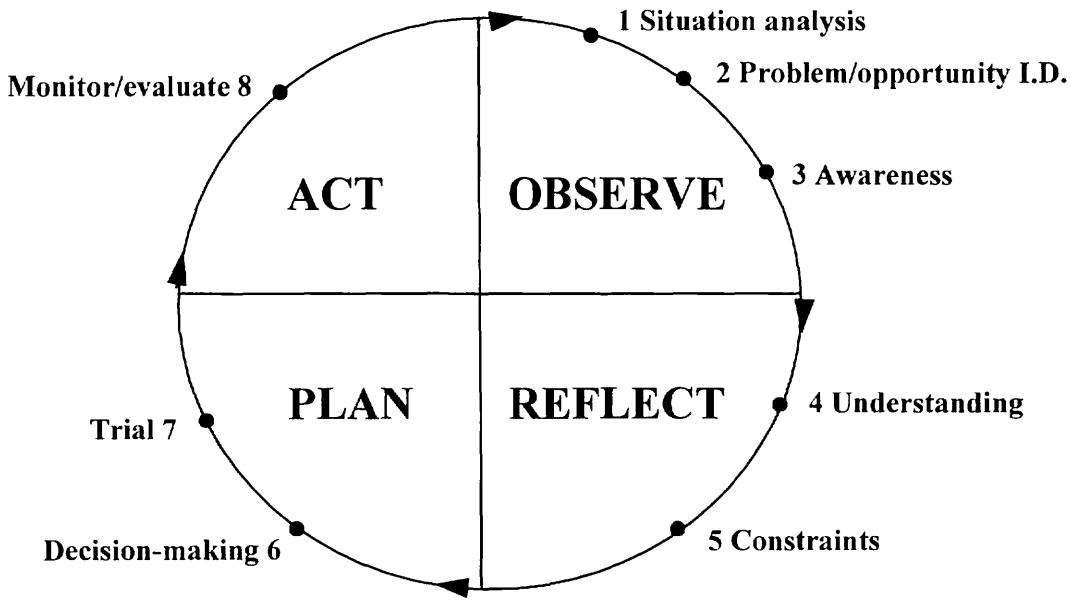
These features were identified by a working group assembled by the Integrated Reproduction Management (IRM) committee of the old National Cattlemen's Association in 1995. The group included producers, extension personnel, and scientists representing many disciplines involved in animal production. The group concluded that upon completion the application would serve as a risk management tool for use by producers to evaluate strategic management decisions. Results stemming from application of the tool would not identify the single best management option, rather identify a set of options from which the producer could select. Since then, a resolution to support development of a management aid to evaluate strategic decisions has been adopted by the National Cattlemen's Beef Association (NCBA). A group of individuals within the animal science community has initiated the effort. Recognizing the complexity of the project, the development was broken into phases with the first to be the animal component. In May of 1996, the Agriculture Research Service of the USDA (ARS-USDA) committed resources for the completion of the first step; the development of a user-friendly decision support aid to assist cattle producers with management decisions involving only the animal component of the total project. This aid allows evaluation of management options concerning feed resource allocation, genetic potential utilization, marketing options, and general herd management questions.

The software application is composed of two components, a graphical user interface used to input producer information about the animals, feeding and management policies, and generate production reports. This is the part visible to the user. In the background, transparent to the producers, a simulation program resides transforming information from years of animal science research into knowledge for use in problem solving. An existing animal production model was updated to current levels of understanding of biology using information from research concerning quantitative genetics, bioenergetics, growth, body composition, and reproduction. This understanding has been encoded into a simulation model to predict performance of cattle in all phases of the beef industry. The structure of the model maintains a record of herd inventory. Retained measures of productivity include weights and carcass composition of animals sold, conception, calving, and weaning rates. Feed resources consumed by animals can be predicted and summarized.

During April 1997, 20 individuals representing producers, extension, and consultants from around the United States traveled to Clay Center, NE to evaluate and critique the alpha version of the software application. Those of us involved in the development of the Decision Evaluator for the Cattle Industry (DECI) were encouraged by the findings of this group. The software evaluated by the representatives of the industry had "bugs," and the evaluators quickly identified these problems. They also pointed out management options for inclusion in the application. Their recommendations are being evaluated at the present time for incorporation into the decision support aid. This initial evaluation represents the beginning of the transformation of the problem solving process from a reductionist to a system viewpoint for the industry. The keyword in this sentence is "beginning." The application will never be finished, just continuously refined and improved. Activities are being initiated to join the animal simulation model with one that simulates forage production. The economic component will be joined with the two biological components to create a total management application for evaluation of management decisions. As information becomes available from research that improves the performance of the application, it will be incorporated. It is the beginning of the means, a novel approach to problem solving in animal production agriculture.

The software application can contribute to the management decision process for all segments of the industry. For example, breeding programs could be developed by seedstock producers to fit the needs of customers from diverse production environments. The seed stock producer in collaboration with the customer could characterize the resources and marketing strategy for the customer and identify the type of sire that would best match the production scenario.

The beef industry is adaptive. Throughout the years producers working together with industry, university and government personnel have adapted production practices to meet the needs of the times. With abundant resources and few societal concerns, the objective function adopted was to increase revenue by maximizing productivity. Profit equals revenue. These changes evolved through use of tools created by identifying problems within a component of the production system. In today's production climate, using profit as a goal requires consideration of both expenses and revenue. This increases the complexity of the problem forcing producers to change the focus of the decision making process to managing risk. This change requires adoption of new problem solving techniques. Coupling biological and economic knowledge with technology provides a tool to achieve a defined goal.



Clark, 1996

Figure 1

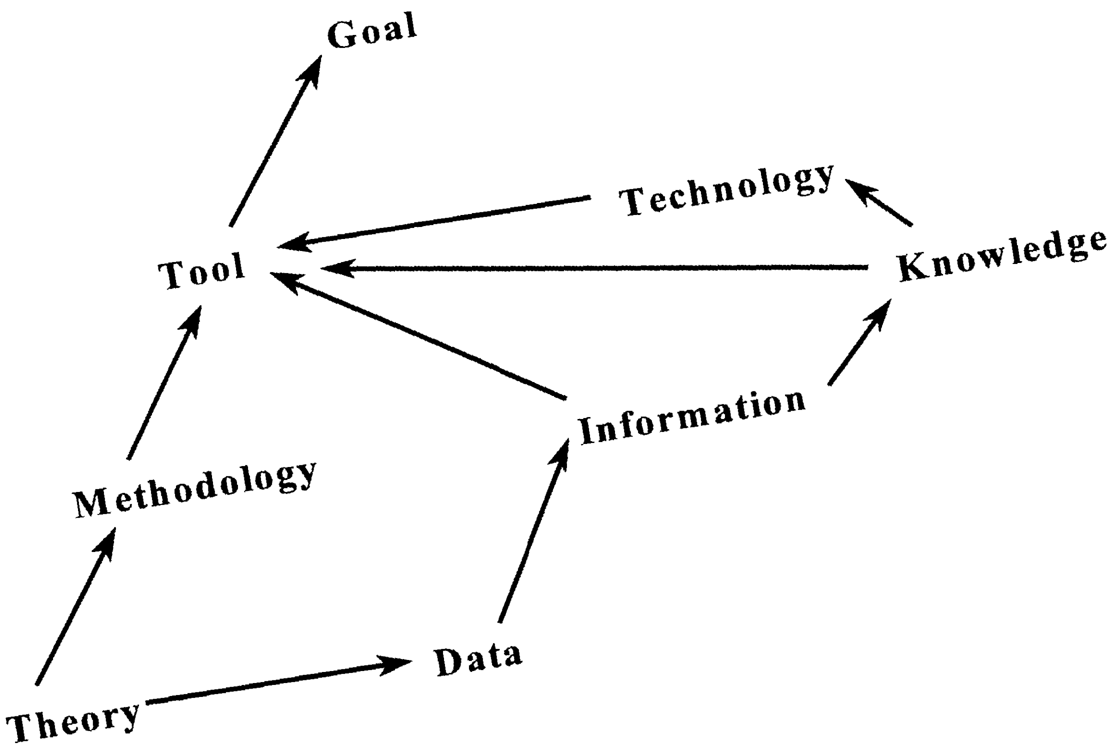

Goal
Technology
Tool
Knowledge
Information
Methodology
Data
Theory

Figure 2

EPDS AND BEYOND

Rick Bourdon and Bruce Golden
Colorado State University

Brian Kinghorn
University of New England

Trying to predict the future direction of a technology is always risky. One approach that can point you in the right direction, however, is to ask what is really needed. What useful attributes could a technology have that it does not have today? What, in their wildest dreams, would users of a technology really want?

In the beef business, the majority of users of animal breeding technology are commercial breeders. Their needs are apparent in the kinds of breeding related questions they ask. Here is a typical list.

- *What crossbreeding system should I use?* Should I use a rotation, terminal sires, composites, some combination of these?
- *What breeds?*
- *What EPDs for what traits?* Should I be concerned about all traits for which expected progeny differences are available or just some of them? What is an ideal EPD for a particular trait? Is there such a thing?
- *If I use* this *bull with* these *EPDs, what will be his short-term effect on weaning weights, feedlot gains, carcass characteristics—production in general?* How will he affect *phenotype* for these traits in my herd?
- *What will be his short-term effect on profitability?* Will he be a money maker?
- *What will be his long-term effect on female fertility, weaning weights—production in general?* Will he produce the kind of daughters I need?
- *What will be his long-term effect of profitability?*
- *What is this bull worth to me?* How much should I be willing to pay for him?
- *If I make changes in my crossbreeding system or other management practices, how will those changes affect the type of bull I need?* Do biotype (biological type or genotype) and management interact in such a way that the ideal cow for one management scenario is quite different from the ideal cow for another?

The breeding technology of the future, if it is to be truly useful, should be capable of answering these questions. It should integrate genetic prediction, herd management, and economics and remove the guesswork (or, at least, much of it) from the breeding decisions commercial producers must make.

What We Have Now—EPDs

What breeding technology is available today? We have lots of research data on breeds, hybrid vigor, crossbreeding systems, and so on, and we use this information, but the only true technology being used widely is the technology of EPDs that is incorporated in sire summaries. EPDs do a remarkable job of characterizing animals within a breed for a number of traits. They are a powerful selection tool for seedstock breeders who know the kinds of changes they want to make in their herds. They are less useful, however, to commercial producers —particularly those who use more than one breed. EPDs, by themselves, don't answer *any* of the questions posed earlier. Following are some of the limitations of EPDs that prevent them from being a complete breeding technology for commercial beef production.

- *EPDs are breed specific.* They are derived from breed association data—usually purebred data. An EPD for weaning weight of +20 lb means one thing in one breed and something quite different in another breed. Yes, we now have a breed table that allows us to convert EPDs to an Angus scale, but there is reason to believe that the table may oversimplify matters—at least for traits like milk production. A one-unit change in EPD for one breed may not be equivalent to a one-unit change in another breed. This makes it hard to predict the performance of crossbreds.
- *EPDs don't predict hybrid vigor.* EPDs are predictions of breeding value. (Technically, *half* of breeding value). Breeding value is important because it is the heritable part of an animal's genetic potential, the part that can be transmitted from parent to offspring. There is another part of genetic potential, however, a part that is sometimes called gene combination value or nonadditive value. It is not heritable, but it affects performance via the mechanism of hybrid vigor. EPDs tell us nothing about it.
- *EPDs don't account for genotype by environment interaction.* Some commercial production environments are so different from the typical seedstock environments in which bulls are raised and evaluated that the relative performance of these bulls' offspring in the commercial environment does not jibe with the EPDs in the sire summary. For example, some high-growth North American sires, when used in the tropics, produce unexceptional calves. The reason for this is not that the North American EPDs are wrong, but that these bulls lack genes for tropical adaptability. Their calves probably don't tolerate heat or parasites well. They have the potential to grow fast but cannot express that potential in the stressful, tropical environment. Short of conducting

separate sire evaluations in different environments, there is little we can do to improve the reliability of EPDs in cases like this.

- *EPDs don't predict phenotype (performance).* EPDs give us an idea of the *difference* in average performance we can expect in the progeny of two animals, but they were never designed to predict offspring performance per se. A sire's weaning weight EPD, for example, does not predict the average adjusted weaning weight of his calves.

  Geneticists like to portray the relationship between parent EPDs and calf performance with a mathematical model like the following:

$$P_{Calf} = \mu + \mathrm{EPD}_{Sire} + \mathrm{EPD}_{Dam} + E_{Cont.\,Group} + E$$

  where:

  P_{Calf} = the performance of single calf for a specified trait,

  μ (mu) = the average performance of a theoretical population for the trait,

  EPD_{Sire} = the EPD of the calf's sire for the trait,

  EPD_{Dam} = the EPD of the calf's dam,

  $E_{Cont.\,Group}$ = the environmental effect of the calf's contemporary group —the effect of weather, management, forage conditions, etc.

  E = everything else: environmental effects specific to the calf, error associated with the parent EPDs, random sampling of the parents' genes, and hybrid vigor effects.

  Note that we can't predict calf performance with this model because the only elements of the model that are known are the EPDs of sire and dam. (In a commercial herd, more likely the sire's EPD only.) We don't know what values to substitute for mu, the mysterious average, or for the "environmental" effects. The most we can say is that a one-unit increase in the EPD of the sire should result in a one-unit increase the average performance of his progeny. But, given the complications of across-breed comparisons, hybrid vigor, and genotype by environment interactions, even this conclusion is suspect.

- *EPDs don't predict profit.* EPDs are measured in trait units, not dollars. They characterize differences in genetic potential for specific traits, but not for profitability.

What Is Needed

To meet the needs of commercial producers, the beef cattle breeding technology of the future should not just characterize animals genetically. It should combine genetic predictions (EPDs) with information about available resources, physical environment, management, costs, and market factors to predict animal performance and herd profitability in a commercial setting. It must be able to show how a genetic change made today affects production and profitability a year from now and ten years in the future. It must be customizable. No two commercial operations are exactly alike, and the breeding technology of the future should account for the variety of differences among operations.

The most promising technology for this purpose is the technology of bio-economic computer simulation. Bio-economic simulation models typically begin with basic information about climate, soils, forage characteristics, and biotypes of animals. These data are combined with information about herd management —breeding seasons, weaning dates, crossbreeding systems, supplementation, and so on. The models then incorporate our knowledge of biological mechanisms to simulate the quantity and quality of available forage, feed intake, rates of animal growth, body composition, fertility, death loss—all the factors that contribute to herd production. When data on costs of inputs and prices of outputs are added, the models generate information about herd profitability over time.

The first step in the bio-economic simulation process is to convert our current genetic predictions, EPDs, into a form that is compatible with simulation models. We call these new predictions physiological breeding values or PhBVs. (More on them later.) The entire process, from EPDs to PhBVs, computer simulation, and, ultimately, prediction of profit, is illustrated in Figure 1.

A typical simulation scenario might be as follows. A commercial producer decides to use the technology to help her decide what bulls to buy in the next few years. She hires a consultant who is well versed in the simulation software and necessary inputs. The consultant gathers available data on the commercial operation—data on the existing cow herd, forage, current production, management and marketing practices, and economics. Where there are gaps in the data—there always will be—he substitutes default information from regional or national databases. He makes initial runs of the model to test whether it does a reasonable job of duplicating current production. If it does not, he must do some detective work to find out what input information is faulty. Once the model is working correctly, many simulations are performed, each using different bulls (bulls with different physiological breeding values). Sires are then compared according to their effects on short- and longer-term profitability. If the producer wants to "cooptimize" management and breeding, we can simulate alternative management systems— different crossbreeding systems, for example—and determine the best types of sires for those systems.

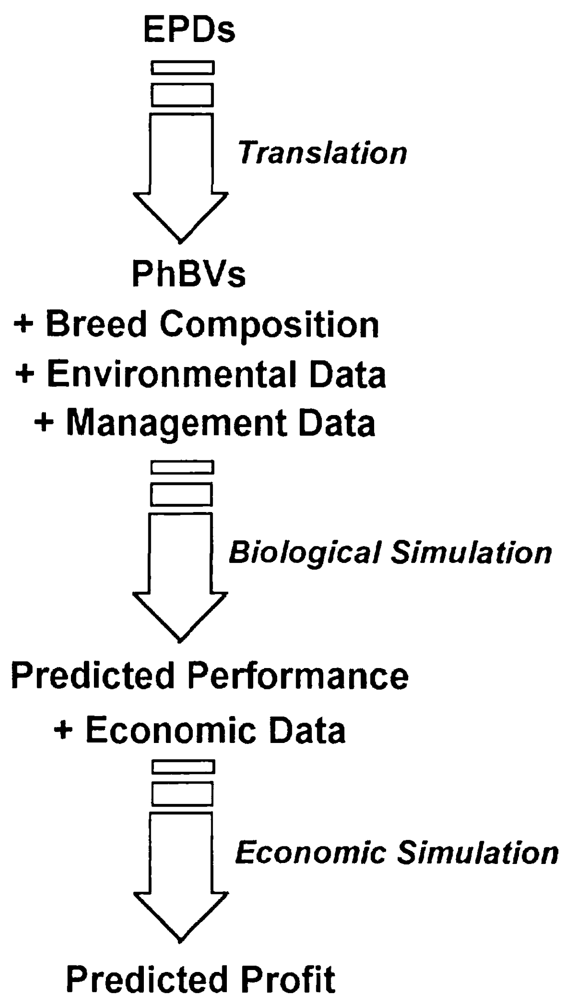


Figure 1. The bio-economic simulation process: from EPDs to profit prediction.

Physiological Breeding Values

Because EPDs are expressed on breed specific, environment dependent scales, they are not biologically compatible with simulation models. The genetic potentials put into these models need to be expressed on a more universal scale—a physiological scale. This is a scale of physiological breeding values (PhBVs). Physiological breeding values may or may not replace EPDs as the standard measure of breeding potential. They may remain invisible to breeders, hidden in the simulation process. But if someday they are published, we need to understand what they are and how to interpret them.

A PhBV is a lot like our conventional notion of breeding value; it represents the transmittable portion of an individual's underlying genetic potential for a trait. What makes it different, however, is the way in which genetic potential is defined. In this context genetic potential refers to performance potential *under optimal conditions*. It indicates how an animal might perform if it were given every advantage. A calf's physiological breeding value for weaning weight, for example, is a predictor of its weaning weight if it had the best mother, nutrition, and all-around environment possible.

Unlike conventional breeding values, PhBVs are not population dependent. While an individual's breeding value for a trait depends on the genetic merit of the population that individual belongs to, its PhBV for the trait does not. As an example, consider an Angus cow with the genetic potential to weigh 1,300 lb at maturity. She is genetically large for an Angus and could have a mature weight EPD of, say, +50 lb. If we could somehow make this cow a part of the Maine Anjou population, she would be comparatively small; her EPD for mature weight might be -50 lb. Her physiological breeding value, however, does not change. It remains 1,300 lb regardless of the population she is associated with. (Note that PhBVs, unlike EPDs, are not expressed as deviations from a mean.)

Physiological breeding values are also free of the complications created by genotype by environment interactions. For example, a relatively heavy milking Angus cow in the US could conceivably be quite fertile genetically, having an EPD for stayability of +10%. If the entire US Angus population had been raised in Ethiopia, however, this same cow would not fare so well. Her high level of milk production would, under nutritionally stressful Ethiopian conditions, cause her and her heavy milking relatives to be less fertile. Her EPD for stayability would be poor—maybe -3%. But this cow's PhBV for postpartum interval (a more appropriate fertility trait for biological simulation) remains constant regardless of the environment in which she and the rest of the Angus population are raised.

PhBVs alone do not indicate phenotype; they don't tell us how animals will perform in a given environment. But when they are combined with information about breed composition (for calculating hybrid vigor), physical environment, and management in a simulation, the simulation model can translate them into performance measures. If the model is biologically good enough, if it is sufficiently mechanistic, the translation process will produce fairly accurate predictions of performance in any simulated environment. Predictions won't be perfect—we can't, for example, predict the environmental effect of next year's weather—but, averaged over time, they should be accurate enough to be useful.

Researchers have not yet developed good methods for translating EPDs into PhBVs. That will take some time. For growth traits, the translation process may be as simple as doubling an EPD and adding a constant that reflects breed differences. For other traits, translation may be much more difficult. Figure 2 is a physiological "map" of milk EPDs from two breeds, one a breed with low (L) milk production and the other with moderate (M) milk production. The map was developed by simulating purebred populations, calculating EPDs within those populations, then relating the EPDs to underlying PhBVs (Enns, 1995). Note that the relationship between EPDs for milk (measured in pounds of weaning weight) and PhBVs for peak milk production (measured in pounds of milk per day) is complicated. A 1-lb difference in milk EPD indicates a larger difference in underlying milking ability in the moderate milking breed than in the low milking breed. And within the moderate milking breed alone, 1-lb differences between high milk EPDs indicate smaller differences in underlying milking ability than 1-lb differences between low milk EPDs. Similarly complicated relationships between EPDs and PhBVs may exist for other traits

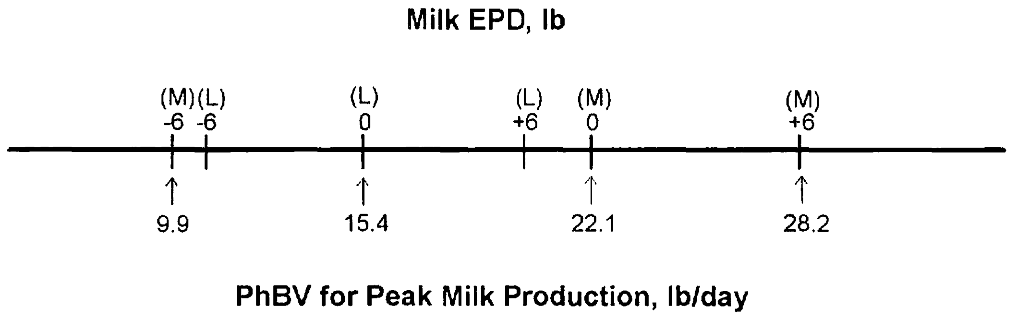


Figure 2. Physiological map of milk EPDs for low (L) and moderate (M) milking breeds.

What Genetic Information Might Look Like in the Future

There is little consensus as to how genetic information should be presented in the future. Academic animal breeders don't all agree on the kind of data that should be listed or the format for those data. And there are lingering computational questions, the answers to which will determine what it is possible to present. The tables and figures that follow represent one vision.

Breeders like to argue about their perceptions of the optimal animal, sometimes debating "ideal type," other times optimal EPDs. We seem to have an inborn need to know the kind of animal we should be breeding for, the target we should be aiming at in our selection programs. Table 1 is a hypothetical representation of such a target, one that has been generated from repeated bio-economic simulation of a commercial operation. In this example, there are just two types of sires (calving ease and maternal) in use under the current management scheme. Optimal physiological breeding values for four traits—age at puberty (AAP), yearling weight (YW), mature weight (MW), and peak milk production (MP)—are listed for each type. (A real example would include many more traits.)

Table 1. Hypothetical Optimal PhBVs Under Current Management

Use	AAP[a]	YW[b]	MW[c]	MP[d]
Calving Ease	350	595	992	22
Maternal	350	690	1230	22

[a]Age at puberty, days
[b]Yearling weight, lb
[c]Mature weight, lb
[d]Peak milk production, lb/day

The values in Table 1 suggest the kinds of sires (and, therefore, females) that would be optimal for this particular commercial operation assuming that management practices remain much the same as in the past. If you (a commercial producer) want to cooptimize sire selection and management, you might get results like those in Table 2. In this case, the simulation model determined that more profit could be made by adding terminal sires and reducing cow size.

Table 2. Hypothetical Optimal PhBVs Under Optimal Management

Use	AAP[a]	YW[b]	MW[c]	MP[d]
Calving Ease	350	595	992	22
Maternal	350	618	1100	22
Terminal	—	827	1488	—

[a]Age at puberty, days
[b]Yearling weight, lb
[c]Mature weight, lb
[d]Peak milk production, lb/day

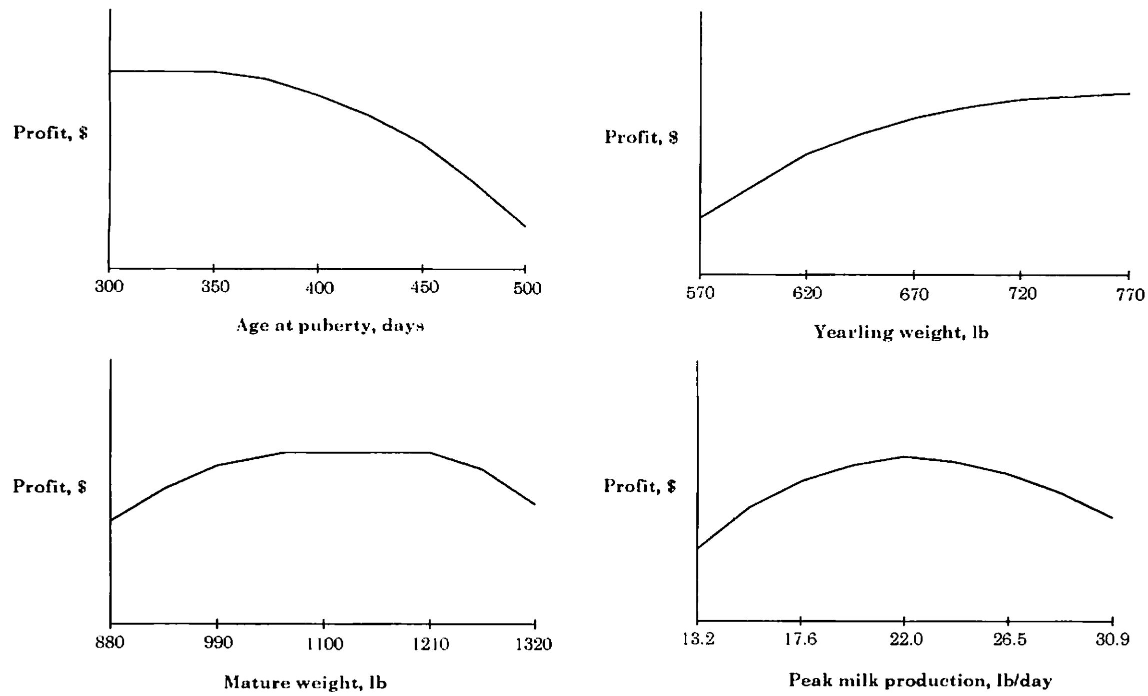


Figure 3. Hypothetical changes in profit for different levels of age at puberty, yearling weight, mature weight, and milk production.

Genetic information like the target PhBVs shown in Tables 1 and 2 will not be the only information presented. Accompanying them will be data on the PhBVs, production, and profitability of the current cowherd, a cowherd of optimal biotype, and cowherds that may be quite different from the optimal biotype but are still economically competitive. With this type of information, you can determine why a particular biotype is favored over another—perhaps it weans a larger calf crop, grades better, or is less costly to maintain. You can also choose target biotypes more objectively. If the optimal biotype is only marginally more profitable than several competing biotypes, you are free to choose the one that, for whatever reason, seems most attractive.

Before settling on a target biotype, you might want to know how "robust" the biotype is—in other words, whether profitability changes little as PhBVs deviate from the target value for a trait or whether a small deviation from the target causes a steep drop in profits. Graphs like those in Figure 3 can answer this question. These hypothetical examples suggest that (1) PhBVs for age at puberty have little effect on profitability until they exceed 350 days, (2) the higher the PhBV for yearling weight the better (all other traits held constant), (3) there is a fairly wide range of optimal PhBVs for mature weight, and (4) a clear optimum value of approximately 22 lb/day exists for peak milk production. These graphs describe a particular commercial scenario. Change the scenario—the physical environment, crossbreeding system, etc.—and you change not only the optimum biotype but the corresponding graphs as well.

Table 3. Hypothetical Optimal Sire Sequence

Use	Years	AAP[a]	YW[b]	MW[c]	MP[d]
Calving Ease	1-5	350	573	992	17.6
" "	6–10	350	584	992	19.8
" "	11-15	350	595	992	22.0
Maternal	1-5	350	593	1056	17.6
"	6–10	350	606	1078	19.8
"	11-15	350	618	1100	22.0
Terminal	1-5	—	827	1488	—
"	6–10	—	827	1488	—
"	11-15	—	827	1488	—

[a]Age at puberty, days
[b]Yearling weight, lb
[c]Mature weight, lb
[d]Peak milk production, lb/day

Knowing the target is one thing; it is quite another to know how to reach that target. Bio-economic simulation can be used to determine optimal biotypes. It can also be used to suggest a selection strategy that will move your herd toward the optimum in the most economically feasible way. Table 3 is an "optimal sire sequence," a listing of optimal sire biotypes to be used in a hypothetical commercial herd. The sire sequence is determined by repeatedly simulating selection over time, starting with the present cowherd and working toward an optimum or near-optimum herd. Different sequences of sires are used in each simulation run, and the most profitable sequence is the winner. You could use such a listing to help you decide what bulls or semen to buy. Note that in this example, optimal PhBVs for milk production increase over a 15-year period. If the existing herd milks too heavily, this sire sequence suggests the use of bulls that will lower milk rapidly, then maintain it at an intermediate level. In other words, this sequence produces complementary matings with respect to milk production.

In the future, online catalogs for bull sales will probably be commonplace. Producers will be able to access them via the internet. It is then theoretically possible to use bio-economic simulation to "test drive" the bulls in the catalog, to simulate the effects they would have on your herd, producing a customized catalog like the sample in Table 4. The last column in the catalog is a computer generated estimate of each bull's worth in your commercial operation. It gives you an idea of how much you should be willing to pay for that bull.

Table 4. Hypothetical Electronic Sale Catalog

Lot	Use	AAP[a]	YW[b]	MW[c]	MP[d]	Worth
18	Maternal	342	590	1042	17.8	$2,300
24	Calving Ease	345	576	1005	18.0	$2,700
77	Maternal	358	575	1085	22.6	$1,300

[a]Age at puberty, days
[b]Yearling weight, lb
[c]Mature weight, lb
[d]Peak milk production, lb/day

How a New Breeding Technology May Evolve

Don't expect to see a fully operational breeding technology involving bio-economic simulation in the next few years. There are still a number of hurdles to be cleared. For starters, the right simulation model doesn't exist. There are several biological beef cattle models or versions of models being used by researchers today. Each has its strong and weak points. One may be more biologically rigorous; one may be more flexible in the kinds of operations it can simulate. But there is no universally accepted model, no model designed for users without a technical background, and no model that incorporates EPDs in a biologically correct way. What we have now is not a well designed, thoroughly tested, comprehensive beef cattle model, but rather the building blocks of such a model.

The first step is to build the model. We must assemble a team of researchers to design and test it. Work on a prototype model is underway at the

US Meat Animal Research Center in Nebraska (see the previous paper by Tom Jenkins), but a greater effort is needed to build the model that will be the centerpiece of a new beef cattle breeding technology.

The initial release of a bio-economic model won't be used to make within-breed selection decisions. In other words, it won't be linked to EPDs. Instead, it will be designed to help make management decisions—decisions about how much to feed, when and how long to breed, what crossbreeding system to use, and so on. Only when the model has achieved some success in the marketplace, when it has gained a measure of credibility among producers, will the components be added that will make it a selection tool.

For a simulation model to succeed in the marketplace, we need a structure for ownership, financing, update, and delivery of the model, and for training model users. This structure is likely to be different than the structure associated with EPD technology. In that case, there were several vendors (universities) and relatively few clients (breed associations). To market the technology, academic animal breeders had to first convince breed associations that EPDs were useful, then both groups had simply to reach a contractual agreement. Universities ran the software, breed associations paid them to do it, and individual breeders benefited.

The situation is fundamentally different for simulation technology. There will probably be just one general model for this purpose, and different research groups will have contributed to its development, so there is a question as to who "owns" the model, who is the vendor. The number of clients is potentially huge. Many commercial producers will want to apply the model to their own operations to help them make management decisions of many kinds. Because of the large number of clients, there needs to be a more sophisticated strategy for marketing the technology and a system for channeling fees from clients back to those organizations that support and update the technology. Finally, applying the model correctly will take some experience and expertise, so there is a need for trained consultants.

One possible structure is shown in Figure 3. This particular structure was conceived by commercial and seedstock producers, academic animal breeders, and breed association personnel at BIF Systems Workshop II, held in November, 1996. At its heart is a nonprofit organization, perhaps a subsidiary of NCBA or BIF, that sets policy for the simulation technology, collects fees for its use, trains users, and pays research organizations to support and improve it. Users, those who actually run the model, may be producers but more likely will be consultants. They could be extension personnel, breed association employees, private consultants, or even seedstock breeders or their employees. Presumably this group will work on a fee-for-service basis. This structure retains central control of the technology, but benefits from the merchandising and feedback generating ability of the free market.

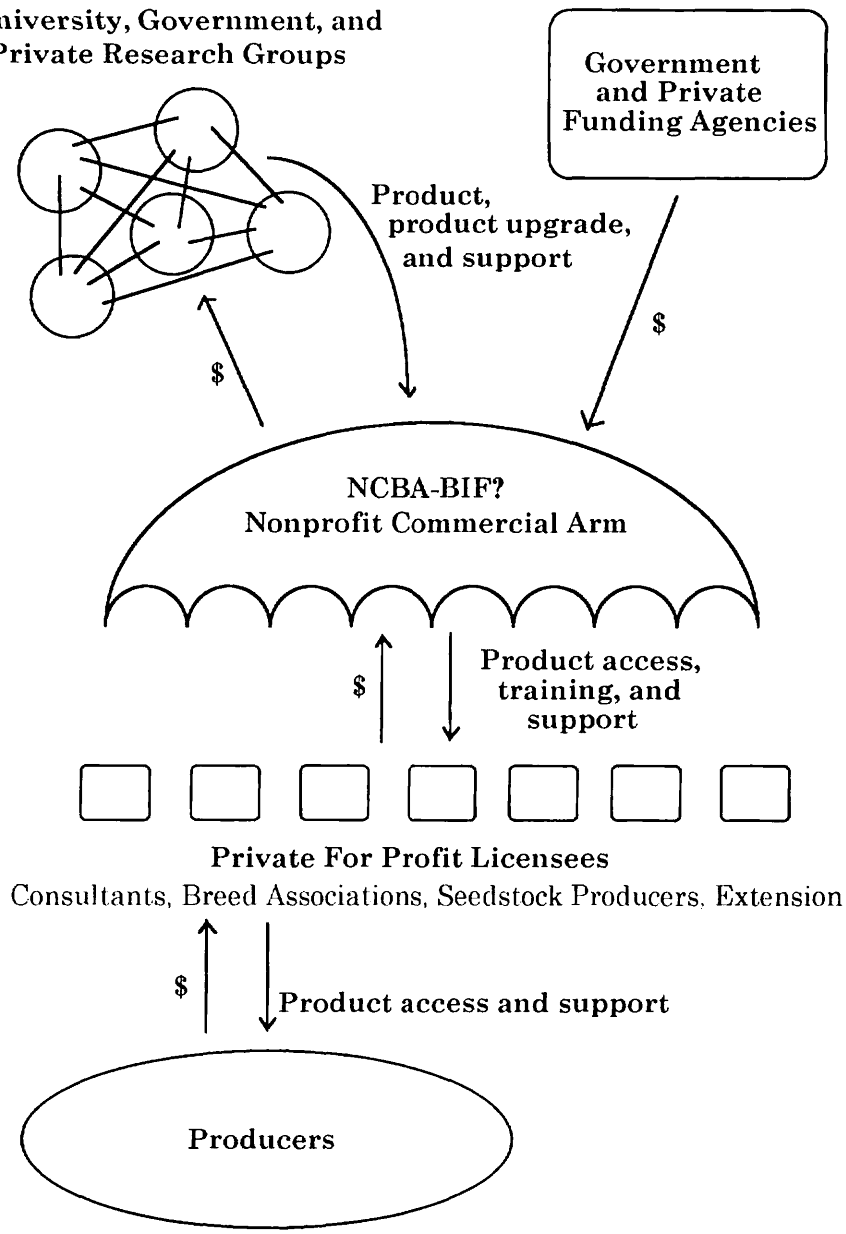


Figure 4. A structure for marketing, financing, and supporting simulation technology.

When (and if) a usable simulation model is developed, a successful mechanism for distributing and supporting the model is put in place, and the model achieves general acceptance among beef producers, it will be time to add the software components that will wed the model to genetic predictions so that it can be used as a selection tool. By then researchers will, we hope, have found ways to translate EPDs to the physiological breeding values required by the model.

There will probably be a great debate as to whether PhBVs should replace EPDs as the genetic predictions of choice in sire summaries and sale catalogs. Some will argue in favor of publishing PhBVs because of their universality. Others will disagree, suggesting that we should not change horses in midstream, that PhBVs are too easily confused with predictions of actual performance, and that the definition of a PhBV is dependent on the particular simulation model being used at the time and may change as the model changes.

Regardless of which camp wins, it is important to understand that simulation technology will never replace EPD technology. EPDs (or EBVs) will continue to be calculated much as they are today. Simulation technology will simply take them a step further, giving them economic relevance.

No one can say with certainty what the breeding related output of simulation technology will look like. The "optimum biotypes" and "sire sequences" described in this paper are attractive possibilities, but only possibilities at this point. Some researchers and producers prefer selection indexes or combinations of indexes and culling levels. We will probably see private companies competing in the marketplace with different products, and individual companies may offer an array of products to choose from.

Conclusion

The beef cattle breeding technology of the future will go well beyond EPDs. It will bring a systems approach to breeding, allowing us to determine much more precisely the kinds of animals that are appropriate for individual cattle operations. It will change both the way commercial producers make selection decisions and the way seedstock producers market their animals. This technology won't be in place this year or next; a usable, comprehensive simulation model and the necessary infrastructure to make such a model marketable must be developed first. But we now have a blueprint, work has begun, and there is momentum to put this technology to use.

Literature Cited

Enns, R.M. 1995. Simulation of across-breed comparisons. Ph.D. Dissertation. Colorado State University, Fort Collins.

GENETIC PREDICTION COMMITTEE MEETING

1997 BIF MEETING

Dickinson, North Dakota

L. V. Cundiff, Chairman
R. L. Willham, Secretary

May 15, 1997

Dr. Larry Cundiff, Chairman, opened the meeting at 3:15 p.m., in Dickinson, North Dakota. He opened noting that the agenda was full of timely topics of concern. The following presentations were made and the papers follow this report:

G. BENNETT (USMARC-ARS-USDA). Selection for Calving Ease. This interim report of four calf crops indicated surprising improvement by selection for calving ease.

K. BERTRAND (Univ. of Georgia). Selection for Carcass Traits. Carcass EPDs are effective. Ultrasound appears to be useful to measure carcass traits.

D. WILSON (Iowa State Univ.). Heritability of ultrasound measured fatness traits. External fat and intramuscular fat were examined. The heritabilities on bulls were less than the steers for some of the traits.

J. POLLAK (Cornell Univ.) and B. CUNNINGHAM (Am. Simmental Assn.). Simmental Multi-Breed Evaluation Update. Cunningham presented. The new system was defined. Canadian and U.S. data were combined. It is MB-ICE.

L. D. VAN VLECK (USMARC-ARS-USDA). Across-breed EPD Update for Multi-Breeds. Some new information was included that did not change the results much.

B. GOLDEN (Colorado State Univ.). Across-breed EPD Update for Red Angus. He discussed a possible scale effect.

Then Cundiff called on a PANEL to consider where should Genetic Prediction be Going - Priorities? The panel was composed of the following:

1. D. NICHOLAS (Nicholas Farms - Iowa). Suggests pounds of retail product per day minus cost. Emphasized importance of feed costs especially for maintenance of cow herds.

2.. ANDERSON (North Am. Limousin Foundation). The latest technology must be used to compute EPDs. Breeds may need to do own current predictions.

3. J. HOUGH (Am. Hereford Assn.). Multiple trait selection is important using the best technology. Composition evaluation will be important. Molecular genetics will contribute shortly.

4. L. LEACHMAN (Leachman Cattle Co. - Montana). Skeptical about our real gains in project.

After the short presentations because of time limits, Cundiff called for discussion of the direction and priorities for the Genetic Prediction Committee.

Reproduction EPDs were asked about. Whole herd recording should help produce such EPDs. But need to focus on consumer, reproduction is our problem. Value of one extra calf is more important than one more egg or piglet. 70% of beef costs are maintenance costs. Can we eliminate the bad experiences in eating beef? Probably need to cull poor products. Reproduction needs some more emphasis. The 5 by 5 were considered relative to cow traits. Carcass fat relative to cow flushing ability appears not to have an answer. A round of applause was given.

SELECTION FOR CALVING EASE[1]

Gary L. Bennett
Roman L. Hruska U.S. Meat Animal Research Center
USDA, Agricultural Research Service
Clay Center, NE 68933-0166

An experiment evaluating selection for heifer calving ease began at USMARC with selection and matings made in 1992 and calves born in 1993. Four purebred (Angus, Charolais, Gelbvieh, and Hereford) and three composite (MARC I, MARC II, and MARC III) populations are being used in the project. Calves born to about 400 two-year-old heifers are evaluated for calving ease each year. About 1250 females of all ages calve each year.

Each breed and composite was split into Select and Control lines. All lines are selected for breed average EPDs for yearling weight and milk. Breed average EPD for purebreds is the average for breed-wide genetic evaluation schemes and for composites is the within herd average EPD of composites born in the six years prior to selection. Select lines are selected for decreased calving difficulty score and the Control lines for breed average birth weight EPD. Selection for decreased calving difficulty score in MARC I and Charolais is based on EPD for direct calving difficulty score (terminal sire objective). MARC II and Gelbvieh are selected for the sum of direct and maternal calving difficulty score (general purpose objective). MARC III, Angus, and Hereford are selected for EPD for daughters' calving difficulty score (maternal objective).

The experiment uses the different sources of genetic improvement that are available in purebred and composite populations. Bulls raised at USMARC and semen from 20 to 85 sires used in the Germ Plasm Utilization experiment were available for use in both purebred and composite populations. Composite populations are restricted to bulls raised within a herd or cooperating group of herds during their formation and early use in the industry. However, purebred populations also have the opportunity to use bulls evaluated in breed-wide genetic evaluation schemes. Some of these sires with high accuracy and desirable EPDs for birth weight, growth, and milk are being used in the purebred populations. Since calving ease EPD was not available on all purebreds, low birth weight EPD sires were selected.

Genetic evaluations are based on within-herd multiple-trait BLUP evaluations using information collected in the Germ Plasm Utilization and Calving Ease projects beginning in 1978. Calving difficulty score, birth weight, 200-d weight, and postweaning gain are evaluated by multiple-trait BLUP. Sires introduced from industry are identified as separate genetic groups in the purebred genetic evaluations. Each purebred evaluation has one group

[1] Presented at the Beef Improvement Federation 29th Annual Meeting and Research Symposium, Dickinson, North Dakota, May 14-17, 1997.

for animals originating at USMARC, one group for non-USMARC sires meeting the Select line criteria, and one group for non-USMARC sires meeting the Control line criteria. Genetic evaluations are run three times a year following weaning, yearling weights, and the first six weeks of heifer calving.

Some preliminary results from the first four calf crops are shown in Tables 1 through 6. The use of EPD from multiple-trait BLUP and sires with progeny evaluated within a herd or across a breed have resulted in substantial change in calving difficulty scores and assistance of two-year-old heifers (Table 1). Birth weight has also changed because it was used to help predict heifer calving ease (Table 2). The incidences of moderate and severe calving difficulty in Select lines have decreased relatively more than the incidence of slight calving difficulty (Table 3). Breeding value for calving difficulty score has steadily separated between Select and Control lines (Table 4). Heifers born in calf crops that had low incidences of calving assistance also produced calves requiring less assistance. This shows that any antagonism between direct and maternal calving ease can be readily overcome by continued selection.

Information stored in pedigrees and performance records, interpreted through EPD, connected to breeding animals and semen, and used for selection is a powerful genetic force. One explanation for the rapid change in calving difficulty score is the use of progeny-tested sires, both those evaluated within herd and those evaluated across the breed, without having to wait for the progeny test. Estimated differences between non-USMARC Select and Control sires selected on birth weight EPD were -.70 calving difficulty score, -4.3 lb birth weight, and no difference in yearling weight. Most Control sires have moderate birth weight EPD so the difference in birth weight and calving difficulty score comes not from culling sires with heavy birth weight EPD but from selecting for sires with light birth weight EPD. Other factors contributing to rapid change in calving difficulty score are the use of multiple-trait BLUP to include correlated traits (especially birth weight), consistent measurement of calving difficulty score on all animals born, and high heifer replacement rates.

Measured against the breeding value of calves born in 1992, Select lines are showing differences in relative emphasis on direct and maternal calving difficulty score (Table 5) depending on the selection objective. However, change in maternal breeding value for calving difficulty score to date is small compared with the Control line (Table 4) or with animals born in 1992 (Table 5).

Table 6 shows that Select and Control lines are similar for yearling weight within purebreds and composites. Table 6 also shows that purebreds are increasing from lower initial yearling weight breeding values towards their breed means. The desired goal for composites was to hold them near their initial genetic levels and this has been achieved. Yearling weight goals for both purebreds and composites are being met while improving calving ease.

Table 1. Mean calving difficulty scores and assistance rates for births to two-year-old heifers.

Birth Year	Scores[a]		% Assisted	
	Control	Select	Control	Select
93	3.08	2.76	52.2	48.4
94	3.06	2.29	53.9	36.5
95	3.08	2.03	54.1	30.7
96	2.65	1.77	46.6	22.6

Table 2. Mean birth weights and gestation lengths.

Birth Year	Birth Weight, lb		Gestation Length	
	Control	Select	Control	Select
93	90.7	88.6	287.4	286.3
94	89.5	84.2	285.4	283.6
95	91.0	85.6	285.6	284.3
96	89.1	82.6	285.7	283.9

Table 3. Incidence of calving scores for calves born to two-year-old heifers in 1996.

	%	
Score[a]	Select	Control
1	77.1	53.6
2+3	7.7	10.7
4+5	10.9	26.2
6+7	4.2	9.5

Table 4. Estimated breeding value trends in Select lines for direct, maternal and total calving difficulty score[a] as a difference from Control lines.

Birth Year	Estimated Breeding Value		
	Direct	Maternal	Total
93	-0.30	-0.02	-0.32
94	-0.70	0.05	-0.65
95	-0.71	-0.09	-0.80
96	-0.90	-0.05	-0.95

Table 5. Average 1993-1996 breeding value for Select lines for direct, maternal and total calving difficulty score[a] as a difference from 1992-born calves depending on selection objective.

Selection Objective	Estimated Breeding Value		
	Direct	Maternal	Total
Terminal	-0.49	0.00	-0.49
General	-0.62	-0.25	-0.87
Daughter	-0.34	-0.16	-0.50

Table 6. Estimated breeding value trends for yearling weight in purebred and composite Select and Control lines.

Birth Year	Estimated Breeding Value			
	Purebred		Composite	
	Select	Control	Select	Control
92	0	0	0	0
93	31	13	-14	-12
94	24	35	-3	2
95	34	31	0	2
96	46	43	3	6

[a] Calving difficulty scores: 1=none, 3=little, 5=moderate, 7=caesarean.

SELECTION FOR CARCASS TRAITS

J. K. Bertrand[a], D. W. Moser[a] and W. O. Herring[b]
[a]University of Georgia and [b]University of Missouri

Introduction

There has been increasing interest within the seedstock and commercial industry for the development of genetic values to enhance selection for carcass traits. This interest has been motivated by a general consensus that the packing and retail industry would move towards a value-based marketing system, where cattle will be individually marketed based on carcass quality and red meat yield. Indeed many breeds, feeders and producers have formed agreements with packers to develop programs that price carcasses individually on a valued-based grid system. Some breeds have sire EPD for carcass traits based on carcass information from finished steer and heifer progeny. However, the amount of carcass data for most breeds is small compared to other traits such as birth, weaning and yearling weight, scrotal circumference and calving ease due to the time consuming nature, cost and difficulty of gathering useful carcass information on finished steers and heifers. Ultrasound technology may offer a vehicle for the seedstock industry to collect large amounts of data on yearling bulls and heifers at a reasonable cost, and therefore, more animals would have genetic values for carcass traits than are currently available. The purpose of this paper is to present information on the usefulness of carcass EPD predicted from data on finished cattle and to present some current research information on the possible usefulness of ultrasound data from young seedstock for use in predicting carcass EPD.

Usefulness of Carcass EPD Predicted from Steer Progeny Data

A few breed associations already provide sire carcass EPD to their breeders. These carcass EPD are predicted from mainly steer carcass data as part of a designed progeny testing program. Carcass weight, 12-13th rib fat thickness and ribeye area and marbling score are the traits most commonly evaluated in these programs.

A study reported by Vieselmeyer et al. (1994) demonstrates the usefulness of carcass EPD. This project, conducted at the University of Nebraska and MARC, involved randomly mating six Angus bulls with high and six Angus bulls with low EPDs for marbling score to 180 MARC II (1/4 Hereford, 1/4 Angus, 1/4 Simmental, 1/4 Gelbvieh) cows. Based on information from the 1992 Angus sire summary, the six high marbling EPD sires had an average EPD of +.31, and the six low line sires had an average marbling EPD of -.18. Steers produced in the project were fed a growing diet for 48 days after weaning and then placed in the feedlot; heifers were fed a growing diet for 191 days after weaning and then placed in the feedlot. Steers from each line were slaughtered in two groups (after 124 and 191 days on feed), and the heifers were also slaughtered in two groups (85 and 148 days on feed). More steers and heifers sired by high marbling bulls graded USDA Choice at both slaughter times compared to the steers and heifers out of low marbling sires. At the first slaughter time and at an average of .37 inches external fat, 59% of the steers from high marbling sires graded Choice compared to 13% of the steers from low sires. At the second slaughter time, the steers averaged .53 inches of backfat, and 94% of steers from high sires graded choice compared to 83% of steers from low sires. Heifers exhibited similar results with 45% and 21% of heifers from high and low sires, respectively, grading Choice at the first slaughter time with an average of .31 inches of external fat. At the second slaughter time and at an average fat thickness of .5 inches, 97% and 72% of heifers from high and low sires, respectively, graded Choice. Neither external fat measured at the 12-13th rib or yield grade was significantly different across the two marbling lines. However, high marbling line sires had lower weaning and yearling weight EPD than the low line sires because sires were selected primarily on marbling score, ignoring other EPD. Because of the differences in growth EPD between the two lines, steers and heifers from low marbling sires had heavier weaning, slaughter and carcass weights than progeny from high sires. The differences in growth between the two lines points out a potential problem with single trait selection: other important traits may be negatively affected because they were not considered in the selection of breeding stock.

When EPD are available for a variety of carcass traits, it is possible to select for more than one trait at a time. In a study at the University of Georgia, six Angus bulls were selected to have marbling score EPD that were above and fat thickness EPD that were below the breed average of Angus bulls being evaluated for carcass traits. In addition to these bulls, three Angus bulls that had marbling score EPD that were below and fat thickness EPD that close to the average of Angus bulls being evaluated were also used. The high marbling line bulls had average marbling and fat thickness EPD (in) of .27 and -.06, respectively, and the low marbling line had average marbling and fat thickness EPD of -.17 and -.02, respectively. The average EPD of the Angus sires evaluated were .01 for marbling score and -.03 for fat thickness. Sires were randomly mated to commercial Angus cows and the resulting steer offspring were backgrounded and then placed into the feedlot. Steers from each line were slaughtered at two times based on external 12-13th rib backfat measured via ultrasound. Averaged across the three years of data, the steers at the first slaughter time were on feed 95 days and had a backfat thickness of .35 in.; steers at the second slaughter time were on feed 148 days and had a backfat thickness of .56 inches. Table 1 presents some of the results of this study. Steers from the two lines did not significantly differ ($p > .15$) for carcass weight or ribeye area. Average ribeye area and carcass weight EPD of the high and low line sires was .33 in^2 and -.04 in^2 and 10.8 lb and 1.4 lb, respectively. Steers from high marbling-below average fat thickness sires had higher ($p < .05$) marbling scores and intramuscular fat percentages as measured by chemical analysis and a greater percentage grading choice at each slaughter time when compared to steers from low marbling-average fat thickness sires. It was also interesting that the steers were not different for 12-13th rib backfat thickness at the first slaughter time, but the high marbling-below average fat thickness line had less backfat at the second slaughter time.

The results reported by Vieselmeyer et al. (1994) and the research at Georgia also demonstrates that it can be difficult to use carcass EPD to predict outcome groups or to hit specification targets. For example, the difference between the marbling EPD between the Angus sires used in the high and low marbling lines were similar. Yet the percentage of the steer progeny from these high and low lines that graded Choice differed across the two studies. In the Nebraska study, 13% and 59 % of the steers from low and high line sires, respectively, graded Choice at the first slaughter time, while in the Georgia study, 72 and 84% of steers from low and high line sires, respectively, graded choice at the first slaughter time. The two studies were more similar at the second slaughter for the percent grading Choice in each of the lines. Gwartney et al. (1994) reported that marbling scores in the Nebraska study for the high and low lines averaged over both slaughter times was 354 and 312, respectively, where 300= small^{00} and 400= modest^{00}. The average marbling score for the high and low line steers in the Georgia study averaged over both slaughter times was 460 and 395, respectively. The differences between the high and low lines were similar across the two studies; however, the average marbling score in the Georgia study was an entire marbling score (100 points) higher. In the Nebraska study, the Angus sires were bred to cows that were 1/4 Angus, 1/4 Hereford, 1/4 Simmental, 1/4 Gelbvieh and the steers were slaughtered at between 14 and 17 months of age. In the Georgia study, the Angus sires were mated to commercial Angus dams and the progeny slaughtered between 20 and 24 months of age. The results of these two studies show that the differences between sire marbling EPD will reflect differences between the phenotypic performance of offspring. However, using EPDs to predict the percent of progeny that will grade choice can be difficult since it is impossible to predict the management and environmental conditions under which progeny will be raised.

Using Seedstock Ultrasound Measures to Predict Carcass EPD

Data composed of 2036 Brangus steers and heifers and 3583 yearling Brangus bulls and heifers were analyzed in order to estimate the genetic relationships between finished cattle and yearling seedstock for 12-13th rib fat thickness and ribeye area. These data were collected by Brangus breeders as a part of the performance program of the International Brangus Breeders Association. There were a total of 48 sires which had progeny with carcass data and yearling seedstock progeny with ultrasound measures. Finished cattle were slaughtered at an average age of 15 months. Genetic parameters were estimated using DMU-AI, which is a REML algorithm that uses the average of observed and expected information from the matrix of second derivatives of the likelihood function(Madsen et al., 1994). The traits analyzed were carcass weight, fat thickness and ribeye area from finished cattle and ultrasound fat thickness and ribeye area and yearling weight from yearling seedstock. The genetic correlation estimates between yearling seedstock and finished cattle for ribeye area and backfat thickness were .65 and .69, respectively. The genetic correlation estimate between carcass weight in finished cattle and yearling weight in seedstock cattle was estimated at .61. Expected progeny differences were predicted using only carcass data and a three-trait model that included carcass weight, ribeye area and fat thickness. Expected progeny differences were also predicted using only yearling seedstock data and a three-trait model that included yearling weight and ultrasound ribeye area and fat thickness. Table 2 provides the ten sires with the highest fat thickness EPD based on carcass data along with their rank and EPD for fat thickness based on ultrasound data. Only 25 sires with accuracy values that were at least .5 in both data sets were considered. Fat thickness is presented here because much concern has centered around the usefulness of ultrasound measures of fat in yearling cattle. The ten sires with the highest EPD based on carcass progeny data generally were also among the top ten sires ranked for largest fat thickness EPD based on ultrasound progeny data. The range in ultrasound fat thickness sire EPD was from .0075 to .-.0142, while the sire EPDs for the same trait predicted from carcass data ranged from .0374 to -.0375. The small range in sire fat thickness EPDs predicted from ultrasound data were of concern. Relatively small differences in ultrasound fat thickness EPD could translate to much larger differences in steer progeny. It is also probable that contemporary groups with a low average fat thickness may need to be eliminated to ensure that suitable variation exists among yearling seedstock within the contemporary group. The range in sire ribeye area EPD were more similar across the carcass and ultrasound data sets. The ribeye EPD based on carcass data and ultrasound data ranged from .81 to -.49 and .63 to -.55, respectively.

Ultrasound fat thickness, ribeye area and intramuscular fat percentage measures from 776 yearling bulls out of 52 sires collected in a study conducted by the University of Missouri were used to predict EPD. Twenty-eight of the sires that had at least two ultrasound progeny also had carcass EPD predicted from carcass data generated by the American Angus Association progeny testing program. Nine bulls had accuracy values of at least .95 in the Angus carcass testing program and also had at least 10 yearling bull progeny in the University of Missouri study. The rank correlations between carcass and ultrasound fat thickness, between carcass and ultrasound ribeye area and between carcass marbling and ultrasound intramuscular fat percentage for these nine bulls was .58, .77 and .62, respectively. Table 3 presents that carcass marbling and ultrasound intramuscular fat percentage EPD for these sires. The sire EPD appear to rank the bulls similarly for both marbling or intramuscular fat percentage with the exception of sire 6 which had the highest EPD for intramuscular fat percentage based on yearling bull ultrasound information but ranked number 6 for his EPD based on steer progeny marbling information. The three sires with the highest marbling EPD based on steer progeny data were ranked in the top 4 based on ultrasound intramuscular fat percentage progeny data. The lowest ranked sire was the same for both marbling and intramuscular fat percentage EPD.

Summary

Sire EPD predicted from progeny steer and heifer carcass data can be used effectively. However, it is difficult to use carcass EPD to hit specification endpoints because management and environment dictate the largest proportion of differences that are observed between contemporary groups of fed cattle. With experience, producers and feedlot operators may be able to make some inferences on the general phenotypic performance of progeny that result from using sire EPD when sires are mated to specified dam breed-types, and when the progeny are raised under predefined management conditions. The preliminary results of research involving the use of ultrasound information on yearling seedstock to produce carcass EPD is promising and justifies the collection of ultrasound information by breeders and breed associations. It is important that breeds also continue to collect carcass data so that the genetic relationships between carcass and ultrasound data can be better defined. Genetic evaluation for carcass traits will most likely include both ultrasound and carcass data in order to increase the accuracy of prediction and to allow for the prediction of useful EPD for young seedstock.

Literature Cited

Gwarney, B., C. Calkins, R. Rasby, R. Stock, B. Vieselmeyer and J. Gosey and 1994. Using expected progeny differences to produce marbled, lean beef: carcass yield and palatability traits. Nebraska Beef Rept. p. 57.

Madsen, P., J. Jensen and R. Thompson. 1994. Estimation of (co)variance components by REML in multivariate mixed linear models using average of observed and expected information. Proceedings of 5th World Congress on Genetics Applied to Livestock Production, Vol. 22:19.

Vieselmeyer, B., R. Rasby, B. Gwartney, C. Calkins, R. Stock, J. Gosey and M. Dragastin. 1994. Using expected progeny differences to produce marbled, lean beef: production traits. Nebraska Beef Rept. p. 54.

Table 1. Least Square Means for Carcass Traits of Steers Sired by High Marbling - Below Average Fat Thickness (H) or Low Marbling - Average Backfat (L) EPD Sires.

	Slaughter #1		Slaughter #2	
Sire EPD Line	H	L	H	L
Number of Steers	52	51	52	52
Marbling Score *[a]	4.2	3.6	5.0	4.3
% Intramuscular Fat*	6.0	5.2	8.8	7.7
USDA Quality Grade[Δb]	11.5	11.1	12.6	11.7
% Choice*	84	72	99	93
Fat Thickness (in)[+]	.35	.35	.52	.60
Ribeye Area (in.^{2})	10.2	9.9	11.2	11.0
Carcass Wt (lb)	570	558	689	684
USDA Yield Grade	2.7	2.7	3.3	3.6

[Δ]Line Significant at (P <.12)
[+]Line x Slaughter group significant at (P <.10)
*Line Significant at (P <.05)
[a]Marbling Score = slight ^{0} = 2.0, small ^{0} = 3.0, modest = 4.0
[b]Quality Grade = select $^{-}$ = 10, choice $^{-}$ = 11, choice^{0} = 12

Table 2. Fat Thickness EPDs Based on Ultrasound Data For Brangus Sires With Highest Fat Thickness EPDs Based on Carcass Data.

	Carcass ($\bar{x}$ = -.0073)			Ultrasound ($\bar{x}$ = -.0036)		
Sire	EPD, in	ACC	Rank	EPD, in	ACC	Rank
1	.0374	.78	1	.0055	.70	2
2	.0274	.87	2	.0025	.81	4
3	.0247	.71	3	.0075	.54	1
4	.0169	.74	4	-.0015	.55	8
5	.0116	.71	5	-.0039	.53	12
6	.0101	.75	6	.0022	.64	5
7	.0062	.77	7	-.0039	.64	12
8	.0043	.75	8	-.0023	.61	9
9	.0018	.73	9	.0013	.67	6
10	-.0032	.86	10	-.0015	.82	7

Table 3. Ultrasound Intramuscular Fat % and Carcass Marbling EPD For Nine Angus Bulls With 10 or More Ultrasound Progeny and Marbling Accuracy ≥.95.

	Carcass ($\bar{x}$ = .10)		Ultrasound ($\bar{x}$ = -.06)	
Sire	EPD	Rank	EPD	Rank
1	.39	1	-.08	4
2	.30	2	-.02	2
3	.17	3	-.04	3
4	.06	4	-.08	4
5	.04	5	-.12	8
6	.03	6	.15	1
7	.02	7	-.09	6
8	-.01	8	-.09	6
9	-.08	9	-.19	9

ESTIMATION OF GENETIC PARAMETERS FOR FAT COMPOSITION TRAITS MEASURED IN LIVE BEEF ANIMALS

M. M. Izquierdo, D. E. Wilson and G. H. Rouse
Iowa State University, Ames, IA

The objectives of this study were to analyze fat traits measured with real-time ultrasound in live bulls and steers at age and weight constant end points. Fat traits considered include 12-13th rib fat thickness measured with ultrasound (UFAT) and in the carcass (FAT) and percent intramuscular fat in the longissimus dorsi muscle as determined by chemical extract (PIFAT) and as predicted by ultrasound (UPIFAT). USDA Marbling Score was also collected and compared to the percent intramuscular fat measurements. The analysis included development of age and weight end point regressions and estimation of genetic parameters for each trait. Breeding values based upon carcass measures and upon ultrasound determined measures were also developed.

Animals used in this study include steers and bulls from the Iowa State University beef cattle breeding project. These animals came from three frame size groups of Angus type cattle and from a medium frame Simmental type. Ultrasound measures and carcass data were gathered from each calf crop over the slaughter years of 1992-1995. The ultrasound measures were collected at approximately 30 day intervals, starting at 380 days of age up to the slaughter age which ranged up to 500 days of age. Animals scanned and slaughtered included 475 head of bulls and 528 head of steers. Several of the tables in this report are only for the Angus animals which included 229 bulls and 341 steers.

General linear model procedures of SAS (1988) were used to test for significance of environmental effects. Multiple-Trait Derivative Free Restricted Maximum Likelihood (MTDFREML) software developed by Boldman, et al. (1995) was used to estimate variance components and breeding values.

Age regression coefficients for the fat traits are given in Table 1. The age regressions for this analysis were conducted across animals using the ultrasound measures and ages of the animals at time of slaughter. The results indicate positive trends in the fat traits with age for steers, but generally negative for the bulls. Within animal regression trends are currently being investigated and may not reflect the same results shown in this study. Within individual animal age regressions would be the preferred method of adjusting animals to either an age or weight end point.

Heritability estimates for each of the fat traits analyzed in the Angus bulls and steers are given in Table 2. The estimates are significantly higher in steers than they are in bulls. Ultrasound measured traits in both sexes are significantly higher than estimates determined from carcass data. External fat thickness and Marbling Score heritability estimates in bulls are essentially zero. The estimates at age end points and at weight end points are in close agreement.

Genetic and phenotypic correlation estimates between the fat traits were computed for the Angus steers. Convergence of the MTDFREML procedures could not be achieved when using the bull data. Weight constant genetic correlation estimates are in the parenthesis. Of significance is the high genetic correlation estimates between the fat traits and the corresponding ultrasound measured trait. This analysis would indicate that the traits are identical with a .95 genetic correlation between PIFAT and UPIFAT and with an ≅1.00 genetic correlation between FAT and UFAT.

The final part of this study was to develop breeding values based upon carcass data and breeding values based upon ultrasound measures and then to compare the two. The results of these comparisons are given in Tables 4 and 5. Using all of the breeding values computed in this study, UFAT breeding values compare quite favorably with FAT breeding values as indicated by the R2 of .76 shown in Table 4. The comparison between PIFAT and UPIFAT breeding values are not quite so good. However, when the comparisons are made for sires that have more than 7 progeny in the analysis, then the percent intramuscular fat breeding values compare very favorably. It is anticipated that as the number of progeny increases beyond 7, then the correlation between carcass trait breeding values and ultrasound trait breeding values should also become higher.

Summary

The ultimate objective of researching ultrasound technologies is to develop programs of implementation that will allow the use of ultrasound measures taken on live animals to develop breeding values of body composition traits for seedstock animals. Current genetic improvement programs for body composition must rely on long-term progeny testing programs which use carcass data. Although the numbers of animals available in this study were limited, there is a clear indication that breeding values determined from ultrasound measures could compare very favorably with breeding values based upon carcass measures. The advantages of using ultrasound are two-fold: (1) the lead-time required to develop breeding values or expected progeny differences (EPD) for animals can be significantly shortened and (2) the requirement to collect the actual carcass data on steers undergoing progeny testing could be eliminated, or at least reduced. This last advantage would help in: maintaining contemporary groups, obtaining more accurate measures of external fat cover, obtaining measures at a more appropriated end point (for example, .3 or .35 inches of external fat) and eliminating the frustrations of loss of carcass data which happens all to frequently.

References

Boldman, K. G., L. A. Kriese, L. D. Van Vleck, C. P. Van Tassell and S. D. Kachman. 1995. A Manual for Use of MTDFREML. U.S. Department of Agriculture, Agricultural Research Service.

SAS. 1988. SAS User's Guide: Statistics. SAS Inst. Inc., Cary, NC.

Table 1. Age regression coefficients for ultrasound fat traits in Angus cattle.

Traits	Bulls	Steers
Carcass 12-13th rib fat thickness, cm/d	-.004	.0098**
Ultrasound 12-13th rib fat thickness, cm/d	.009**	.007**
Carcass chemical percent intramuscular fat, %/d	-.016**	.003**
Ultrasound percent intramuscular fat, %/d	-.018**	.003
USDA Marbling Score, unit/d	-.240	.160

**P<.05.

Table 2. Heritability Estimates for ultrasound fat traits in Angus cattle.

Traits	Bulls	Steers
Carcass 12-13th rib fat thickness	.01[a](.02)[b]	.32(.14)
Ultrasound 12-13th rib fat thickness	.33(.35)	.50(.34)
Carcass chemical percent intramuscular fat	.08(.06)	.45(.38)
Ultrasound percent intramuscular fat	.26(.22)	.81(.84)
USDA Marbling Score	.01(.01)	.79(.80)

[a]Age constant; [b]Weight constant.

Table 3. Genetic and phenotypic correlations between ultrasound fat traits in Angus cattle for age and weight constant end points.

Trait	PIFAT	UPIFAT	FAT	UFAT	MS
Percent Intramuscular Fat (PIFAT)	.48[a]	.50[b]	.14	.19	.65
Ultrasound PIFAT (UPIFAT)	.95(.91)[c]	.80	.18	.08	.54
Carcass 12-13th Rib Fat Thickness (FAT)	.17(-.21)	.67(.95)	.34	.68	.11
Ultrasound12-13th Rib Fat Thickness (UFAT)	.21(-.03)	.53(.66)	≅1(≅1)	.50	.15
USDA Marbling Score	.99(≅1)	.83(.84)	.15(.18)	.09(.21)	.77

[a]h^2; [b]r_p; [c]r_g; (weight constant).

Table 4. Regressions of carcass fat trait breeding values on ultrasound fat trait breeding values.

Regression	R^2	r
FAT = β * UFAT	.76	.87
PIFAT = β * UPIFAT	.32	.57

Table 5. Regression of carcass chemically determined percent intramuscular fat breeding values on ultrasound percent intramuscular fat breeding values.

Number of progeny/sire	R^2	r
All categories (1 - 15)	.46	.68
> 3	.49	.70
> 7	.59	.77

ACROSS-BREED EPD TABLES ADJUSTED TO A 1995 BASE

L. D. Van Vleck and L. V. Cundiff
Roman L. Hruska U.S. Meat Animal Research Center, ARS, USDA, Lincoln and Clay Center, NE 68933

Introduction

This report is the 1997 update of estimates of sire breed means from data of the Germ Plasm Evaluation project at the U.S. Meat Animal Research Center (MARC) adjusted to a 1995 base using EPDs from the most recent national cattle evaluations.

Changes in records analyzed from the 1996 update (Van Vleck and Cundiff, 1996) are:

1) Birth weights of 167 progeny of 12 Angus bulls, 27 progeny of 2 Brahman bulls, and 28 progeny of 2 Charolais bulls were added with corresponding increases in progeny with weaning and yearling weights.
2) Weaning weights of 129 grandprogeny and 3 Hereford sires, of 307 grandprogeny and 28 Angus sires, and of 116 grandprogeny and 6 Brahman sires were added to the maternal analyses.
3) Average EPD of Brahman non-parents born in 1995 was used. Due to mis-communication, average EPD from the 1994 calculations were used in the 1996 update.

Methods

The calculations are as outlined in the 1996 BIF Guidelines. The basic steps were given by Notter and Cundiff (1991) with refinements by Núñez-Dominguez et al. (1993), Cundiff (1993, 1994) and Barkhouse et al. (1994, 1995). All calculations were done with programs written in Fortran language with estimates of variance components, regression coefficients, and breed effects obtained with the MTDFREML package (Boldman et al., 1995). All breed solutions were estimated as a difference from Angus. The table values to add to within-breed EPDs are relative to Angus.

For completeness, the basic steps in the calculations will be repeated.

Models for Analysis of MARC Records

The fixed effects in the models for birth weight, weaning weight (205-d) and yearling weight (365-d) were: breed of sire (12), dam line (Hereford, Angus, MARC III Composite), sex (female, male), age of dam (2, 3, 4, 5-9, ≥10 yr), year of birth (70-76, 86-90, 92-94) and a covariate for day of year at birth. Dam of calf was included as a random effect to account for correlated maternal effects for cows with more than one calf (2893 dams for BWT, 2707 for WWT, 2596 for YWT). For estimation of variance components and to estimate breed of sire effects, sire of calf was also used as a random effect (389).

Variance components were estimated with a derivative-free REML algorithm. At convergence, the breed of sire solutions were obtained as were the sampling variances of the estimates to use in constructing prediction error variance for pairs of bulls of different breeds.

For estimation of coefficients of regression of progeny performance on EPD of sire, the random sire effect was dropped from the model. Pooled regressions, regressions by sire breed, by dam line, and by sex of calf were obtained. These regressions are monitored as accuracy checks and for possible genetic by environment interactions. The pooled regression coefficients were used as described later to adjust for genetic trend and bulls used at MARC.

The fixed effects for the analyses of maternal effects included breed of maternal grandsire (12), maternal granddam line (Hereford, Angus, MARC III), breed of natural service mating sire (15), sex of calf (2), birth year-GPU cycle-age of dam subclass (59), and mating sire breed-GPU cycle-age of dam subclass (32) with covariate for day of year of birth. The subclasses are used to account for confounding of years, mating sire breeds, and ages of dams. Ages of dams were (2, 3, 4, 5-9, $\geq$10 yr). For estimation of variance components and estimation of breed of maternal grandsire effects, random effects were maternal grandsire (365) and dam (1778 daughters of maternal grandsires). For estimation of regression coefficients of grandprogeny weaning weight on maternal grandsire EPD, random effects of both maternal grandsire and dam (daughter of MGS) were dropped from the model.

Adjustment of MARC Solutions

The calculations of across-breed adjustment factors rely on solutions for breed of sire or maternal grandsire from records at MARC and on within-breed EPDs. The calculations are simplified because records from MARC are not included in within-breed EPD calculations.

The basic calculations for BWT, WWT, and YWT are as follows:

MARC breed of sire solution adjusted for genetic trend:

$$M_i = \text{MARC (i)} + b[\text{EPD(i)}_{1995} - \text{EPD(i)}_{\text{MARC}}]$$

Breed table factor to add to EPD for bull of breed i:

$$A_i = (M_i - M_x) - (\text{EPD(i)}_{1995} - \text{EPD(x)}_{1995})$$

where,

MARC(i) is solution from mixed model equations with MARC data for sire breed i,

EPD(i)_{1995} is the average within-breed EPD for breed i for animals born in 1995,

$\text{EPD(i)}_{\text{MARC}}$ is the weighted (by number of progeny at MARC) average of EPD of bulls of breed i having progeny with records at MARC, b is the pooled coefficient of regression of progeny performance at MARC on EPD of sire (for 1997: 1.07, .91, and 1.24 for BWT, WWT, YWT),

i denotes breed i, and

x denotes the base breed x, which is Angus in this report.

The calculations to arrive at the Breed Table Factor for milk are more complicated because of the need to separate the direct effect of the maternal grandsire breed from the maternal (milk) effect of the breed.

MARC breed of maternal grandsire solution for WWT adjusted for genetic trend:

$$MWWT(i) = MARC(i)_{MGS} + b_{wwt}[EPD(i)_{95WWT} - EPD(i)_{MARCWWT}] + b_{MLK}[EPD(i)_{95MLK} - EPD(i)_{MARCMLK}]$$

MARC breed of maternal grandsire solution adjusted for genetic trend and direct genetic effect:

$$MILK(i) = [MWWT(i) - .5\ M(i)] - [\overline{MWWT} - .5\ \overline{M}]$$

Breed table factor to add to EPD for MILK for bull of breed i:

$$A_i = [MILK(i) - MILK(x)] - [EPD(i)_{95MLK} - EPD(i)_{MARCMLK}]$$

where,

$MARC(i)_{MGS}$ is solution from mixed model equations with MARC data for MGS breed i for WWT,

$EPD(i)_{95WWT}$ is the average within-breed EPD for WWT for breed i for animals born in 1995,

$EPD(i)_{MARCWWT}$ is the weighted (by number of grandprogeny at MARC) average of EPD for WWT of MGS of breed i having grandprogeny with records at MARC,

$EPD(i)_{95MLK}$ is the average within-breed EPD for MILK for breed i for animals born in 1995,

$EPD(i)_{MARCMLK}$ is the weighted (by number of grandprogeny at MARC) average of EPD for MILK of MGS of breed i having grandprogeny with records at MARC,

b_{WWT}, b_{MLK} are the coefficients of regression of performance of MARC grandprogeny on MGS EPD for WWT and MILK (for 1997: .49 and 1.24),

$M(i) = M_i$ is the MARC breed of sire solution from the first analysis for WWT direct adjusted for genetic trend,

$\overline{MWWT}$ and $\overline{M}$ are unneeded constants corresponding to unweighted averages of MWWT(i) and M(i) for i = 1,...,12, the number of sire and maternal grandsire breeds.

Results

Tables 1, 2, and 3 (for BWT, WWT and YWT) summarize the data from, and results of, MARC analyses to estimate breed of sire differences and the adjustments to the breed of sire effects to a 1995 base. The last column of each table corresponds to the "breed table" factor for that trait. The number of MARC progeny with records was the same for 1997 as for 1996 except for an increase 167 Angus, 27 Brahman, and 28 Charolais sired calves and 12, 2, and 2 additional bulls, respectively, for the three breeds. Changes from 1996 are larger than expected. The additional Angus records in general resulted in increased solutions for Angus relative to most other breeds which were also expressed in the table adjustments. Changes could also be due to any changes in edits or genetic parameters used for the National Cattle Evaluations. A more likely reason for slight changes is the average genetic change from the previous base year of 1994 to the current base year of 1995.

Table 4 summarizes the calculations for the table adjustment for MILK EPDs. Because daughters of the MGS are still producing calves and some bulls were reported for the first time, some new grandprogeny had records; 129 more Hereford, 307 more Angus, and 116 more Brahman. Changes in 1997 compared to 1996 were less than 4 lb with most from 0 to 2 lb.

Table 5 summarizes the average BIF accuracy for bulls with progeny at MARC weighted by number of progeny or grandprogeny. Table 6 reports the estimates of variance components from the records that were used in the mixed model equations to obtain breed of sire and breed of MGS solutions.

Table 7 updates the coefficients of regression of MARC progeny on EPD for BWT, WWT and YWT which have theoretical expected values of 1.00. The standard errors of the specific breed regression coefficients are large relative to the regression coefficients. One noticeable pattern, which may have a biological basis, is the decrease in the Brahman regression from birth to yearling age with regression coefficients of 1.55 for BWT, 1.02 for WWT, and .71 for YWT. Brahman sired calves from purebred Brahman dams are known to be smaller than calves from dams of other breeds.

The regressions by sex for YWT EPD, although still different, are becoming more alike. Now both are significantly different from 1.00. Another puzzle is why the regression for WWT for Hereford cows remains so low (.45 ± .12) relative to the expected regression of 1.00 and especially relative to Angus cows. The difference in regression coefficients for Hereford and Angus dams, if real, suggests different responses when sire breeds are mated to Hereford or Angus dams. A similar pattern is shown for the regression of grandprogeny performance on MGS EPD for WWT (Table 8) with the Hereford regression less than .5 and the Angus regression greater than .5.

The coefficients of regression of grandprogeny on MGS EPD for WWT and MILK are shown in Table 8. The theoretical expected values of the regression coefficients are .50 for WWT and 1.00 for MILK. The difference in coefficients of regression on milk EPD for heifer and steer calves has become similar. For WWT EPD, the regression coefficients are equal. The standard errors for regression coefficients associated with heifers and steers overlap for milk EPD.

Prediction Error Variances of Across-Breed EPD

The standard errors of differences in the solutions for breed of sire and breed of MGS differences from the MARC records can be adjusted by theoretical approximations to obtain variances of adjusted breed differences (Van Vleck, 1994: Van Vleck and Cundiff, 1994). These variances of estimated breed differences can be added to prediction error variances of within-breed EPDs to obtain prediction error variances (PEV) or equivalently standard errors of prediction (SEP) for across-breed EPDs (Van Vleck and Cundiff 1994, 1995). The variances of adjusted breed differences are given in the upper triangular part of Table 9 for BWT, lower triangular part of Table 9 for YWT, upper triangular part of Table 10 for direct WWT, and lower triangular part of Table 10 for MILK. How to use these to calculate standard errors of prediction for expected progeny differences of pairs of bulls of the same or different breeds was discussed in the 1995 BIF proceedings (Van Vleck and Cundiff, 1995).

Even though the variances of estimates of adjusted breed differences look large, especially for YWT and MILK, they generally contribute a relatively small amount to standard errors of predicted differences. For example, suppose for WWT a Salers bull has an EPD of 15.0 with prediction error variance of 75 and a Hereford bull has an EPD of 30.0 with PEV of 50. The difference in predicted progeny performance is (Salers adjustment + Salers bull's EPD) - (Hereford adjustment + Hereford bull's EPD):

$$(26.1 + 15.0) - (3.7 + 30.0) = 41.1 - 33.7 = 7.4.$$

The prediction error variance for this difference is (use upper Table 10 at intersection of row for HE and column for SA):

V(Salers breed - Hereford breed) + PEV(Salers bull) + PEV(Hereford bull):

$$23.1 + 75 + 50 = 148.1$$

with

standard error of prediction $\sqrt{148.1} = 12.2$.

If the difference between the Salers and Hereford breeds in 1994 was estimated perfectly, the variance of the estimate of the breed difference would be 0 and the standard error of prediction between the two bulls would be:

$\sqrt{0 + 75 + 50} = 11.2$ which is only slightly smaller than 12.2.

Literature Cited

Barkhouse, K. L., L. D. Van Vleck, and L. V. Cundiff. 1994. Breed comparisons for growth and maternal traits adjusted to a 1992 base. Proc. BIF Research Symposium, Des Moines, IA, May, 1994. pp 197-209.

Barkhouse, K. L., L. D. Van Vleck, and L. V. Cundiff. 1995. Mixed model methods to estimate breed comparisons for growth and maternal traits adjusted to a 1993 base. Proc. BIF Research Symposium, Sheridan, WY. May 31-June 3, 1995. pp 218-239.

Cundiff, L. V. 1993. Breed comparisons adjusted to a 1991 basis using current EPD's. Proc. BIF Research Symposium, Asheville, NC, May, 1993.

Cundiff, L. V. 1994. Procedures for across breed EPD's. Proc. Fourth Genetic Prediction Workshop, Beef Improvement Federation, Kansas City, MO, Jan. 1994.

Notter, D. R., and L. V. Cundiff. 1991. Across-breed expected progeny differences: Use of within-breed expected progeny differences to adjust breed evaluations for sire sampling and genetic trend. J. Anim. Sci. 69:4763.

Nuñez-Dominguez, R., L. D. Van Vleck, and L. V. Cundiff. 1993. Breed comparisons for growth traits adjusted for within-breed genetic trend using expected progeny differences. J. Anim. Sci. 71:1419.

Van Vleck, L. D., and L. V. Cundiff. 1994. Prediction error variances for inter-breed genetic evaluations. J. Anim. Sci. 71:1971.

Van Vleck, L. D., and L. V. Cundiff. 1995. Assignment of risk to across-breed EPDs with tables of variances of estimates of breed differences. Proc. BIF Research Symposium, Sheridan, WY. May 31-June 3, 1995. pp 240-245.

Van Vleck, L. D., and L. V. Cundiff. 1996. The across-breed EPD tables adjusted to a 1994 base. Proc. BIF Research Symposium, Birmingham, AL. May 16-18, 1996. pp 130-145.

Van Vleck, L. D. 1994. Prediction error variances for inter-breed EPD's. Proc. Fourth Genetic Predication Workshop, Beef Improvement Federation, Kansas City, MO, Jan. 1994.

Table 1. Breed of sire solutions from MARC, mean breed and MARC EPDs used to adjust for genetic trend to 1995 base and factors to adjust within breed EPDs to Angus equivalent - BIRTH WEIGHT (lb)

Breed	Number Sires	Number Progeny	Raw MARC Mean (1)	Ave. Base EPD Breed 1995 (2)	Ave. Base EPD MARC Bulls (3)	Breed Soln at MARC + Ang (4)	Breed Soln at MARC vs Ang (5)	Adjust to 1995 Base + Ang (6)	Adjust to 1995 Base vs Ang (7)	Factor to adjust EPD to Angus (8)
Hereford	67	858	85	3.5	2.0	89	4.5	91	5.5	4.7
Angus	68	676	85	2.7	2.1	85	.0	86	.0	.0
Shorthorn	25	181	87	2.0	1.0	92	7.2	93	7.7	8.4
Brahman	28	422	100	2.6	1.0	99	13.8	101	14.9	15.0
Simmental	28	422	85	2.6	-.5	94	8.7	95	9.1	11.3
Limousin	20	387	80	.5	-.9	90	4.6	92	6.2	7.7
Charolais	63	583	88	1.2	1.3	95	9.8	95	8.9	10.6
Maine-Anjou	15	174	94	1.0	1.1	97	11.6	95	9.7	12.4
Gelbvieh	24	365	89	-.1	-1.3	92	6.7	93	7.3	10.1
Pinzgauer	16	435	84	.0	-.4	92	6.7	92	6.4	9.1
Tarentaise	7	199	80	2.5	1.7	90	5.2	91	5.5	5.7
Salers	27	189	85	.8	1.2	91	5.8	90	4.7	6.6

Calculations:

(4) = (5) + (1, Angus)

(6) = (4) + b[(2) - (3)] with b = 1.07

(7) = (6) - (6, Angus)

(8) = (7) - (7, Angus) - [(2) - (2, Angus)]

Table 2. Breed of sire solutions from MARC, mean breed and MARC EPDs used to adjust for genetic trend to 1995 base and factors to adjust within breed EPDs to Angus equivalent - WEANING WEIGHT (lb)

Breed	Number Sires	Number Progeny	Raw MARC Mean (1)	Ave. Base EPD Breed 1995 (2)	Ave. Base EPD MARC Bulls (3)	Breed Soln at MARC + Ang (4)	Breed Soln at MARC vs Ang (5)	Adjust to 1995 Base + Ang (6)	Adjust to 1995 Base vs Ang (7)	Factor to adjust EPD to Angus (8)
Hereford	68	826	506	27.1	12.4	486	1.9	499	5.5	3.7
Angus	68	619	484	25.3	14.5	484	.0	494	.0	.0
Shorthorn	25	170	521	12.4	7.4	502	18.2	507	12.9	25.8
Brahman	28	358	541	18.7	6.2	508	24.3	520	25.9	32.5
Simmental	27	368	470	9.6	-13.0	505	20.8	525	31.5	47.2
Limousin	20	338	445	7.7	-8.4	491	7.1	506	12.0	29.6
Charolais	62	506	491	3.5	1.9	510	25.6	511	17.2	39.0
Maine-Anjou	15	155	460	1.3	.8	507	23.1	508	13.7	37.7
Gelbvieh	24	336	484	4.7	-3.2	510	26.5	518	23.8	44.4
Pinzgauer	16	415	478	.3	-4.1	492	7.8	496	2.0	27.0
Tarentaise	7	191	476	9.5	-4.8	494	10.4	508	13.7	29.5
Salers	27	176	525	9.1	8.1	503	18.8	504	9.9	26.1

Calculations:

(4) = (5) + (1, Angus)

(6) = (4) + b[(2) - (3)] with b = .91

(7) = (6) - (6, Angus)

(8) = (7) - (7, Angus) - [(2) - (2, Angus)]

Table 3. Breed of sire solutions from MARC, mean breed and MARC EPDs used to adjust for genetic trend to 1995 base and factors to adjust within breed EPDs to Angus equivalent - YEARLING WEIGHT (lb)

Breed	Number Sires	Number Progeny	Raw MARC Mean (1)	Mean EPD Breed 1995 (2)	Mean EPD MARC Bulls (3)	Breed Soln at MARC + Ang (4)	Breed Soln at MARC vs Ang (5)	Adjust to 1995 Base + Ang (6)	Adjust to 1995 Base vs Ang (7)	Factor to adjust EPD to Angus (8)
Hereford	68	762	848	46.3	21.4	838	-5.7	869	.7	-2.4
Angus	68	576	844	43.2	23.5	844	.0	868	.0	.0
Shorthorn	25	168	918	19.7	14.8	875	31.3	881	12.8	36.3
Brahman	28	312	841	31.5	10.3	815	-29.1	841	-27.3	-15.6
Simmental	27	332	795	15.9	-22.9	867	22.8	915	46.5	73.8
Limousin	20	334	740	14.9	-13.0	830	-14.3	864	-4.2	24.1
Charolais	62	468	849	4.8	3.4	884	39.9	886	17.1	55.5
Maine-Anjou	15	154	791	2.0	2.5	879	34.8	877	9.8	51.0
Gelbvieh	24	334	819	8.8	-5.1	866	21.8	883	14.6	49.0
Pinzgauer	16	347	838	.3	-8.0	841	-2.7	852	-17.0	25.9
Tarentaise	7	189	807	15.2	-.2	834	-9.8	583	-15.2	12.8
Salers	27	173	898	15.0	13.9	871	27.2	873	4.2	32.4

Calculations:
(4) = (5) + (1, Angus)
(6) = (4) + b[(2) - (3)] with b = 1.24
(7) = (6) - (6, Angus)
(8) = (7) - (7, Angus) - [(2) - (2, Angus)]

Table 4. Breed of maternal grandsire solutions from MARC, mean breed and MARC EPDs used to adjust for genetic trend to 1995 base and factors to adjust within-breed EPDs to Angus equivalent - MILK (lb)

					Mean EPD				Breed Soln at MARC MWWT		Adjust to 1995 Base			Factor to adjust MILK EPD to Angus
				Raw MARC Mean	Breed		MARC				MWWT		MILK	
	Number				WWT	MILK	WWT	MILK	+ Ang	vs Ang	+ Ang	vs Ang		
Breed	Sr	Gpr	Daughters	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Hereford	63	1205	333	472	27.1	9.3	7.3	1.0	474	-9.6	494	-6.0	-14.3	-6.7
Angus	65	779	236	484	25.3	11.3	10.0	4.1	484	.0	500	.0	-5.6	.0
Shorthorn	22	251	69	527	12.4	3.0	7.4	8.1	515	30.6	511	10.3	-1.8	12.1
Brahman	28	385	144	510	18.7	8.8	5.4	2.9	524	40.4	538	37.8	19.3	27.4
Simmental	27	796	152	513	9.6	.3	-13.0	-2.8	521	36.7	536	35.1	13.8	30.4
Limousin	20	764	150	477	7.7	1.9	-8.5	.0	483	-1.1	493	-7.3	-18.9	-3.9
Charolais	56	901	195	501	3.5	1.0	1.5	1.0	502	17.5	503	2.2	-12.0	3.8
Maine-Anjou	14	355	63	536	1.3	.4	.6	-1.0	521	36.6	523	22.3	9.8	26.3
Gelbvieh	24	635	138	537	4.7	1.7	-3.3	-.1	525	41.0	531	30.7	13.3	28.4
Pinzgauer	15	545	133	504	.3	-.8	-1.7	6.4	507	23.0	499	-1.4	-8.0	9.7
Tarentaise	6	341	78	513	9.5	.8	-5.9	4.7	515	30.6	517	16.9	4.5	20.6
Salers	25	351	87	534	9.1	2.0	6.7	6.0	515	30.6	511	10.4	-.1	14.8

Calculations:
(6) = (7) + (1, Angus)
(8) = (6) + b_{WWT} [(2) - (4)] + b_{MLK} [(3) - (5)] with $b_{WWT} = .49$ and $b_{MLK} = 1.24$
(9) = (8) - (8, Angus)
(10) = [(9) - Average (9)] - .5[(7, Table 2) - Average (7, Table 2)]
(11) = (10) - (10, Angus) - [(3) - (3, Angus)]

Table 5. Mean weighted[a] accuracies for birth weight (BWT), weaning weight (WWT), yearling weight (YWT), maternal weaning weight (MWWT) and milk (MILK) for bulls used at MARC

Breed	BWT	WWT	YWT	MWWT	MILK
Hereford	.63	.63	.53	.69	.57
Angus	.65	.65	.60	.68	.59
Shorthorn	.79	.78	.65	.79	.75
Brahman	.54	.58	.39	.59	.42
Simmental	.96	.96	.96	.95	.94
Limousin	.96	.95	.93	.93	.88
Charolais	.64	.63	.61	.63	.60
Maine-Anjou	.39	.43	.24	.42	.25
Gelbvieh	.68	.61	.57	.52	.46
Pinzgauer	.85	.68	.62	.59	.52
Tarentaise	.96	.95	.94	.94	.93
Salers	.83	.67	.62	.75	.75

[a]Weighted by number of progeny at MARC for BWT, WWT, and YWT and by number of grand progeny for MWWT and MILK.

Table 6. REML estimates of variance components (lb^2) for birth weight (BWT), weaning weight (WWT), yearling weight (YWT), and maternal weaning weight (MWWT) from mixed model analyses

	Direct			Maternal
Analysis[a]	BWT	WWT	YWT	MWWT
Direct				
Sires (389) within breed (12)	11.3	157	736	
Dams (2707) within breed (3)	30.6	1081	1483	
Residual	67.8	1551	4299	
Maternal				
MGS (365) within MGS breed (12)				226
Daughters within MGS (1778)				876
Residual				1245

[a](Numbers) for weaning weight.

Table 7. Pooled regression coefficients (lb/lb) for weights at birth (BWT), 205 days (WWT), and 365 days (YWT) of F_1 progeny on sire expected progeny difference and by sire breed, dam breed, and sex of calf

	BWT	WWT	YWT
Pooled	1.07 ± .07	.91 ± .08	1.24 ± .07
Sire breed			
Hereford	.96 ± .12	.81 ± .11	1.12 ± .10
Angus	.97 ± .15	.55 ± .17	1.36 ± .16
Shorthorn	.87 ± .45	.75 ± .43	1.01 ± .33
Brahman	1.55 ± .29	1.02 ± .29	.71 ± .27
Simmental	1.34 ± .30	1.11 ± .29	1.39 ± .31
Limousin	1.08 ± .39	1.23 ± .46	1.94 ± .51
Charolais	1.30 ± .19	.86 ± .21	1.22 ± .21
Maine-Anjou	.15 ± .52	.65 ± .58	.94 ± .76
Gelbvieh	.69 ± .24	.95 ± .42	.85 ± .33
Pinzgauer	1.25 ± .17	1.49 ± .22	1.66 ± .17
Tarentaise	.71 ± .86	.76 ± .61	1.35 ± .89
Salers	1.25 ± .39	1.07 ± .52	1.13 ± .56
Dam breed			
Hereford	1.10 ± .11	.45 ± .12	1.00 ± .11
Angus	1.18 ± .09	1.14 ± .09	1.32 ± .09
MARC III	.77 ± .15	.87 ± .18	1.41 ± .17
Sex of calf			
Female	1.06 ± .09	.93 ± .09	1.29 ± .08
Male	1.09 ± .08	.89 ± .09	1.19 ± .08

Table 8. Pooled regression coefficients (lb/lb) for progeny performance on maternal grandsire EPD for weaning weight (MWWT) and milk (MILK) and by breed of maternal grandsire, breed of maternal grandam, and sex of calf

Type of regression	MWWT	MILK
Pooled	.49 ± .06	1.24 ± .09
Breed of maternal grandsire		
Hereford	.70 ± .09	.89 ± .14
Angus	.64 ± .16	1.01 ± .23
Shorthorn	.39 ± .34	.58 ± .37
Brahman	.87 ± .27	.82 ± .60
Simmental	.50 ± .21	1.03 ± .56
Limousin	.68 ± .34	2.52 ± .34
Charolais	-.17 ± .17	1.16 ± .25
Maine-Anjou	-.64 ± .56	.05 ± 1.13
Gelbvieh	.49 ± .30	1.23 ± .36
Pinzgauer	.66 ± .19	.53 ± .58
Tarentaise	.16 ± .74	.81 ± .83
Salers	1.09 ± .35	2.68 ± .38
Breed of maternal grandam		
Hereford	.26 ± .09	1.41 ± .14
Angus	.62 ± .07	1.23 ± .11
MARC III	.37 ± .19	.42 ± .30
Sex of calf		
Female	.48 ± .07	1.34 ± .12
Male	.49 ± .07	1.16 ± .11

Table 9. Variances (lb^2) of adjusted breed differences to add to sum of within breed prediction error variances to obtain variance of differences of across breed EPDs for bulls of two different breeds[a].
Birth weight above diagonal and yearling weight below diagonal

Breed	HE	AN	SH	BR	SI	LI	CH	MA	GE	PI	TA	SA
HE	.0	.5	1.0	.7	1.1	1.1	.7	1.7	1.0	.9	2.7	1.0
AN	35.3	.0	1.0	.7	1.1	1.2	.7	1.8	1.0	1.0	2.7	1.0
SH	70.0	72.6	.0	1.4	1.6	1.6	1.0	2.2	1.3	1.4	3.2	1.1
BR	54.1	54.9	105.4	.0	1.5	1.5	1.1	2.1	1.3	1.1	2.9	1.4
SI	73.8	77.2	110.9	109.0	.0	.9	.8	2.3	1.5	1.5	3.3	1.6
LI	75.6	79.2	113.8	110.8	60.3	.0	.9	2.3	1.6	1.6	3.4	1.6
CH	46.8	50.2	73.3	81.6	57.1	60.2	.0	1.9	1.1	1.1	2.9	1.0
MA	122.2	125.5	156.4	154.3	161.4	163.6	134.6	.0	1.5	2.0	3.8	2.2
GE	67.5	71.2	93.4	98.9	106.7	107.9	74.5	115.1	.0	1.3	3.1	1.3
PI	67.3	72.1	98.9	90.2	109.0	111.3	79.1	149.1	92.5	.0	2.6	1.3
TA	182.8	188.6	222.2	201.7	225.7	228.7	199.3	263.8	213.3	181.8	.0	3.2
SA	67.5	71.0	80.2	103.3	109.0	111.9	71.6	154.3	92.1	98.1	220.3	.0

[a]For example, a Hereford bull has within breed PEV of 300 for YWT and that for a Shorthorn bull is 200. Then the PEV for the difference in EPDs for the two bulls is 70.0 + 300 + 200 = 570.0 with SEP = 23.9.

Table 10. Variances (lb^2) of adjusted breed differences to add to sum of within breed prediction error variances to obtain variance of difference of across breed EPDs for bulls of two different breeds. Weaning weight direct above diagonal and MILK below the diagonal

Breed	HE	AN	SH	BR	SI	LI	CH	MA	GE	PI	TA	SA
HE	.0	11.4	24.1	15.6	23.0	23.9	14.9	37.0	20.7	18.9	46.6	23.1
AN	27.4	.0	25.3	16.6	24.6	25.5	16.5	38.4	22.3	20.9	49.1	24.6
SH	57.5	59.3	.0	34.6	37.1	38.5	25.8	50.6	31.4	32.1	62.2	28.7
BR	39.8	41.1	79.7	.0	33.2	34.1	25.0	46.2	29.7	24.5	51.3	33.6
SI	53.8	55.9	86.9	77.1	.0	18.7	17.1	50.7	33.7	32.9	61.5	36.3
LI	58.2	60.6	91.5	81.6	54.3	.0	18.5	51.6	34.3	34.0	62.8	37.6
CH	33.6	35.6	61.3	56.3	44.1	48.8	.0	42.3	23.8	24.1	53.4	25.0
MA	74.6	77.3	107.4	96.3	105.5	110.1	84.6	.0	33.5	44.7	72.9	49.7
GE	46.5	48.5	73.2	68.1	76.3	80.8	53.1	75.9	.0	27.6	57.5	30.0
PI	57.1	60.6	87.8	72.1	89.1	93.7	66.8	106.5	77.1	.0	45.0	31.6
TA	134.1	138.3	169.6	146.0	167.5	172.1	146.6	183.7	156.8	146.9	.0	61.4
SA	48.5	51.1	69.3	71.1	78.5	83.1	53.0	98.8	64.9	79.6	161.0	.0

1995 AVERAGE EPDs FOR EACH BREED

For selection of breeding stock, it is important to know how expected progeny differences (EPDs) for an individual animal compare to the current breed average. Mean non-parent EPDs are useful for making comparisons within breeds. They cannot be used to compare different breeds because EPDs are estimated from separate analyses for each breed. The means are for all calves born in 1995 from the most recent (1996-1997) genetic evaluations. The 1995 birth year was chosen because limited data were available on calves born in 1996 for yearling weight and other traits.

1995 ALL ANIMAL NON-PARENT AVERAGE EPDs FROM 1995-1996 GENETIC EVALUATIONS

Breed	Birth wt. lb.	Wean. wt. lb.	Yrlg. wt. lb.	Milk lb.	Total mat., lb.	Yrlg. ht. in.	Scrot. circ. cm.	Calv. ease dir., %	Calv. ease mat., %	Gest. length days	Ultra-sound ribeye area	Stay-ability
Angus	+2.7	+25.3	+43.2	+11.3		+.4	+.03					
Beefmaster	+.26	+3.98	+8.01	+2.72								
Brahman	+2.58	+18.7	+31.5	+8.8								
Brangus	+1.3	+15.0	+27.0	+1.0	+9.0		+.22				+.17	
Charolais	+1.03	+3.49	+4.81	+1.05	+2.50							
Gelbvieh	-.1	+4.7	+8.8	+1.7	+4.5			+1.0	+1.5	-.1		
Hereford	+3.5	+27.1	+46.3	+9.3	+22.9		+.3					
Limousin	+1.2	+7.7	+14.9	+1.9			+.07			-.18		
Maine Anjou	-.01	+1.3	+2.0	+.4	+1.0							
Pinzgauer	-.0	+.3	+.3	-.8	-.6							
Red Angus	+.5	+.22	+35	+8	+19							+5
Salers	+.8	+9.1	+15.0	+2.0	+6.5		+.1					
Santa Gert.	+.66	+4.18	+5.32	+2.06	+4.15							
Shorthorn	+2.0	+12.4	+19.7	+3.0	+9.2							
Simmental	+.5	+9.6	+15.9	+.3	+5.1			+2.6	+3.1			
Tarentaise	+2.52	+9.5	+15.2	+.8								

DIFFERENT BIF ACCURACY OF EPD FOR INCLUDING RECORDS IN MARC ANALYSES TO ESTIMATE BREED OF SIRE DIFFERENCES

L. D. Van Vleck and L. V. Cundiff
Roman L. Hruska U.S. Meat Animal Research Center, ARS, USDA, Lincoln and Clay Center, NE 68933

Introduction

One step in calculation of the across-breed table for adjusting breed association EPD to a common base is to determine whether a record at MARC should be included in the analysis.

The first step is that a list of registered bulls used at MARC is sent to the appropriate breed association. The second step is for the breed association to add the most current EPD for birth weight, weaning weight, yearling weight and milk to the list with corresponding BIF accuracies and then to return the list to MARC. The assumption is that the breed associations will return EPD for any bull that has been evaluated whether EPD for the bull are currently published or not. The third step is to match this file with progeny of those bulls at MARC and to insert the EPD and accuracies into the data file for each progeny. The fourth step is to eliminate any progeny of bulls mated to the same breed of dam. A missing code is assigned for any missing EPD or accuracy for a specific trait. The fifth step is to send the records to Lincoln for a final check which is a comparison with the number of sires and progeny included in the analyses the previous year. For BWT, WWT, and YWT, these numbers change only if the list of sires with returned EPD is different from the list for the previous year. For milk, grandprogeny are still being produced so those numbers are expected to change.

This year (1997) several additional Angus bulls were reported as having EPD. Generally these were bulls with relatively low BIF accuracy. However, low BIF accuracy may be equivalent to several progeny with a record or to a record on the animal. For example, Table 1 shows the relationship between BIF accuracy which was designed to make the high accuracy values relative to one minus the standard error of prediction. At low accuracy, however, the BIF accuracy may correspond to considerable information. For example, with heritability of .20 as for weaning weight, a record on an animal would have accuracy (correlation between true breeding value and predicted breeding value) of: $acc = \sqrt{.20} = .45$, but BIF accuracy is $1 - \sqrt{(1\text{-}acc^2)} = .11$.

Some associations also report EPD with zero BIF accuracy. Any EPD as calculated will have non-zero accuracy so these EPD probably have relatively low accuracy, although reported as zero to discourage over reliance on what may be a parental EPD.

The number of Angus bulls reported for the first time in 1997 stimulated a new look at the question of the effects of eliminating bulls and progeny (grandprogeny) based on accuracy of EPD from the MARC data base before estimation of breed of sire and breed of maternal grandsire differences. After adjustment for sire sampling, these estimates of breed differences may also affect the table of across-breed factors.

Theoretically the level of accuracy should not affect the across-breed factors except that more sires would provide a different sample of the breed. Low accuracy bulls would have some, but a rather limited effect on the standard errors of the breed table factors (Van Vleck and Cundiff, 1994).

Methods and Data

To examine the effects of limiting the MARC analysis to progeny of sires with different levels of minimum accuracy, four levels were chosen. The limits and notation are:

Analysis	Exclude sire and progeny (grandprogeny)
All	if no EPD reported
.00	if reported BIF accuracy = .00
.10	if reported BIF accuracy < .10
.15	if reported BIF accuracy < .15

Table 2 shows the reduction in number of records as the accuracy requirement is increased. The reduction is greatest as expected for the maternal weaning weight analysis as both WWT and MILK accuracies need to meet the requirement and MILK accuracies are typically less than the weight accuracies.

Across-Breed Adjustment Factors

Tables 3, 4, 5, and 6 show the reduction in number of progeny by breed and also the calculated across-breed table factors using those records. The table factor is influenced mostly by the breed of sire differences estimated at MARC and the weighted average of EPD obtained from the breed associations for bulls used at MARC. The average EPD is used to adjust the breed solutions at MARC. If the bulls added have larger or smaller EPD than the previous group of bulls, that difference would be expected to show up in their progeny at MARC and thus the breed solution and MARC EPD would tend to cancel in theory except that the sample of bulls has changed.

The number of sires and progeny excluded are different depending on the trait and required BIF accuracy. The effect of change in bulls and progeny included may also affect other breeds as not all breeds were compared in the same years. Seven of the newly reported Angus bulls had BIF accuracy of about .09 which is reflected in the differences for number of Angus progeny between the .00 and .10 columns of 131, 123, 114, and 192 progeny for birth, weaning, yearling and maternal weaning weights. These differences are also reflected in the largest changes in the table adjustment factors for weaning and yearling weight. Differences in table adjustment factors associated with BIF accuracy for including records were minimal for birth weight and for MILK.

For Charolais, about 100 progeny were associated with nine sires with zero accuracy. The main effect on the table factor was 9 lb for yearling weight and 3 lb for MILK. More than 100 progeny of Hereford sires had sires with BIF accuracy of between .10 and .15. Sires of 46 Brahman and 49 Maine-Anjou were also in this range of accuracy. The effects on the table adjustment factors were minor between the .10 and .15 columns for all traits including MILK for which 200 grandprogeny of eight Maine-Anjou sires were excluded when BIF accuracy of .15 was required.

Regression of Progeny on Sire EPD

The regressions of progeny on sire EPD are a measure of whether MARC progeny reflect differences in breed association EPD. Any difference in the regression coefficients when some sires were excluded because of accuracy would indicate problems with the EPD of those bulls. Table 7 shows the four sets of regressions for the weight traits. The regression coefficients for each weight are generally the same for all BIF accuracy limits. The one regression coefficient that changed the most was for Maine-Anjou for yearling weight when 49 progeny of five sires were excluded. In that case, the regression coefficient dropped from close to the theoretical value of 1.00 to nearly zero. This change is likely due to sampling error because of the small number of sires and progeny involved.

The regressions on sire EPD are not the same for all breeds but the standard errors are also large for most breeds (see Van Vleck and Cundiff, 1997, these proceedings).

Similarly, Table 8 shows the regression of grandprogeny weaning weight on maternal grandsire EPD for weaning weight and MILK. Only one breed, Simmental, has regressions that are nearly the same as the theoretical coefficients of .50 for weaning weight and 1.00 for MILK although averaged over all breeds the regression coefficients were .49 and 1.24. Two breeds have regression coefficients drastically different from expectations: Charolais for the weaning weight regressions of about zero and Maine-Anjou for both weaning weight and MILK. The only change in regressions due to exclusion of records was for MILK based on BIF accuracy going from .10 to .15 with the coefficient increasing to .53 from about .10 which is closer, but not close, to the theoretical expectation of one for Maine-Anjou.

Summary

What can be concluded from these comparisons? Including (or excluding) the Angus sires had an effect on the table adjustment differences from Angus. There is no evidence from the regression coefficients to contradict the theoretical basis of including all sires with EPD in the analyses of breed of sire and maternal grandsire effects.

One conclusion is that the genetic prediction committee or a subcommittee should set the standards for BIF accuracy for including progeny of sires with EPD in the MARC analyses to estimate breed of sire or maternal grandsire differences. All breeds should attempt to submit similar information. Obviously, what information is submitted may influence the breed table factors, although what the effect would be is unknown until the analyses are done. There is, however, little evidence to suggest requiring anything more than a breed association EPD of a sire to allow progeny and grandprogeny into the analyses.

Literature Cited

Van Vleck, L. D., and L. V. Cundiff. 1994. Prediction error variances for inter-breed genetic evaluations. J. Anim. Sci. 71:1971.

Van Vleck, L. D., and L. V. Cundiff. 1997. Across-breed EPD tables adjusted to a 1995 base. Proc. BIF Research Symposium, Dickinson, ND. May 1997.

Table 1. Correspondence between usual accuracy (correlation between true and predicted breeding value, r, and BIF accuracy)

Accuracy	
Usual	BIF
.05	.001
.10	.005
.15	.011
.20	.020
.25	.032
.30	.046
.35	.063
.40	.084
.45	.107
.50	.134
.55	.165
.60	.200
.70	.286
.75	.339
.80	.400
.85	.473
.90	.564
.95	.688
1.00	1.000

$r = \sqrt{1-(1-r_{BIF})^2}$

$r_{BIF} = 1-(1-r^2)^{.5}$

Table 2. Number of records analyzed at MARC with different limits on BIF accuracy

BIF ACC	BWT	WWT	YWT	MWWT (dau)
All	4891	4458	4149	7308 (1778)
>.00	4795	4330	4024	7077 (1720)
≥.10	4659	4202	3899	6806 (1663)
≥.15	4564	4146	3693	6561 (1614)

Table 3. Number of progeny and across-breed factors by breed with different limits on BIF accuracy: BIRTH WEIGHT

SIRE	No. sires				No. progeny				Table adjustment			
BRD	All	.00	.10	.15	All	.00	.10	.15	All	.00	.10	.15
HER	67	67	66	64	858	858	853	782	4.7	4.8	5.2	5.1
ANG	68	68	61	61	676	676	545	545	.0	.0	.0	.0
SHO	25	25	25	25	818	181	181	181	8.4	8.4	8.8	8.9
BRA	28	28	28	27	422	422	422	398	15.0	15.1	15.4	15.5
SIM	28	28	28	28	422	422	422	422	11.3	11.8	12.2	11.9
LIM	20	20	20	20	387	387	387	387	7.7	8.1	8.5	8.3
CHA	63	54	54	54	583	487	487	487	10.6	11.4	11.8	11.6
M-A	15	15	15	15	174	174	174	174	12.4	12.5	12.5	12.0
GEL	24	24	24	24	365	365	365	365	10.1	10.0	10.2	9.9
PIN	16	16	16	16	435	435	435	435	9.1	9.1	9.3	8.9
TAR	7	7	7	7	199	199	199	199	5.7	5.7	5.9	5.3
SAL	27	27	27	27	189	189	189	189	6.6	6.6	7.0	7.1

Table 4. Number of progeny and across-breed factors by breed with different limits on BIF accuracy: WEANING WEIGHT

SIRE	No. sires				No. progeny				Table adjustment			
BRD	All	.00	.10	.15	All	.00	.10	.15	All	.00	.10	.15
HER	68	68	67	66	826	826	821	783	3.7	4.1	6.4	6.1
ANG	68	68	61	61	619	619	496	496	.0	.0	.0	.0
SHO	25	25	25	25	170	170	170	170	25.8	24.7	26.3	26.6
BRA	28	28	28	28	358	358	358	358	32.5	32.5	35.3	35.2
SIM	27	27	27	27	368	368	368	368	47.2	49.2	53.8	53.9
LIM	20	20	20	20	338	338	338	338	29.6	31.3	36.1	35.9
CHA	62	53	53	53	506	416	416	416	39.0	42.6	46.1	46.0
M-A	15	15	15	13	155	155	155	137	37.7	37.6	38.5	36.9
GEL	24	20	20	20	336	298	298	298	44.4	43.8	45.3	45.5
PIN	16	16	16	16	415	415	415	415	27.0	26.3	28.6	27.9
TAR	7	7	7	7	191	191	191	191	29.5	29.5	31.7	30.8
SAL	27	27	27	27	176	176	176	176	26.1	25.8	27.1	27.2

Table 5. Number of progeny and across-breed factors by breed with different limits on BIF accuracy: YEARLING WEIGHT

SIRE BRD	No. sires All	No. sires .00	No. sires .10	No. sires .15	No. progeny All	No. progeny .00	No. progeny .10	No. progeny .15	Table adjustment All	Table adjustment .00	Table adjustment .10	Table adjustment .15
HER	68	68	67	64	762	762	757	646	-2.4	-2.0	2.9	-1.3
ANG	68	68	61	61	576	576	462	462	.0	.0	.0	.0
SHO	25	25	25	25	168	168	168	168	36.3	35.6	38.4	37.5
BRA	28	28	27	23	312	312	306	260	-15.6	-16.2	-11.1	-7.0
SIM	27	27	27	27	332	332	332	332	73.8	77.6	86.6	88.6
LIM	20	20	20	20	334	334	334	334	24.1	27.5	36.6	38.4
CHA	62	53	53	53	468	381	381	381	55.5	64.5	70.9	71.5
M-A	15	15	15	10	154	154	154	105	51.0	52.0	52.9	55.3
GEL	24	20	20	20	334	296	296	296	49.0	50.5	52.2	51.5
PIN	16	16	16	16	347	347	347	347	25.9	24.7	27.4	26.2
TAR	7	7	7	7	189	189	189	189	12.8	12.7	15.5	14.1
SAL	27	27	27	27	173	173	173	173	32.4	32.0	34.5	33.8

Table 6. Number of grandprogeny and across-breed factors by breed with different limits on BIF accuracy: MILK

MGS	No. sires				No. grandprogeny				Table adjustment			
BRD	All	.00	.10	.15	All	.00	.10	.15	All	.00	.10	.15
HER	63	63	61	59	1205	1205	1127	1099	-6.7	-6.6	-5.4	-5.3
ANG	65	65	58	58	779	779	587	587	.0	.0	.0	.0
SHO	22	22	22	22	251	251	251	251	12.1	12.2	13.6	13.3
BRA	28	28	28	28	385	385	385	385	27.4	27.6	28.7	28.4
SIM	27	27	27	27	796	796	796	796	30.4	32.5	34.4	34.2
LIM	20	20	20	20	764	764	764	764	-3.9	-1.8	-.1	-.1
CHA	56	47	47	47	901	729	729	729	3.8	6.8	8.2	8.2
M-A	14	14	14	6	355	355	355	155	26.3	25.4	25.1	25.8
GEL	24	20	20	18	635	576	576	558	28.4	26.2	26.6	26.6
PIN	15	15	15	15	545	545	545	545	9.7	10.0	10.3	10.5
TAR	6	6	6	6	341	341	341	341	20.6	21.1	21.7	21.8
SAL	25	25	25	25	351	351	351	351	14.8	14.5	16.0	15.9

Table 7. Regression coefficients by breed of sire of progeny on EPD with different limits on BIF accuracy for birth weight, weaning weight, and yearling weight. (Theoretical expectations are 1.00.)

SIRE	BWT				WWT				YWT			
BRD	All	.00	.10	.15	All	.00	.10	.15	All	.00	.10	.15
HER	.96	.95	.97	.97	.81	.81	.80	.80	1.12	1.10	1.10	1.10
ANG	.97	.97	.87	.91	.55	.56	.51	.52	1.36	1.34	1.41	1.39
SHO	.87	.85	.83	.83	.75	.62	.64	.65	1.01	.97	.97	.98
BRA	1.55	1.54	1.55	1.47	1.02	1.03	1.00	.99	.71	.70	.70	.67
SIM	1.34	1.34	1.35	1.34	1.11	1.11	1.11	1.11	1.39	1.38	1.38	1.36
LIM	1.08	1.09	1.09	1.09	1.23	1.23	1.26	1.28	1.94	1.96	1.98	2.00
CHA	1.30	1.32	1.31	1.34	.86	.89	.85	.86	1.22	1.15	1.10	1.09
M-A	.15	.16	.21	.19	.65	.66	.64	.70	.94	.96	.93	.06
GEL	.69	.69	.72	.69	.95	1.25	1.24	1.22	.85	1.07	1.05	1.02
PINZ	1.25	1.27	1.26	1.25	1.49	1.50	1.50	1.50	1.66	1.65	1.66	1.66
TAR	.71	.71	.78	.75	.76	.76	.73	.77	1.35	1.34	1.32	1.29
SAL	1.25	1.22	1.19	1.19	1.07	1.09	1.13	1.11	1.13	1.12	1.13	1.12

Table 8. Regression coefficients by breed of MGS of progeny on sire EPD for weaning weight and MILK with different limits on accuracy. (Theoretical expectations are .50 and 1.00.)

MGS	WWT				MILK			
BRD	All	.00	.10	.15	All	.00	.10	.15
HER	.70	.69	.71	.70	.89	.91	.94	.92
ANG	.64	.62	.64	.63	1.01	1.01	1.10	1.09
SHO	.39	.39	.39	.40	.58	.56	.55	.54
BRA	.87	.87	.88	.87	.82	.80	.83	.82
SIM	.50	.50	.50	.50	1.03	1.03	1.03	1.02
LIM	.68	.68	.68	.68	2.52	2.51	2.51	2.51
CHA	-.17	.00	.01	.00	1.16	1.09	1.10	1.10
M-A	-.64	-.63	-.63	-.48	.05	.10	.10	.53
GEL	.49	.63	.68	.65	1.23	1.28	1.32	1.35
PIN	.66	.66	.68	.68	.53	.50	.41	.40
TAR	.16	.15	.16	.16	.81	.81	.77	.77
SAL	1.09	1.06	1.04	1.04	2.68	2.68	2.67	2.67

DIFFERENCES IN BREED OF SIRE DIFFERENCES FOR WEIGHTS OF MALE AND FEMALE CALVES

L. D. Van Vleck and L. V. Cundiff
Roman L. Hruska US Meat Animal Research Center, Lincoln and Clay Center, NE

Abstract

Weights of bull and heifer calves can be considered to be correlated traits with different averages and variances. This study attempted to determine if defining traits as expressed in males or in females would change estimates of breed of sire differences needed to calculate across-breed factors for adjustment of within-breed EPD to across-breed EPD. Records from USMARC of progeny of Hereford and Angus dams mated to 12 sire breeds that had been used to calculate breed of sire adjustments in 1996 were used. Breeds of sire were Hereford, Angus, Shorthorn, Brahman, Simmental, Limousin, Charolais, Maine-Anjou, Gelbvieh, Pinzgauer, Tarentaise, and Salers. Female and male records for birth, weaning and yearling weights were considered to be separate although correlated traits. Heritability estimates for expression as females and males were: .44 and .47 for BWT, .25 and .19 for WWT, and .55 and .49 for YWT. Corresponding genetic correlations between sexes were .85, 1.00 and .92. Phenotypic standard deviations were slightly larger and coefficients of variation slightly smaller for males than for females with the largest differences for YWT. Breeds ranked similarly for female and male weights with major exceptions being Brahman for BWT and WWT; Simmental for WWT and YWT; Tarentaise for BWT; Hereford for WWT, and Limousin, Maine-Anjou and Gelbvieh for YWT. Averages of breed of sire contrasts for expression in females and males were almost identical to contrasts from analyses of combined male and female records. Largest differences between averaged and combined breed of sire contrasts were about 2 lb for BWT and WWT and about 4 lb for YWT. The conclusion is that considering male and female weights as separate traits is not needed in calculation of across-breed adjustment factors from MARC records. Further investigation of the difference in birth weights of crossbred heifer and bull calves of Brahman bulls needed, because of the potential for calving difficulty.

Introduction

Across-breed adjustment factors for comparing EPDs of bulls of different breeds are currently based on estimates of differences due to breed of sire from crossbred calves produced at the Meat Animal Research Center (Cundiff, 1994; Notter and Cundiff, 1991). Those estimates of breed of sire differences are adjusted for genetic trend by comparing the EPD of bulls used to produce the progeny at MARC that have records in the analyses to estimate breed of sire differences with average EPD of bulls of the breed. These adjusted breed of sire estimates are then adjusted to a common base year. A final step is to make all comparisons to a base breed or composite of base breeds. Nevertheless, the basic component of the calculations is the breed of sire solutions. In those analyses, expression of a sire's genes is assumed to be the same in his male and female calves except for an additive adjustment for sex which is further assumed to be the same for all breeds of sire. The questions asked in this study are:

1) Are breed of sire differences the same for male and female calves?
2) Will defining weight traits by sex of progeny improve across-breed adjustment factors? and
3) Is expression of a sire's genes the same in male and female progeny?

The answers to the questions can be obtained from analyses with a trait such as birth weight split into two traits: expression of breed of sire effects and sire genotypes defined as two traits depending on the sex of the progeny. Then question 1) is answered by comparing solutions for breed differences for the "male" and "female" traits. Question 2) is answered by comparing breed of sire differences from the usual analysis with both sexes combined into one analysis with averages of breed of sire differences from the analysis with two traits--the male and female expressions for the same name trait. This averaging assumes equal numbers of male and female calves. Question 3 examines the genetic differences of sires within a breed for male and female expression; i.e., are heritabilities the same and is the genetic correlation between the male and female expression sufficiently high (near 1.00) that the two can be considered the same trait except for some constant difference between sexes for all breeds of sire.

Data

The records used in the analyses were those used in 1996 to calculate across breed adjustment factors (Van Vleck and Cundiff, 1996) to a 1994 base year with a model that considered sex of calf as a fixed factor. The twelve breeds of sire were mated to Hereford or Angus cows with a few mated to MARC III composite cows. Progeny of Hereford by Hereford and of Angus by Angus matings were not included in the analyses. All other edits were also as in the 1996 analyses. The numbers of measurements by sex are shown in Table 1. For maternal weaning weight the breed of maternal grandsire differences were estimated from grandprogeny of bulls of the 12 breeds produced by mating crossbred daughters to unidentified bulls of other breeds.

Table 1. Numbers of males and females with weight measurements at birth, weaning (205d) and 365d (yearling) and for maternal weaning weight.

Traits	Female	Male
Birth weight	2189	2480
Weaning weight (205 d)	2066	2179
Yearling weight (365 d)	1844	2108
Maternal weaning weight (Breed of MGS)	3284	3413

The models for analyses were as in the 1996 analysis (Van Vleck and Cundiff, 1996) except that instead of a fixed factor for sex, the records were recoded to two traits specified by sex of calf. The random effects for the breed of sire analyses were sires within breeds (374) and dams within breeds (2809) and for the breed of maternal grandsire analyses were maternal grandsires within breeds (339) and daughters within maternal grandsires (1564).

Relationships among sires were assumed zero. Analyses were done with the MTDFREML package (Boldman et al., 1995). At declared convergence for the covariance components, fixed effects solutions for breeds of sire (or breeds of maternal grandsire) were obtained. Solutions were differences from the Angus solutions which were constrained to zero.

Results

Estimates of genetic parameters

Estimates of heritability (intra sire correlations multiplied by four) and of ratio of component of variance due to dam effects to phenotypic variance, and genetic correlations and dam correlations between expression in male and females are shown in Table 2.

Table 2. Estimates of parameters for birth weight (BWT), weaning weight (WWT) and yearling weight (YWT) for expression in female and male calves.

	Heritability			Relative dam variance		
	Female	Male	r_g	Female	Male	r_c
BWT	.44	.47	.85	.30	.31	.86
WWT	.25	.19	1.00	.46	.34	1.00
YWT	.55	.49	.92	.28	.25	.92

The heritability estimates and relative dam variances were similar for both male and female expression. The heritability estimates were within the ranges summarized by Koots et al. (1994) and Mohiudin (1993). The genetic correlations ranged from .85 to approaching 1.00 as did the dam effect correlations. These correlations agree with previous reports (Garrick et al, 1989; Rodriguez-Almeida, 1994). Heritability was less for weaning weight but the relative dam variance was greater than for birth weight and yearling weight. The correlation between expression of sire effects in male and female progeny approached 1.00 for weaning weight as did the expression of dam effects in males and females.

The estimates of relative variance due to maternal grandsires and daughters within maternal grandsires are shown in Table 3.

Table 3. Estimates of parameters for genetic expression in males and females of maternal weaning weight.

Fractional variance due to	Female	Male	Correlation
MGS/breed	.080	.066	1.00
Daughter/MGS	.369	.392	1.00

The estimates were similar for both sexes and both correlations approached unity. Estimates of phenotypic variance shown as standard deviations in Table 4 were slightly larger for males than for females in agreement with previous reports (e.g., Rodriguez-Almeida, et al., 1994).

Table 4. Estimates of phenotypic standard deviations (lb).

Traits	Female	Male
BWT	10.2	10.7
WWT	51.6	53.8
YWT	69.3	82.4
MWWT	45.5	48.5

The estimates of genetic parameters suggest that genetic expression is highly correlated between males and females. The genetic correlations are large enough to conclude that considering them as two traits is not necessary. Whether the breed effects are the same for both sexes and whether heterogeneity of variance needs to be considered are additional questions. The first question will be addressed here.

Breed of sire and maternal grandsire solutions

The solutions as differences from Angus solutions are in Table 5 for female and male expression considered as separate but correlated traits. The rankings for birth weight are similar for males and females with generally small changes in ranking. The largest change in rank was for Tarentaise with heifer calves being smallest next to Angus but with bull calves being in the middle of the range. The most important change in rank was for Brahman crossbred calves. Although the heifer calves were second heaviest, the bull calves were heaviest of all sire breeds with a spread of 6.2 lb to the next sire breed. The t-statistic for the difference in the sex specific differences from Angus was 5.49 which suggests an important sex difference in crossbred calves sired by Brahman bulls as compared to crossbred calves sired by Angus bulls. This result has possible implications for ease of calving. Breed of sire by sex of calf interactions involving Brahman and Bos taurus breeds have been previously reported (e.g., Gregory et al., 1979; Paschal et al., 1991). The male difference from Angus was somewhat larger in the current analysis. Other sex by breed of sire interactions were not statistically significant.

Table 5. Differences in breed of sire solutions from same sex in Angus (lb)

	BWT		WWT		YWT		MWWT	
Breed	Female	Male	Female	Male	Female	Male	Female	Male
Hereford	4.4	4.2	8	-4	0	-14	-12	-9
Shorthorn	6.9	7.3	18	16	28	22	30	35
Brahman	9.6	18.0 *	20	35	-28	-26	37	47
Simmental	7.3	9.9	29	16	38	15	37	37
Limousin	3.5	5.7	11	10	2	-17	0	-1
Charolais	8.8	10.3	30	23	29	38	19	19
Maine-Anjou	10.5	11.8	20	25	25	40	26	40
Gelbvieh	6.3	6.8	27	27	10	26	35	46
Pinzgauer	6.1	7.0	15	4	5	-11	19	29
Tarentaise	2.5	7.2	5	15	-17	-17	26	39
Salers	5.0	6.3	21	14	26	16	29	35

Rankings by sex differences from Angus were more variable for weaning weight, yearling weight, and maternal weaning weight than for birth weight. The rankings, however, were generally similar. The sex differences for Brahman and Tarentaise became larger for weaning weight but were not significant. Simmental female calves were relatively larger than male calves relative to Angus female and male calves at weaning and also at a year of age.

The other feature shown in Table 5 is the effect of age on the difference from Angus for Brahman. Under the MARC conditions, they went from among the heaviest, especially the males at birth and weaning, to the lightest at a year of age when the differences from Angus were essentially the same for both females and males. A similar but less pronounced pattern can be seen for Tarentaise calves.

Comparison of breed of sire differences averaged by sex vs combined

Even if the breed of sire (or maternal grandsire) differences are different for males and females, the practical importance may be less because of the lack of control of sex of calf, generally assumed to be about 50% of each. Thus in calculation of breed adjustment factors, the likely method would be to average the breed of sire solutions for the two sexes before proceeding with the other steps in the procedure. Table 6 shows a comparison of breed of sire differences from Angus with the two sexes averaged and the breed of sire differences from the 1996 analyses with both breeds combined in a model that included the fixed effects of sex of calf (Van Vleck and Cundiff, 1996). The values in the table for the two ways of expressing breed of sire differences are the ones that would be adjusted for genetic trend and to a common base year. If the Table 6 differences are the same, then the across-breed adjustment factors would be the same. Table 6 shows that the two ways of obtaining breed of sire differences yield essentially the same differences from Angus. The rankings are exactly the same except for a switch for weaning weight for Brahman and Charolais for ranks 1 and 3, although carrying more decimals than shown in Table 6 are required to do the ranking. The actual differences from the averaged and combined methods are essentially the same for BWT, WWT and MWWT. Some of the differences between the methods for YWT are slightly larger but are generally small. The conclusion is that treating the expression of weight in males and females as separate but correlated traits will not affect the across-breed adjustment factors if the male and female differences are averaged. Some caution might be required if data were used which lack records for one sex. In such cases, combining records might lead to misleading breed of sire differences, particularly for birth weight of Brahman sired crossbred calves and for weaning weight for crossbred calves of other breeds.

Table 6. Breed of sire differences from Angus (lb) averaged by sex (AVE) compared with combining sexes as one trait (Com).

	BWT		WWT		YWT		MWWT	
Breed	Ave	Com	Ave	Com	Ave	Com	Ave	Com
Hereford	4.3	4.3	2	2	-7	-7	-10	-10
Shorthorn	7.1	7.2	17	18	25	26	32	32
Brahman	13.8	13.8	27	26	-27	-28	42	42
Simmental	8.6	8.6	22	23	26	25	37	38
Limousin	4.6	4.6	10	10	-7	-11	-1	0
Charolais	9.6	9.6	26	26	33	38	19	19
Maine-Anjou	11.1	11.1	22	22	32	29	33	34
Gelbvieh	6.6	6.5	27	26	18	17	41	40
Pinzgauer	6.5	6.4	9	8	-3	-6	24	24
Tarentaise	4.9	4.9	10	11	-17	-13	32	31
Salers	5.6	5.6	18	19	21	22	32	32

Summary and Conclusions

Heritabilities for genetic expression in males and females are similar and of a magnitude similar to those reported under other environmental conditions. The genetic correlations between male and female expression of a sire's genotype are large enough ($\geq .85$) that for selection purposes, either expression in males or females can be used for selection for the other. Variation in males was somewhat larger than in females but the differences are not enough to be important.

Rankings of breeds of sires were similar whether using male or female progeny, although there were some indications of reranking by sex. Care should be taken that both sexes are represented in calculation of breed differences used for calculation of across-breed adjustment factors needed to compare within breed EPD of different breeds. With MARC records of both sexes, the across breed adjustment factors are the same whether breed of sire differences are calculated from averages by sex or from conventional analysis of records of both sexes as one trait. The significant sex difference between Brahman sired crossbred heifer and bull calves for birth weight might affect calving difficulty of non-Brahman dams.

Literature Cited

Boldman, K. G., L. A. Kriese, L. D. Van Vleck, C. P. Van Tassell, and S. D. Kachman. 1995. A manual for use of MTDFREML. A set of programs to obtain estimates of variances and covariances. (DRAFT). USDA-ARS-MARC. Clay Center, NE. pp 114.

Cundiff, L. V. 1994. Procedures for across-breed EPD's. Proc. Fourth Genetic Prediction Workshop. Beef Improvement Federation. 6 pages.

Garrick, D. J., E. J. Pollak, R. L. Quaas, and L. D. Van Vleck. 1989. Variance heterogeneity in direct and maternal weight traits by sex and percent purebred for Simmental-sired calves. J. Anim. Sci. 67:2515-2528.

Gregory, K. E., G. M. Smith, L. V. Cundiff, R. M. Koch, and D. B. Laster. 1979. Characterization of biological types of cattle - Cycle III. I. Birth and weaning traits. J. Anim. Sci. 48:271-279.

Koots, K. R., J. P. Gibson, C. Smith, and J. W. Wilton. 1994. Analyses of published genetic parameter estimates for beef production traits. 1. Heritability. An. Brdg. Abstracts 62:309-338.

Mohiudin, G. 1993. Estimates of genetic and phenotypic parameters of some performance traits in beef cattle. An. Brdg. Abstracts 61:495-522.

Notter, D. R., and L. V. Cundiff. 1991. Across-breed progeny differences: Use of within-breed expected progeny differences to adjust breed evaluations for sire sampling and genetic trend. J. Anim. Sci. 69:4763-4776.

Paschal, J. C., J. O. Sanders, and J. L. Kerr. 1991. Calving and weaning characteristics of Angus-, Gray Brahman-, Gir-, Indu-Brazil-, Nellore-, and Red Brahman-sired F_1 calves. J. Anim. Sci. 69:2395-2402.

Rodríguez-Almeida, F. A., L. D. Van Vleck, L. V. Cundiff, and S. D. Kachman. 1995. Heterogeneity of variance by sire breed, sex, and dam breed in 200- and 365-day weights of beef cattle from a top cross experiment. J. Anim. Sci. 73:2579-2588.

Van Vleck, L. D., and L. V. Cundiff. 1996. The across-breed EPD tables adjusted to a 1994 base. Proc. BIF 28th Res. Symp., Birmingham, AL. pp 130-145.

PREDICTABLE POWER GENETICS—CATCH THE WAVE OR DROWN

J. David Nichols
Nichols Farms, Bridgewater, Iowa

The beef industry is changing very rapidly. It is changing so fast that even the changes are changing. The Red Queen in "Alice in Wonderland" had to keep running just to stay in place. In order to make any progress she had to run twice as fast. I know how she feels.

Poultry and pork have been eating our lunch and capturing beefs market share. Today over 70% of US swine are purchased on a grid or value system, up from 30% just a few short years ago. Instead of just talking about change and embracing a few cute one-liners, the beef industry in general and seedstock breeders in particular must define their strategies and adopt them in order to stay in business.

Every dime in the beef industry comes from consumers who purchase beef with their hard earned dollars. Seedstock breeders and their organizations must recognize that value based markets are evolving to reflect the consumer's preferences for safe, tender, high quality, and healthy beef products. While consumers are moving targets, if breeders don't measure and select for carcass merit, further declines in beefs market share and devaluation of assets are likely. Our competition long ago recognized changing consumer tastes and life styles. Because of this they captured significant domestic and export market share from beef.

We must identify and multiply individual cattle with proven repeatable carcass merit which consistently provides consumers good values. Seedstock breeders must take the long view. A genetic solution based on short term price spreads in near by markets; may in fact, produce the opposite long range effect. Markets only pay premiums for those commodities which are in immediate short supply. Breeders and breed organizations should aim for specific targets which they believe will be viable markets five years from now. Selection parameters which utilize ultra-sound and progeny testing are current tools cattlemen may use.

Industry will find the genetics that get the job done. The swine industry is a prime example. To get loans for facilities or to qualify for certain pork processor contracts, specific genetic inputs are required. And the breeder down the road who had the champion pig at the state fair is not included— nor is the latest boar test station winner. Predictable power genetics and total quality management is the way to accomplish a viable and profitable beef industry.

It starts with genetics and breeding stock with accurate genetic predictions of traits which represent real economic values, not perceived ones. Performance and rate of gain are still of primary importance. It's remarkable how many successful cattlemen and tenured professors still equate rapid early growth with increased mature size and maintenance as absolute correlations. Retail value per day of age, less input costs represent the ultimate traits which will translate into profits for the producers and contented consumers.

Maintenance costs represent by far the biggest cost in the cattle business. Technology and methodology for gathering data on feed inputs as well as reliable data on composition and metabolic rate of beef animals must be developed. This data could be expressed in breeding values or EPDs. The seedstock industry largely ignores feed efficiency and maternal cow maintenance costs. Yesterdays emphasis on large frames and today's insistence on + maternal milk regardless of breed are prime examples of seedstock breeders indifference about the costs of maintenance.

In most cases, commercial feed lots are not paying the feed bills, but in fact have a conflict of interest, because feed mark up is their major profit center. Among those who retain ownership and pay those marked up feed bills, whispers are being heard about 5 by 5 cattle. This catch phrase describes cattle that gain 5 pounds per day in the feed yard and convert at 5 pounds. Watch for it. it's liable to catch on with purebred breeders and AI studs. Let's hope the genetics accompany the vanacular.

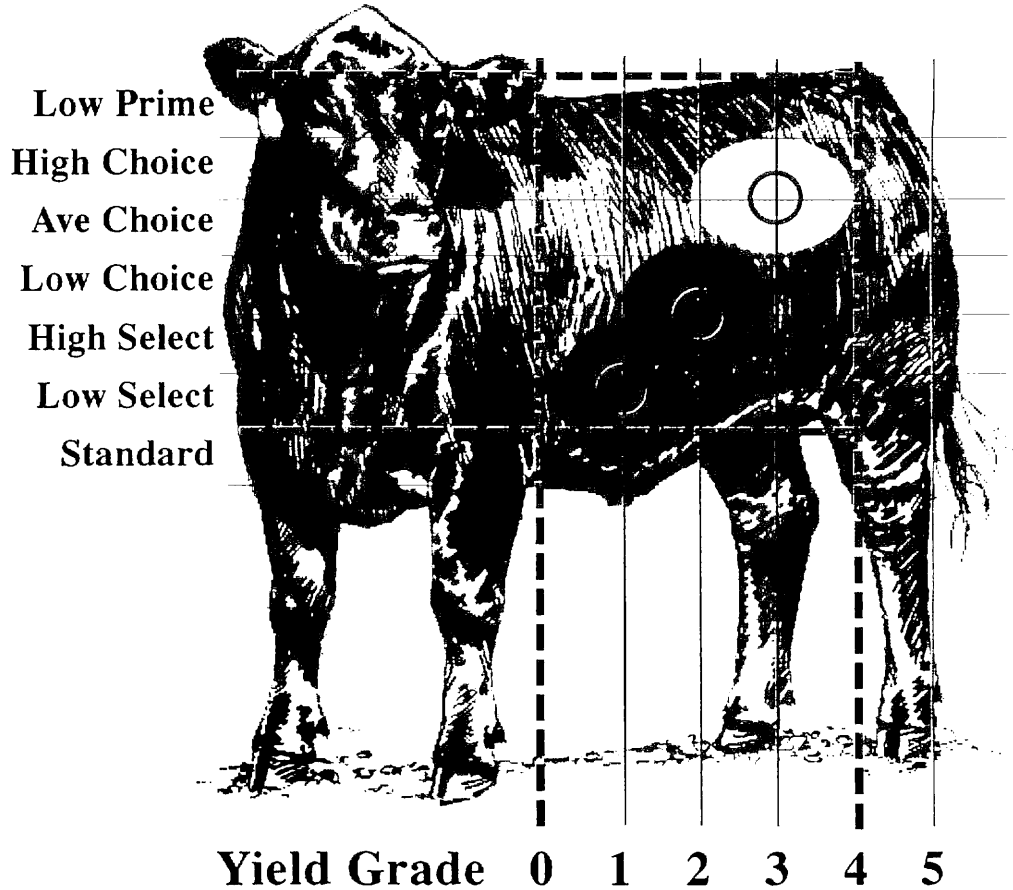
A common practice is to run small framed black white faced cows. Then breed these dollies to a big white bull and "wa-la" you have the beef industry's "systems approach". This simplistic approach makes lots of assumptions, does not measure maintenance costs, and/or product outputs, and is seldom repeatable. This surely leaves the MBA types scratching their heads in bewilderment. Those invested in the poultry and pork business must find all of this, if not hilarious, ample cause for celebration.

The beef industry must support ongoing research and development. Our Land Grant Universities should invest a portion of the dollars they acquired from hard working tax payers into beef research and not prioritize their research to the highest bidders. In order to make sound breeding and management decisions to increase percent retail pounds, tenderness, taste, and net value produced per day, ongoing research is critical.

As breeders we must utilize the scientific tools that are available today. At Nichols Farms, our commercial customers are armed with individual bull data which utilizes real time ultrasound to measure rib-eye area (muscling), fat thickness (cutability) and percent intra-muscular fat (quality grade). This information is compiled to determine retail carcass value per day of age, which in my opinion, when coupled with EPDs reflects a credible estimate of a bull's real value.

But working towards a common goal does not mean all cattle should be bred for the same target, in fact, the opposite is true. As new technology becomes available and as consumer tastes change again, we must be open-minded enough to identify and multiply those cattle which deliver consistent, tender, and good tasting beef with less fat and more producer profit. A major change in mind set is needed. While most will whine "show me the money", now as in the past, a few thoughtful individuals know it's time to make it happen.

ON TARGET



1190 pound steer -750 pound carcass

Top 2/3 Choice - Back Fat .5 - Rib Eye Area 12.5
Yield Grade 3.0 - Cutability %69
Retail Value/day $2.83

H Select-L Choice - Back Fat .25 - Rib Eye 13.5
Yield Grade 2.0 - Cutability %75
Retail Value/day $3.06

Low Select - Back Fat .10 - Rib Eye-15.0
Yield Grade 1.0 - Cutability %79
Retail Value/day $2.98

WHERE SHOULD GENETIC PREDICTION BE GOING?

John Hough, American Hereford Association

In many respects, the cutting edge of genetic evaluation has not been terribly exciting in recent years. A few new traits and methodologies are slowly being developed. To be economically competitive in future food production, cattlemen and researchers must continue to expand their horizons in the genetic prediction arena.

I envision several enhancements in cattlemen's selection methods in the near future. Single-trait selection practices and independent culling levels are very inefficient methods of production. Multiple-trait selection methods must be used in the future. Dr. Hazel developed selection index theory forty years ago. It is time to use this methodology in the beef cattle business. Whole-herd inventory systems and analysis is a reality with some breeds and will be utilized by many more breeds in the near future. Traits used for selection in the future must be more specification based. Cattle in the future can not be all things to all people. Cattle must be selected for your customer's needs not for your own needs.

Production traits will continue to be important in the future, but product traits will gain in importance. Carcass trait EPDs must become important to all breeders in the near future. With whole-herd data reporting, true reproductive performance can and will be accurately measured. Genetic identification of reproduction traits should become a high priority to all purebred and commercial cattlemen. Research in the molecular genetics field is beginning to yield economically important results. Marker-assisted selection can be incorporated with current-day EPDs extremely simply. Relative EPD accuracy stands to increase dramatically by incorporating molecular markers in the analysis procedures. Product and production economics must drive analysis and selection practices in the future.

The dissemination of data has changed and will continue to change dramatically in the future. Farm record-keeping procedures are being completely computerized as we speak. Internet and World Wide Web utilization will be the key to data transfer and information retrieval for all computerized cattlemen. The current annual and semi-annual genetic analyses will become much more frequent in the future. Daily national genetic analyses is now a reality. Education of cattlemen to accept the resulting continued EPD changes (and accuracy improvement) will be a challenge, though. With improved computer systems on farms, on-farm genetic analyses tied to national analyses should become more common in the future.

Many challenges face cattlemen in the future. In most cases, the current technology and methodology surpass genetic evaluation utilization. Improvement in genetic evaluation programs directly tied to economically based product, reproductive and production traits is essential for the future improvement of the beef cattle industry.

Minutes
BIF Emerging Technologies Committee
May 15, 1997
Dickinson, North Dakota

The meeting was called to order at 2:00 pm by Donnell Brown, filling in for Chairman Ronnie Green. The following presentation was made and is included elsewhere in these proceedings.

"Current Status of Sexing Bovine Semen", Dr. George Seidel, Colorado State University.

Following this presentation, Dr. Don Boggs, South Dakota State University, Chairman of the BIF Fact Sheet Committee, lead a discussion focused on the need for new technological Fact Sheets. Following is a list of potential Fact Sheet topics:

- Gender Determination of Semen, Embryos and Fetuses
- Effects of Genetics and Management of Tenderness
- DNA Fingerprinting and Genetic Markers
- Producer's Guide to Emerging Technologies (descriptions of basic terms and procedures)
- Use of Ultrasound in Reproductive Management
- Ultrasound Evaluation of Carcass Traits
- Defining Contemporary Groups for Growth and Carcass Traits
- Innovative Methods for Presenting EPDs
- Selection Index Development and Utilization
- Impact of Bull Development Programs on Fertility
- Utilizing Carcass Data in the Commercial Cow Herd
- Heparin Binding Protein 5 (HBP5) and it's Relationship to Fertility
- Genetic Evaluation of Fertility and Longevity

Green and Boggs would prioritize the list and report back to the Board at Midyear.

The meeting was adjourned at 4:40 pm.

Respectfully Submitted
Ron Bolze (for Ronnie Green)

Current Status of Sexing Bovine Semen

George E. Seidel, Jr.
Animal Reproduction and Biotechnology Laboratory
Colorado State University
Fort Collins, CO 80523

For millennia, stockmen have wanted to choose the sex of offspring from their livestock. The jargon term "heifer luck" is instantly understood amongst cattle producers -- when one has had an excess or a deficit of female calves from good breeding stock. Here I will concentrate on sexing bovine sperm, but the principles can be applied to virtually any mammalian species, and likely are of commercial interest for cattle, swine, sheep, horses, game species, pets and even human beings. I will describe the status as of mid-1997; this very likely will change dramatically over the next year or two as the technology for sexing semen advances.

The natural sex ratio for cattle is 51% males : 49% females. This has been documented numerous times on large samples and also is true for embryo transfer offspring (King et al., 1985). One clear exception to the 51:49 sex ratio is with in vitro fertilization, at least as currently practiced, for which approximately 55% of offspring are males.

Potential Applications of Sexing Semen in Cattle

Whether for beef or dairy cattle, there are two distinctly separate objectives in breeding programs. One objective is for female herd replacements, in which case one wants moderate-sized animals that are fertile, give large quantities of milk, and in the case of beef cattle have good maternal instincts. For this objective, one obviously wants female offspring; most of the males resulting from this breeding objective are eventually used for meat production, and represent a compromise in that they are not of the appropriate genetics for optimum meat production.

The second major objective of cattle breeding is to produce animals for meat production, in which case one desires males because they grow faster, larger, and more efficiently than females. The ideal sires to produce these meat animals are quite different from those to produce female herd replacements. The females that result when breeding for meat production are much less profitable than had they been males. To deal with these dilemmas, one frequently compromises, choosing mates for the cow herd that result in fairly good but not optimal replacement animals if they turn out to be females, and fairly good but also not optimal animals for meat production if they turn out to be males. Such compromises probably cost 3-4% in the efficiency of beef production.

One-third to one-fourth of matings in cattle represent the special case of breeding heifers, which will be much smaller when they give birth to their first calf than when they are mature cows. To accommodate this situation, one frequently uses so-called low birthweight bulls, that is animals whose calves will be smaller than average. One elegant application of sexed semen would be to use X-bearing sperm to inseminate these females because female calves are about 5 pounds lighter at birth than males calves, on the average. In many situations, the heifers being bred represent the ideal mothers for replacement females because young heifers are the best animals genetically in any herd with a good breeding program.

Background on Sexing Semen

There are about eight United States patents on sexed semen. All except one are for techniques that have never been demonstrated to in fact separate X- and Y-bearing sperm. The one technique that unequivocally works to separate X- and Y-bearing sperm has been patented by the United States Department of Agriculture and licensed to several companies for application. This technique uses a flow cytometer/cell sorter to separate the sperm based on DNA content. The only other technique with at least a hint of evidence of efficacy is swimming of sperm through a serum albumin solution. The evidence is that human Y-bearing sperm swim through such solutions more rapidly than X-bearing sperm, or at least the faster sperm result in a slight excess of male babies. Because of the difficulty of verifying data collected in human clinical situations, this technique is not considered by most scientists to have been proven to be effective.

How Semen is Sexed via Flow Cytometry

The main principle is to measure the amount of DNA in the sperm. In cattle, X-chromosome bearing sperm have about 4% more DNA than the Y-chromosome bearing sperm. A DNA dye, Hoechst 33342, is placed into the solution containing the sperm and this dye binds to DNA molecules. Since the bovine X chromosome has 4% more DNA than the Y chromosome, 4% more dye is bound to the DNA of X-bearing sperm than Y-bearing sperm. Sperm can be monitored as they flow by a detector at a very rapid rate of speed in a thin stream of fluid. The fluid exits a nozzle and forms small droplets, many of which contain a sperm. A specific wavelength of light emitted by a laser excites the dye bound to the sperm. The resulting fluorescence is detected, and the information is conveyed to a computer that calculates how much fluorescence was detected. The resulting sperm are categorized in three ways: 1) probably X-bearing sperm, 2) probably Y-bearing sperm, or 3) not possible to differentiate. A charge is placed on the droplets in such a way as to have an excess of negative or positive charge and, using electrostatic plates, it is possible to separate the drops into the three groups just described, that is X-bearing sperm, Y-bearing sperm, or unclear. The equipment used to accomplish this is termed a flow cytometer/cell sorter.

Recently, there have been major advances in flow cytometer/cell sorter technology. With these methods (using a MoFlo® system), the sperm exit the flow cytometer nozzle at about 60 miles per hour, and approximately 100,000 drops are formed per second. The majority of these drops have no sperm in them, but about 10% of the drops have 1 sperm, with a few drops having 2 or more sperm. Currently, the effective sorting rates are about 600 viable X sperm per second, 600 viable Y sperm per second and 8-9,000 sperm for which it was impossible to determine the sex, or that the sperm were non-viable. Typically in bovine semen, about 20% of sperm are dead when they are ejaculated from the bull.

There are two main reasons why not all sperm can be sorted for sex. One concerns their shape -- sperm are paddle-shaped, and if the laser strikes the sperm as they go by on the flat side, a valid observation is obtained. If they are oriented differently, the amount of fluorescence detected is misleading, so the sperm are not sorted. The second major reason for not being able to sort sperm is that the distributions of the amounts of DNA measured overlap between an X- and Y-bearing sperm, so there are some sperm for which it is impossible to tell the amount of DNA to the accuracy required, even if they are oriented correctly.

Currently, we aim to have 90% purity of X- or Y-bearing sperm after sorting. It is possible to increase the purity to 95% or more, but this results in sorting fewer sperm. For most purposes, 90% accuracy appears reasonable. A minor reason that not all sperm are sorted is that some drops contain 2 sperm. When this occurs, drops that contain both an X sperm and a Y sperm are discarded.

Problems with Sperm Sorted by Flow Cytometry

We and others have repeatedly verified that approximately 90% X-chromosome bearing and 90% Y-chromosome bearing sperm can be collected. However, there are two other important characteristics of the system that are less ideal. One is that sperm viability is slightly compromised. This effect is subtle but can be detected in a number of ways, including reduced fertility. It is unclear what the problem is, but further study likely will identify how spermatozoal integrity is compromised so that methods can be developed to minimize the damage.

The second major problem with sorting sperm is that the number sorted is low relative to needs for routine artificial insemination. Sorting 600 sperm per second of each sex, one at a time, out of 9,000 to 10,000 sperm is impressive indeed. However, typical doses of semen for artificial insemination are 20 million or more sperm. To obtain 20 million sperm at 600 per second requires about 34,000 seconds or over 9 hours. This clearly is impractical.

The number of sperm needed for in vitro fertilization, however, is in the range of practicality for using sexed semen. Many dozens of calves have been produced using sexed semen for in vitro fertilization, and sexed semen is likely to be commercially available for this purpose in the near future.

Artificial Insemination with Low Doses of Semen

Since only one sperm is required to fertilize an ovum, it seems unreasonable that 20 million or more sperm are required to obtain optimal fertility. Recently, we have made a number of minor changes to artificial insemination procedures to increase success with fewer sperm. Insemination of as few as 100,000 sperm into the uterine horn adjacent to the ovary about to ovulate resulted in pregnancy rates of more than 40% (Seidel et al., 1997). In another study, inseminating 500,000 frozen sperm, half into the tip of each uterine horn, resulted in 68% of heifers pregnant, not significantly different from the 66% pregnant with a control dose of 10 million frozen sperm (Seidel et al., 1996). These studies involved well-trained technicians, well-managed heifers, and above-average fertility bulls. We have thus shown that, at least under some conditions, fertility can be close to normal with many fewer sperm than are used conventionally. At this point, we do not recommend inseminating cattle with such low doses of semen; it is still a research technique.

Combining Low Dose Insemination with Sexed Semen

Recently, we did an experiment in which semen was collected in Pennsylvania, transported to Beltsville, Maryland for flow cytometer cell sorting at the United States Department of Agriculture laboratory, and then flown to Denver International Airport and transported to Fort Collins, Colorado. Semen was then loaded into straws and inseminated into cows and heifers. The cell sorter used for that project only sorted about 100 sperm per second of each sex.

Pregnancy rates on this experiment ranged from 0 to 45%, depending on the particular bull and the length of time from sperm sorting to artificial insemination. The overall pregnancy rate was 22% pregnant to term (15 out of 66) when semen was used within 9 to 13 hours post-sorting. The term pregnancy rate was only 3% (2 pregnant of 78) when the elapsed time from the end of the sorting procedure to insemination ranged from 17 to 29 hours. There was a hint of excess embryonic mortality between 1 and 2 months of pregnancy in this study, but the number of observations is too small to be certain. All 17 head that were pregnant at 2 months of gestation calved; 14 of the 17 calves produced were of the predicted sex.

Future Studies

We are just starting experiments inseminating heifers with sperm sorted by sex using the new MoFlo technology. We anticipate combining other technological breakthroughs with the faster flow cytometer/cell sorter to increase speed of sorting even further, perhaps to 5,000 or more viable sperm of each sex per second. If this is possible, we could produce 2 doses of 300,000 viable sperm each minute (one of X sperm and one of Y sperm). This brings the technology into the reach of practicality for commercialization.

We also need to develop cryopreservation procedures for sexed semen. There are no known barriers to this, but details need to be worked out. A final requirement before commercial use is to document that calves are normal, and that embryonic death rates are not appreciably higher than normal. This will require breeding thousands of females under field trial conditions.

When Will Sexed Semen Become Available?

It already is possible to sex embryos with 90% efficiency and over 95% accuracy. However, this procedure requires biopsying each embryo using microsurgical techniques; therefore, considerable time and expense are incurred. Furthermore, half of the embryos will be of the less valuable sex. For these reasons, use of technology for sexing embryos is limited.

It also is possible to sex bovine fetuses between 2 and 4 months of gestation by ultrasonography. A well-trained technician who proceeds carefully can be 98-99% accurate in diagnosing sex. Note that this is a sex-diagnostic, rather than a sex-selection technique unless selective abortion is practiced. This simple, non-invasive technique can be done in conjunction with pregnancy diagnosis for purposes of planning and merchandising.

Use of sexed semen for producing embryos from in vitro fertilization may become available for commercial use within the next year. Predicting timing of commercial availability of sexed semen for artificial insemination is more problematic. This technology likely would be installed at individual bull studs so that semen from any ejaculate could be available in both sexed and unsexed versions. Possibly the cost per dose for sexing will eventually be as low as $10 above the cost of unsexed semen. We estimate that sexed semen for artificial insemination could be available in 3 years.

Acknowledgments

Numerous people assisted with the preliminary studies described on inseminating cattle with sexed semen, including C.H. Allen, A. Blaszczyk, Z. Brink, J.G. Graham, M. Holland, L.A. Johnson, and G.R. Welch. Financial support for these studies came from Atlantic Breeders Cooperative, Agricultural Experiment Station of Colorado State University, Agricultural Research Service of USDA, Colorado Advanced Technology Institute, DUO Dairy, the Houston Family Fund, and the National Association of Animal Breeders. Current research in this area is supported by XY, Inc. and Cytomation, Inc., both of Fort Collins, Colorado.

References

Seidel, G.E., Jr., C.H. Allen, L.A. Johnson, M.D. Holland, Z. Brink, G.R. Welch, J.K. Graham and M.B. Cattell. 1997. Uterine horn insemination of heifers with very low numbers of sperm and sexed sperm. Theriogenology 48:in press.

Seidel, G.E., Jr., C.H. Allen, Z. Brink, M.D. Holland and M.B. Cattell. 1996. Insemination of heifers with very low numbers of frozen spermatozoa. J. Anim. Sci. 74 (Suppl. 1):235.

Johnson, L.A., D.G. Cran and C. Polge. 1994. Recent advances in sex preselection of cattle: Flow cytometric sorting of X- and Y-chromosome bearing sperm based on DNA to produce progeny. Theriogenology 41:51-56.

King, K.K., G.E. Seidel, Jr. and R.P. Elsden. 1985. Bovine embryo transfer pregnancies. I. Abortion rates and characteristics of calves. J. Anim. Sci. 61:747-757.

RESTRUCTURING OF THE INTEGRATED GENETIC SYSTEMS COMMITTEE

John Hough, American Hereford Association and
Kent Anderson, North American Limousin Foundation

The BIF Future Focus Task Force met last June yielding several recommendations to the BIF Board. One of those recommendations was to reevaluate the committee structure and direction. Therefore, the Integrated Genetic Systems Committee was evaluated at the mid-year BIF Board meeting. This committee has had two main focal points in the last few years. Namely multi-trait selection practices and whole-herd / economic analysis procedures. The BIF Board through these two areas where important to warrant entire committee agendas. Thus the Multiple Trait Selection Committee chaired by Kent Anderson and the Whole Herd Analysis Committee chaired by John Hough were formed. As a further response to Future Focus recommendations, all BIF committees will be evaluated on a three year basis. Every three years, committees will be re-appointed, abolished or redirected depending on the current needs at the time. The Whole Herd Analysis committee will be evaluated in two years while the Multiple Trait Selection Committee will be evaluated in three years.

Minutes

BIF Multiple Trait Selection Committee Meeting

Friday, May 16, 1997, 2:00 to 4:30 p.m.

29th Annual Meeting and Research Symposium

North Dakota Hospitality Inn - Dickinson, North Dakota

The first meeting of the BIF Multiple Trait Selection Committee convened for a joint session with the Whole Herd Analysis Committee on Friday, May 16th 1997 in Dickinson, North Dakota. These two new committees were formed to replace the Integrated Genetic System Committee as a result of recommendations made by the Future Focus Task Force which met in 1996. The task force suggested the change in order to provide greater focus and attention to the overall systems concept of production.

Following a brief discussion of these committee changes by Dr. John Hough, the two committees met jointly to view a demonstration of the Decision Support Application for the Cattle Industry software by Dr. Tom Jenkins of the U.S. Meat Animal Research Center. The demonstration was an extension of Dr. Jenkins address to the general session which occurred earlier in the day and which is described in his BIF proceedings paper included herein. Following a question and answer period, the two committees met separately to present additional material specific to their topic areas.

Committee chairman Kent Andersen of the North American Limousin Foundation summarized the primary objectives of the new Multiple Trait Selection Committee, and then served as moderator for the program outlined below:

Multiple Trait Selection Committee Agenda

I. **Multiple Trait Selection In Practice** - Panel Discussion and Questions
   A. Describe how you determine selection objectives and practice multiple trait selection.
   B. Identify the strengths and shortcomings of how you determine selection objectives and the tools you have available for multiple trait selection.

Panel: Donnell Brown, R.A. Brown Ranch
Roy Wallace, Select Sires
Doug Frank, American Breeders Service

II. **Selection Indexes In Practice** - A New Zealand Case Study

Mark Enns, Ph.D., The University of Arizona

III. **New Concepts In Multiple Trait Selection** - Panel Discussion and Questions
   C. Overcoming current challenges to determination of selection objectives and multiple trait selection for the purpose of improving production efficiency.

Panel: Richard Bourdon, Ph.D., Colorado State University
Michael MacNeil, Ph.D., USDA-ARS, Miles City, MT
Mark Enns, Ph.D., The University of Arizona

IV. **The BIF Multiple Trait Selection Committee** - Open Discussion

Following an active question and answer period, there being no further business the meeting adjourned.

Respectively submitted,
Kent Andersen, Chairman

SIMPLIFIYING MUTIPLE TRAIT SELECTION

Roy Wallace
Select Sires

With the vast amount of EPD data available to today's cattleman, sorting to find 'genetically-balanced' cattle can be cumbersome and time consuming. For several years, we have utilized a relatively simple method that we call a 'Power Score' to quickly evaluate bulls for multiple trait balance.

This system uses the percentile EPD breakdown from the respective breed sire summary and utilizes four traits: Birth, Weaning, Yearling and Milk. By weighting all four traits on an equal basis, we actually give growth performance twice the value of the other two traits. This simple method allows us to find bulls that excel for balanced performance and quickly identifies bulls that may be lacking in one or more traits. To obtain the 'power score' for a bull we take their percentile ranking for each of the traits listed above, add them together and divide by four--simple, yet meaningful.

For example (table 1), Angus bull A with EPDs of .4 lbs. for birth, +41 lbs. for weaning, +70 lbs. for yearling and +16 lbs. for milk ranks in the top 10%, top 3%, top 2% and top 25% for these respective traits (table 2). Adding these percentiles together and dividing by four, this bull has a power score of 10. Compare this with Angus bull C with EPDs of +4.7 lbs. for birth, +30 lbs. for weaning, +50 lbs. for yearling and +14 lbs. for milk--his power score is 62.5.

When we look for bulls that excel for all four traits, those bulls with lower power scores are generally speaking the best in terms of providing balance for calving ease, growth and maternal traits. Those bulls that rank low (from the 60th to 100th percentile) for one or more traits end up with high scores and are easily separated from bulls with lower (better) power scores.

Table 1

Angus 'Power Score'

	Trait	BW	WW	YW	Milk	Total
A	EPD	.4	41	70	16	
	Pct.	10%	3%	2%	25%	40 / 4 = 10
B	EPD	.7	43	69	27	
	Pct.	15%	2%	2%	1%	20 / 4 = 5
C	EPD	4.7	30	54	14	
	Pct.	85%	30%	20%	35%	170 / 4 = 62.5

Table 2

Angus JANUARY 1997 EPD PERCENTAGE BREAKDOWN
1995 NON-PARENT BULLS

TOP PCT	BIRTH	WEAN	MILK	YRL	YRL HT
1%	-1.5	+44.0	+25.0	+72.0	+1.3
2%	-.9	+42.0	+24.0	+69.0	+1.2
3%	-.6	+40.0	+23.0	+67.0	+1.1
4%	-.4	+40.0	+22.0	+65.0	+1.1
5%	-.2	+39.0	+21.0	+64.0	+1.0
10%	+.5	+36.0	+19.0	+60.0	+.9
15%	+1.0	+34.0	+18.0	+57.0	+.8
20%	+1.3	+33.0	+17.0	+54.0	+.8
25%	+1.6	+32.0	+16.0	+52.0	+.7
30%	+1.9	+30.0	+15.0	+50.0	+.7
35%	+2.2	+30.0	+14.0	+49.0	+.6
40%	+2.4	+29.0	+13.0	+47.0	+.6
45%	+2.6	+28.0	+13.0	+46.0	+.5
50%	+2.8	+27.0	+12.0	+44.0	+.5
55%	+3.1	+26.0	+11.0	+43.0	+.5
60%	+3.3	+25.0	+11.0	+41.0	+.4
65%	+3.5	+24.0	+10.0	+40.0	+.4
70%	+3.8	+23.0	+9.0	+38.0	+.3
75%	+4.0	+22.0	+9.0	+37.0	+.3
80%	+4.3	+21.0	+8.0	+35.0	+.3
85%	+4.7	+19.0	+7.0	+33.0	+.2
90%	+5.1	+17.0	+5.0	+30.0	+.1
95%	+5.7	+15.0	+3.0	+25.0	+.0
100%	+10.3	-28.0	-10.0	-54.0	-2.0
TOTAL ANIMALS	52,899	54,074	54,074	32,554	54,074
AVG EPD	+2.8	+26.7	+12.2	+44.4	+.5

Table 3

Simmental 'Power Score'

	Trait	BW	WW	YW	Milk	Total
A	EPD	-2.0	21	38	8	
	Pct.	10%	10%	10%	5%	35 / 4 = 8.8
B	EPD	.3	13	25	5	
	Pct.	50%	40%	30%	30%	150 / 4 = 37.5

Table 4

PUREBRED SIMMENTAL NON-PARENT BULLS BORN IN 1996

%	Calving Ease	Birth Weight	Weaning Weight	Yearling Weight	Maternal Calving Ease	Maternal Milk	Maternal Weaning Weight
1	10.7	-4.2	30.5	48.6	10.1	10.4	17.6
2	9.7	-3.6	27.8	45.7	9.4	9.0	16.2
3	9.1	-3.3	26.5	43.7	8.9	8.1	15.5
4	8.8	-3.0	25.5	41.8	8.6	7.6	14.8
5	8.5	-2.8	24.6	40.2	8.3	7.1	14.3
10	7.6	-2.1	21.5	35.4	7.3	5.7	12.5
20	6.3	-1.2	17.8	29.4	5.9	3.8	10.1
30	5.2	-0.6	15.3	25.3	5.0	2.6	8.6
40	4.3	-0.1	13.1	21.7	4.1	1.4	7.3
50	3.3	0.3	11.0	18.6	3.4	0.3	6.0
60	2.4	0.8	9.1	15.3	2.7	-0.8	4.7
70	1.4	1.3	7.1	12.1	1.8	-1.9	3.3
80	0.4	1.9	4.7	8.1	1.0	-3.2	1.6
90	-1.2	2.8	1.1	2.4	-0.5	-5.1	-0.7
Mean	3.2	0.3	11.2	18.7	3.3	0.3	5.9
Low	-10.6	-6.7	-34.1	-48.6	-14.1	-19.6	-17.2
High	15.6	7.1	46.0	68.7	13.4	17.0	24.5

Angus 'Power Score'

Trait	BW	WW	YW	Milk	Total
EPD	.4	41	70	16	
Pct.	10%	3%	2%	25%	40 / 4 = 10
EPD	.7	43	69	27	
Pct.	15%	2%	2%	1%	20 / 4 = 5
EPD	4.7	30	54	14	
Pct.	85%	30%	20%	35%	170 / 4 = 62.5

Simmental 'Power Score'

Trait	BW	WW	YW	Milk	Total
EPD	-2.0	21	38	8	
Pct.	10%	10%	10%	5%	35 / 4 = 8.8
EPD	.3	13	25	5	
Pct.	50%	40%	30%	30%	150 / 4 = 37.5

INDEX SELECTION IN PRACTICE— A NEW ZEALAND CASE STUDY

R.M. Enns[1] and G.B. Nicoll[2]

[1]University of Arizona, Tucson, Arizona
[2]Landcorp Farming, Ltd, Hamilton, New Zealand

Introduction

Selection and mating are breeders' primary means of making genetic change. One of the most useful tools available for making selection and mating decisions is the expected progeny difference (EPD) but EPD are just that— a tool. EPD supply no information on the relative importance of traits in a breeding program. So what should seedstock producers try to improve? Should selection focus on what is most important to their own profitability, or on what is important to customers' profitability, or perhaps to a level beyond the commercial breeder (e.g. backgrounder)? After all, the commercial cow/calf producer, who buys bulls from the seedstock breeder, is likely concerned primarily with growth and reproduction, the backgrounder with growth, and the feedlot operator with finding animals that have the genetic potential for efficient growth and possibly, the ability to produce a quality carcass. The challenge for seedstock breeders is to produce animals that meet the genetic requirements of the industry and maintain profitability of their own operation.

Selection, in essence, must have an element of practicality— selection should be for economically important traits, traits that will earn the breeder's clients money and keep them coming back for more (and improved) seedstock. All EPD traits are assumed to be economically important, but important to whom? With the large number of traits with EPD covering most facets of beef production, the task of collating these in to a meaningful order of importance from which to make rational (and profitable) selection decisions becomes increasingly difficult. One tool that can be used to determine the relative importance of EPD traits is the breeding objective and associated selection indexes. With breeding objectives, seedstock producers can weight traits (and EPD) by their relative impact on profitability from both a seedstock and an industry-wide standpoint.

With that perspective, this paper begins with a very brief overview of breeding objective development. The literature on breeding objective development is quite extensive (such as Hazel, 1943; Melton, 1995; Newman et al., 1992; Ponzoni and Newman, 1989; and the review by Harris and Newman, 1994), and will not be addressed in depth here. The majority of the paper, however, relates the experiences and results of one producer that has selected for economic breeding objectives for 21 years.

Brief Review of Economic Breeding Objective Development

All breeders, both commercial and seedstock, have a unique set of physical resources (management level, feed resources, environment, etc) and market conditions that influence their breeding program. Genetically important traits for one producer may not be important for another producer. The many different production and marketing systems therefore necessitate that each breeding objective is unique to a specific production and marketing system.

The first step in developing a breeding objective, after describing the production and marketing system, is to identify sources of income and expense within that production system. At minimum, this information should include 1) cost of feed per feed unit, 2) cost of labor and facilities, 3) product value per unit weight, and 4) cost of initial breeding animals (Harris and Newman, 1992). Biological traits that influence income and expense must then be identified (the second step). These are not necessarily easily measured traits, but should include any trait that directly influences profitability. A list of these traits likely includes feed intake, reproduction, sale weight, and if quality effects profitability, quality. Once costs and income are quantified and biologically important traits identified, economic weights can be calculated. Combining this information in a mathematical form produces the breeding objective.

In general, the breeding objective is designed to weight traits that influence profitability of a specific production system by their contribution to that profit. The general form of the breeding objective is then

$$H(\$) = v_1 BV_1 + v_2 BV_2 + \cdots + v_n BV_n$$

where H is the aggregate breeding value of an individual expressed in dollars, v are the economic values associated with genetic changes in the biological traits influencing profit, and BV are the breeding values for those traits.

If EPD or estimated breeding values (EBV) are available for the biologically important traits, these can be used directly in the breeding objective to calculate aggregate breeding values for each individual. In the likely event that EPD (EBV) are not available for all traits in the breeding objective, a selection index can be calculated. This index value predicts the breeding objective or aggregate breeding value much like an EPD (EBV) is a prediction of an animal's *true* genetic merit.

Calculating a selection index requires additional information. Traits to be included in the index must be chosen. These traits should be easily measured and genetically correlated to the traits in the breeding objective. For instance, feed intake, although *difficult* to measure, is usually included in the breeding objective, but mature cow weight which is *easy* to measure and is genetically correlated to feed intake is used in the selection index. Hopefully EPD (EBV) will be available for the traits that are included in the index. With this information and estimates of the genetic correlations, the appropriate weighting factors (b) for the selection criteria traits can be calculated. The index (I) takes the general form:

$$I(\$) = b_1 BV_1 + b_2 BV_2 + \cdots + b_n BV_n$$

where *BV* are EPD (EBV) of traits chosen for the index. In essence, the selection index allows the use of EPD (EBV) for traditional production traits (weaning weight, yearling weight, etc) to predict a breeding objective that contains traits for which EPD (EBV) are unavailable.

The remainder of this paper focuses on the genetic progress of an Angus herd, owned by Landcorp Farming, Ltd, Wellington, New Zealand (NZ), that has been selected for an economic based breeding objective since 1976. Generally, the methodology used to calculate this breeding objective was the same as just described. A notable exception is that EPD (EBV) were unavailable for typical production traits in 1976 (at least compared to present EPD which are the result of BLUP procedures).

Overview of Landcorp Farming, Ltd

Landcorp Farming, Ltd, a subsidiary of Land Corporation Ltd, is New Zealand's largest single commercial livestock farming enterprise, owning 138 farms covering over 1,020,000 acres on both the north and south islands. As with most businesses, Landcorp's goal is to operate as a profitable livestock production enterprise. The company focuses on the production of beef cattle, sheep, deer, and goats. A breakdown of production by species based on current breeding numbers is listed in Table 1. Income for the company is derived primarily from the sale of slaughter animals with an increasing emphasis on the sale and marketing of a branded, boxed and processed product (Table 1).

Table 1. Breeding female numbers (June 30, 1996) and proportion of slaughter animals processed and marketed under the Landcorp brand.

Species	Breeding females	Branded product
Beef cattle	61,241	23%
Sheep	601,808	58%
Deer	13,350	94%
Goats	5,594	0%

For all species, the production system is based entirely on the grazing of improved pastures throughout the year (i.e. no grain feeding at any stage). Depending upon geographical location, climate, and grass production levels, individual farms may specialize in breeding, growing, or finishing. The final production stage takes place on designated finishing farms from which animals are eventually sent to the processor.

Genetic improvement is driven by designated nucleus breeding herds/flocks for each species. The primary focus of these nucleus herds/flocks is to produce genetically superior sires that are subsequently dispersed to the commercial breeding farms. Surplus replacement females may also be dispersed from these nucleus herds/flocks. This arrangement allows Landcorp to control its own genetic improvement and to select for traits that are economically important to the company. Currently, Landcorp's beef cattle, sheep and deer nucleus herds/flocks are selected for the economically-based breeding objective of improving profit per commercial breeding female in the company. Selection indexes developed to predict this objective vary with the breeding program and species. For example, selection indexes for maternal sire breeds such as the Romney in sheep, are different to those developed for the terminal sire breeds such as the Texel and the Lamb Supreme (a composite). But the objective remains the same— to increase profit per *commercial* breeding female. After 21 years of index selection in Landcorp's beef cattle breeding program, a newly developed breeding objective and suite of selection indexes will be applied this year to account for both the maternal and terminal sire breeding programs.

The beef production system centers around 5 nucleus breeding herds: three Angus and one each of Simmental and Charolais. The three genetically linked Angus herds produce bulls to be used in the commercial beef herd for the production of commercial replacement females. The Simmental and Charolais nucleus herds produce terminal sires that are bred to excess commercial Angus females. This terminal system encompasses approximately 30% of the total beef cow herd. All commercial male progeny and surplus females are slaughtered at approximately 26 and 30 months of age, respectively.

Landcorp's Beef Breeding Objective

The first Angus nucleus herd was established in 1970 from the screening of Angus cows that had weaned exceptionally heavy calves in the commercial herds of the company. As previously stated, the primary purpose of this herd, known as the Waihora herd, was to produce young bulls for use in the company's commercial breeding herds. Previous to the formation of the Waihora herd, replacement bulls were purchased from industry sources. The concern, however, was that the selection goals of the industry breeders might not reflect the goals and production system of the company.

In 1976, the company began selecting animals in the Waihora herd for an economic breeding objective developed by Morris, Baker, and Johnson (1980) and further described by Nicoll, et al (1979). The breeding objective was defined as

$$H\ (Net\ income(\$)\ per\ cow\ lifetime) = 0.53 \cdot L \cdot D_P(4.8F - 1) + 0.06 \cdot M \cdot D_M$$

Where:

.53, .06	=	the net income (1976NZ$/kg carcass) from the slaughter of young stock and cull cows, respectively;
L	=	slaughter weight (kg) of surplus progeny at 30 months of age;
D_P, D_M	=	dressing percentage (x.01) of slaughtered progeny and the culled cow, respectively;
F	=	net fertility; and
M	=	weight (kg) of cow at disposal.

The value for 4.8F represents the total number of saleable calves per cow lifetime. One was subtracted from this total to account for the cow's replacement in the herd. Costs of production and income were based on data from the New Zealand Meat and Wool Boards' Economic Service.

The breeding objective did not directly account for costs of production unlike a subsequent breeding objective developed by Newman et al. (1992) for New Zealand conditions. Newman included food intake as a trait in the breeding objective. Rather than include feed intake in the Landcorp breeding objective, gross income realized through increased carcass weight was adjusted to reflect associated increases in feed intake and therefore feed costs. Eleven and thirty-two percent of the gross returns resulting from increased slaughter weight of surplus progeny and of cull cows, respectively, were allocated to extra feed costs. At the time the Landcorp Angus objective was defined, the developers felt that there was insufficient data published on the genetic correlations between feed intake of grazing cattle and the traits likely to be included in the selection index.

After defining the breeding objective, selection indexes were calculated to predict the aggregate breeding values of individuals. (Co)Variance ratios used in the calculation of the index are shown in Table 2. The calculation of a selection index was required because with the exception of fertility, traits in the breeding objective were not recorded on individual animals. Traits included in the index were cow fertility, weaning weight, and yearling weight. Selection of replacement bulls and heifers occurred at a year of age and was based on a yearling index that incorporated the individual's weaning (WW_I) and yearling weights (YW_I), and the dam's fertility (F_D) and average weight of calf weaned (MWW). An example index for an animal out of a dam with four weaning records is

$$I(NZ\$) = 40.4F_D + .0398MWW + -.2274WW_I + .6191YW_I$$

Animals were then ranked and selected based on *I*. Selection for the breeding objective continued until 1993.

Table 2. Heritabilities, and genetic (above the diagonal) and phenotypic (below the diagonal) correlations for traits in the breeding objective and selection index.

	Fertility	Weaning Weight	Yearling Weight	Slaughter Weight	Dressing %	Mature Weight	Maternal Weaning Weight
Fertility	.05	.00	.12	.12	.00	.1	.00
Weaning Weight	.00	.23	.75	.60	.30	.50	-.57
Yearling Weight	.12	.68	.35	.90	.04	.60	.05
Slaughter Weight	.12	.67	.87	.35	.04	.60	.05
Dressing %	.00	.14	.20	.23	.40	.00	.00
Mature Weight	.19	.40	.50	.55	.10	.50	.35
Maternal Weaning Weight	.00	.14	.14	.14	.00	.40	.46

Calculation of Genetic Trends

Performance data from the Waihora Angus herd were used to estimate genetic trends resulting from selection for the breeding objective. Performance data included weaning and yearling weights, calving data, and mature cow weight records. No information on slaughter animals was available for analysis.

Variance component estimates were obtained with MTDFREML (Boldman et al., 1993). Weaning weight and yearling weight variance components were each estimated with single-trait, multi-component animal models. Fertility variance components were estimated with a single-trait, animal model and mature weight variance components were estimated with a single-trait, repeat measures, animal model.

Breeding values were calculated using BLUP procedures, the Animal Breeder's Toolkit (Golden et al., 1992), and the same models as used to estimate variance components. Genetic trends were determined from the resulting EBV. Because slaughter weight observations were not available and because yearling and slaughter weights are genetically correlated, yearling weight observations were used to calculate slaughter weight EBV with multiple-trait BLUP procedures. The correlations used in that analysis were those used in the formation of the breeding objective.

Results of Index-based Selection

Heritability estimates were generally lower than those used in the formation of the selection index (Table 3).

Table 3. Comparison of heritability estimates used in the formation of the index with those estimated from performance data.

Trait	Assumed for Index	Estimated from data
Fertility	.05	.04
Weaning weight	.23	.16
Milk	—	.10
Yearling weight	.35	.17
Mature weight	.50	.42

Genetic trends for the direct and maternal (milk) components of weaning weight as well as yearling weight are shown in Figure 1. Although the genetic trends included animals born prior to 1976, selection for the objective did not begin until that year. From that time, the direct and maternal components of weaning weight increased at a rate of .72 lb/year and .33 lb/year, respectively. Yearling weight breeding values increased at a rate of 1.67 lb/year. In 1976, the technology used to separate weaning weight into direct and maternal components was unavailable. The index used "weight of calf weaned" as opposed to "pure" milk. The milk trend shown here, however, reflects the genetic gain in weaning weight due to genes affecting milk production.

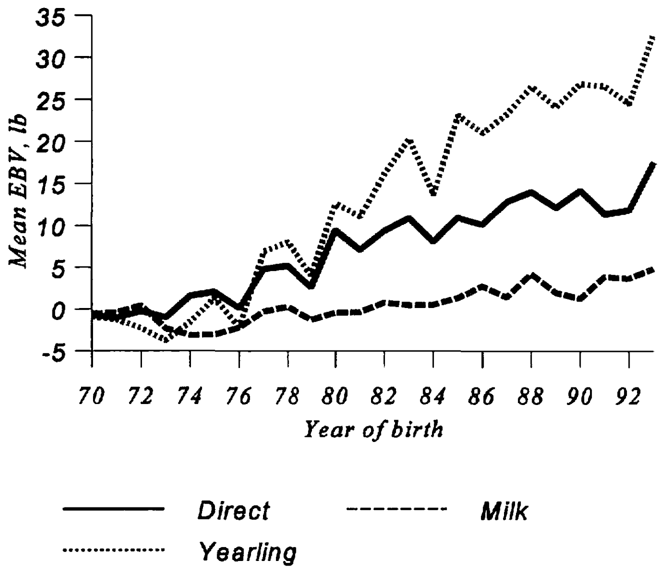


Figure 1. Genetic trends for direct and maternal (milk) weaning weight, and yearling weight.

Fertility was defined as the number of calves weaned per cow exposed to the bull. Even with a low heritability some genetic progress, albeit small, was seen in the number of calves weaned (.00077calves/year, Figure 2). Approximately one extra calf per 100 cows mated was the *total* increase in genetic potential for number of calves weaned.

The trend for slaughter weight breeding value was 3.2 lb/year (Figure 3). Again, because no data were available for slaughter weight, EBV were calculated using a multiple-trait analysis and yearling weight observations.

The genetic change in mature weight breeding value was -1.6 lb/year. Mature weight EBV were calculated using a single-trait, repeat measures animal model. This type of analysis necessitates the use of a selected set of data— mature weight observations are only from producing cows within the herd. The overall negative trend in mature weight may be an artifact of the selected set of data and the model of analysis. Alternatively, because the decrease in mature weight breeding value did not begin until shortly after the breeding objective was implemented in 1976, the trend in mature weight EBV may be the result of selection for the breeding objective. This question warrants further investigation.

Figure 2. Genetic trend for number of calves weaned.

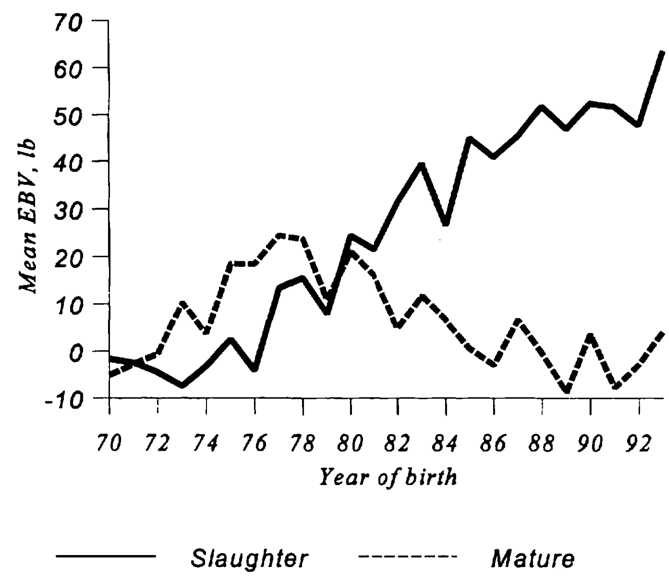


Figure 3. Genetic trend for slaughter and mature weight.

Calculating a mean aggregate breeding value by year of birth should give an indication of the overall economic effect of selecting for this breeding objective. Mean EBV for the traits in the objective were used to calculate the mean aggregate breeding value by year of birth. Because information on dressing percentage of surplus progeny and cull cows was not available, values used in the formation of the objective and index were applied. These were 58% and 43% for surplus progeny and cull cows, respectively. The mean aggregate breeding values were then plotted by year of birth (Figure 4.). The aggregate breeding value increased $4.32/year (1976 NZ dollars). As a result of selecting for this breeding objective, every heifer entering production was $4.32 more profitable than heifers that had entered production the previous year.

Approximately 2550 commercial heifers sired by bulls selected for this breeding objective were put into production yearly, translating into a sizeable increase in profit resulting from this breeding objective(1976 NZ$1.97 million). Of course, this assumes that the production and marketing system and the income and expense of production have remained relatively constant in New Zealand since 1976. While this is not the case, the economic benefit to the company was likely great.

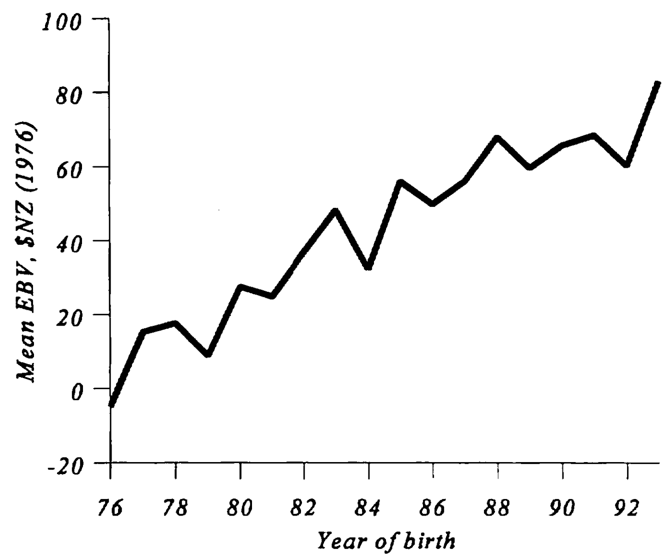


Figure 4. Genetic trend for the breeding objective.

The Future

Because of the overall success of Landcorp's breeding objectives and because the beef production and marketing system has changed considerably since 1976, along with the income and expense of production, a new beef breeding objective is currently being implemented. Another reason behind the development of a new objective is the availability of genetic predictions from large scale genetic evaluations in the form of EBV and EPD. These predictions allow comparisons of animals across herds and environments— something not possible when the objective described here was implemented. The new breeding objective incorporates these advancements in technology.

Other groups in New Zealand are now developing breeding objectives of their own. The Angus, Hereford, and Simmental breed associations are among these. The goal is to make available (via the Internet) a computer sire selector that allows breeders to use EBV, and economic values suitable for their production and marketing system to calculate aggregate breeding values. The user will have flexibility in choosing which economic values are appropriate to his(her) farming system. The choices include 6 different farming environments in New Zealand, 2 bull uses (maternal or terminal sire) and 3 selling ages (weaning, 12 months, and slaughter age) (P. Charteris, pers. Comm.).

Summary

An economic based breeding objective was developed in 1976 for the general beef production system in New Zealand at that time. Selection indexes based on this breeding objective were calculated and used for selection in an Angus herd designed to produce bulls for use in commercial herds.

Even though assumptions were made in the development of the original objective, subsequent analysis has shown genetic progress in all traits in the breeding objective. The results of this study illustrate the usefulness of implementing breeding objectives as a means to base selection decisions on a single value (aggregate breeding value), representing the genetic potential for profitability of each animal.

References

Boldman, K.G., L.A. Kriese, L.D. Van Vleck, and S.D. Kachman. 1993. A manual for use of MTDFREML. A set of programs to obtain estimates of variances and covariances [Draft]. ARS, USDA.

Golden, B.L., W.M. Snelling, and C.H. Mallinckrodt. 1992. Animal Breeders Tool Kit User's Guide and Reference Manual. Colorado State Univ. Agric. Exp. Sta. Tech. Bull. LTB92-2, Fort Collins.

Hazel, L.N. 1943. The genetic basis for construction of selection indexes. Genetics 28:476.

Harris, D.L. and S. Newman. 1994. Breeding for profit: Synergism between genetic improvement and livestock production (A Review). J. Anim. Science 72:2178.

Melton, B.E. 1995. Conception to consumption: The economics of genetic improvement. Proceedings of the 27th Research Symposium and Annual Meeting of the Beef Improvement Federation. Sheridan, WY

Morris, C.A., R.L. Baker, and D.L. Johnson. 1980. Breeding Objectives and selection indices for national beef improvement. unpublished.

Newman, S., C.A. Morris, R.L. Baker, and G.B. Nicoll. 1992. Genetic improvement of beef cattle in New Zealand: breeding objectives. L. Prod. Sci. 32:111.

Nicoll, G.B., A.E. Gibson, and D.C. Dalton. 1979. The recording and data-handling procedures used in the Angus cattle breeding programme of the Rotorua Land Development District of the Department of Lands and Survey. Department of Lands and Survey. Wellington, New Zealand.

Ponzoni, R.W., and S. Newman. 1989. Developing breeding objectives for Australian beef cattle production. Anim. Prod. 49:35.

Whole Herd Analysis Committee Meeting
Dickinson, South Dakota
Minutes

The first meeting of the newly formed Whole Herd Analysis committee was chaired by John Hough. The meeting began as a joint session with the Multiple Trait Selection committee. John Hough and Kent Anderson, chairman of the Multiple Trait Selection committee, discussed the restructuring of the old Genetic Systems committee and the formation of new committees. The joint committee meeting continued with Tom Jenkins discussing decision support software.

Committees separated and the Whole Herd Analysis committee continued with a presentation by Harlen Hughes of North Dakota State University on utilization of SPA data. Bruce Golden of Colorado State reported on the importance of whole herd reporting in the development of genetic evaluation for reproductive traits. Dick Gilbert of the Red Angus Association discussed the process of changing to a whole herd reporting system. Jim Oltjen, University of California-Davis, discussed the economic uses of whole herd data.

After presentations had been made John Hough lead a discussion on the issue of whole herd reporting. Representatives of breed associations who were in attendance were asked to report on developments in their breed. The majority reported that they were either working on development of a whole herd reporting system or seriously discussing the prospect. There seemed to be general agreement that whole herd reporting systems are necessary to develop evaluation procedures for economically important traits like reproductive traits. An issue that appeared to be a major problem in establishment of whole herd systems was setting a fee structure. Several saw a challenge in developing a fee structure that would encourage complete reporting and also, be acceptable to both small and large producers.

No motions or resolutions were passed and no board action is required.

Respectfully submitted,

Ronnie Silcox,
Recording Secretary

IRM-SPA HAS ARRIVED IN COW COUNTRY

by
Harlan Hughes[1]
Extension Livestock Economist
North Dakota State University

Introduction

Two economic forces are greatly impacting today's beef cow producers. The first is their individual unit cost of producing a hundred weight of calf produced and the second is the beef price cycle. Let's take a brief look at these two economic factors and see what beef cow producers might do to mange these significant economic forces.

Average unit cost of production for North Dakota's IRM Cooperators has averaged from $66 to $76 per hundred weight of calf produced over the last three years. The range for individual producers is extremely wide going from the high $40s to well over $100 per hundred weight of calf produced. I wonder where the beef industry would be today if every beef cow producer knew the answer to two questions? First, what does it cost me to produce a hundred weight of calf? Second, am I a low cost or high cost producer?

Most cattlemen that I work with today can not answer either one of these questions. I contend that beef cow industry profits would be considerably higher, even in today's tough times, if all beef cow producers knew the answers to these two questions.

Now for beef price cycle. As commercial beef cow producers, purebred beef cow producers, breed associations, university researchers, and extension specialists assemble at this 1997 Beef Improvement Federation Annual Meeting and Research Symposium, it behooves all participants to be cognizant of the impact that cattle cycles and the resulting beef price cycles have on the beef business. The main impact of the beef price cycle is on the bottom line of beef cow herds.

Figure 1 illustrates how the beef price cycle of the '90s has impacted commercial beef cow operators. These net returns are defined as the returns to the three resources that North Dakota ranch families contribute — their unpaid family labor, management, and their equity capital. These North Dakota returns should be indicative of the U.S. beef cow industry in general. Average net returns for North Dakota ranchers and beef farmers went from the high of $192 per cow in 1990 to a low of a minus $51 per cow in 1996. The primary cause of this dramatic change in net income per cow was the "cattle cycle" of the '90s and its resulting

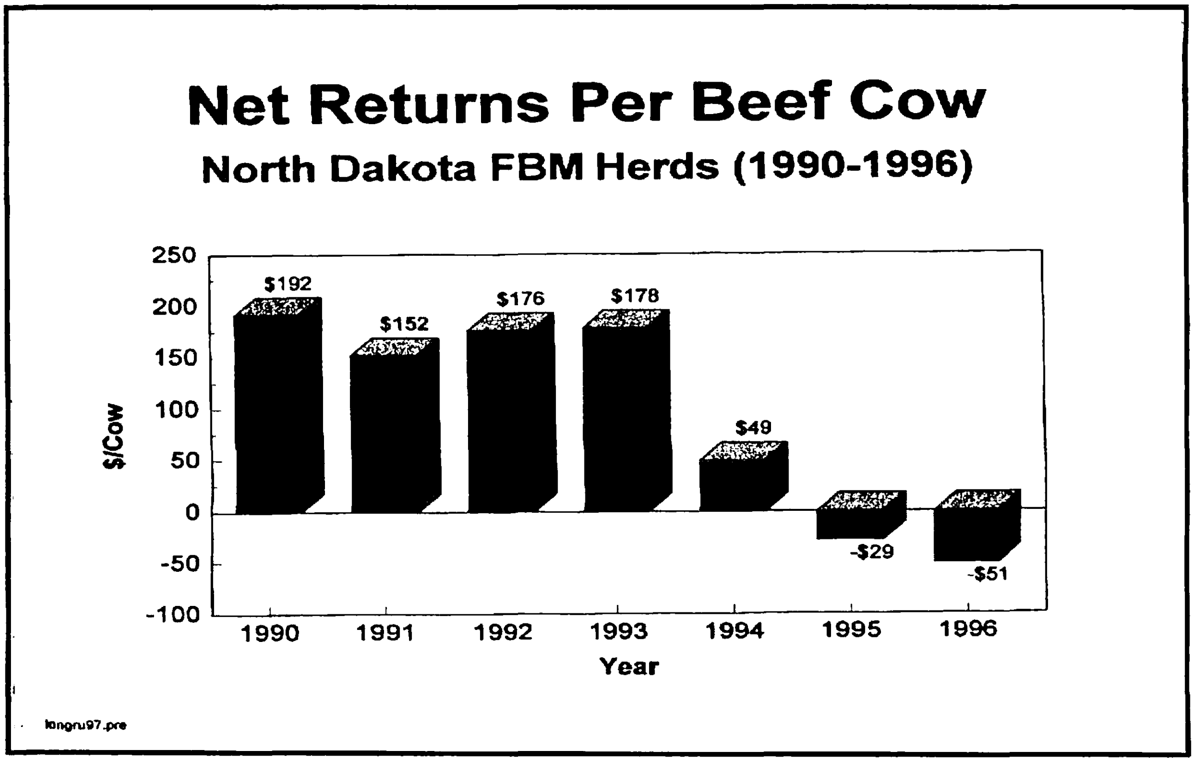
---

[1] Paper presented at the 29th Annual Meeting & Research Symposium, Beef Improvement Federation, Dickinson, North Dakota, May 15, 1997.

bifFinalWImages.wpd

"beef price cycle." I encourage each and every participant at this conference to keep this fundamental economic concept in mind as we discuss the many aspects of the beef cattle production over the next two days.

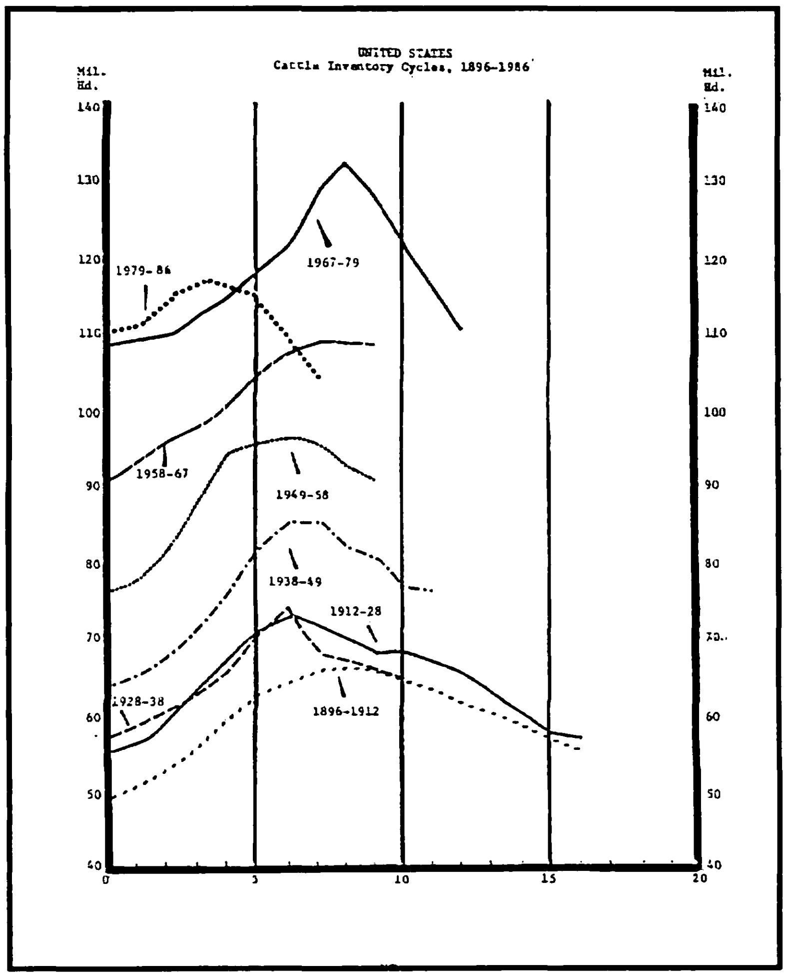
Figure 1: North Dakota Beef Cow Profits
Farm Business Management Herds



Beef cattle cycles go back to the 1860s --as far back as the U.S. recorded history of beef cow numbers goes. The typical cattle cycle goes for 9-11 years (see Figure 2) and can be broken into three stages— the deceleration stage where beef cow numbers decrease, the turn around stage that we are now in, and the acceleration stage where beef cow numbers increase. The peak in cattle numbers tends to be around the mid-point of each decade (1996 in the current cycle). Projections are that the U.S. all-cattle numbers will now decrease through year 2000 (see Figure 2).

Cattle numbers cause beef price cycles. As cattle numbers increase, leading to more beef supply, cattle prices go down. As cattle numbers decrease, leading to less beef supply, cattle prices go up. Beef price cycles, and the resulting changing beef supply, are the single most dominant factors determining beef cow profits. As a result, beef cow production practices and production recommendations typically need to change with the stage of the beef cattle cycle.

Figure 2: Historical Cattle Cycles



Objectives

The objective of this paper is to describe the

IRM-SPA management information system designed to help beef cow producers manage through the cattle cycles. The relatively new IRM-SPA Guidelines suggest how beef cow producers can integrate production measures into a financial and economic costs and return analysis for the total beef cow herd. Given where we are in the current beef price cycle, emphasis will be placed on how IRM educational programs are being designed to help beef cow producers use IRM-SPA to enhance beef cow profitability.

Cattle Cycles And Resulting Beef Price Cycles

A complete 10-year cattle cycle goes from the low cattle numbers at the beginning of a decade to high cattle numbers in the middle of the decade and back to the low cattle numbers at the end of the decade and are typically "n" shaped. The Food And Agricultural Research Institute (FAPRI), Iowa State University and University of Missouri, provide annual long-run projections for the beef cattle industry. Figure 3 presents historical U.S. January 1 all-cattle inventory for 1991 through 1996 with projections for 1997 through year 2006.

The U.S. all-cattle number is projected to go from the 104 million cattle in 1996 to a low of 97 million cattle by the end of the current decade. All-cattle numbers are projected to increase back up to 101 million in the middle of the next decade.

Two points need to be made about the projected current cattle cycle. First, there will be a "n" shaped U.S. all-cattle inventory numbers over the next 8-10 years. Second, beef numbers in the next decade are projected to peak at 101 million head — 3 million head less than the 104 million head peak in 1996. If this projected 3 million head decrease in peak cattle numbers becomes true, one has to wonder who is "not" going to be running cows in 2005? Economic theory suggests that it will be the high cost producers and high cost region or regions that reduce cattle numbers. As the national IRM-SPA database develops, it will provide some clues as to where the high cost and low cost regions are.

Figure 3: U.S. All-Cattle Inventory Projections

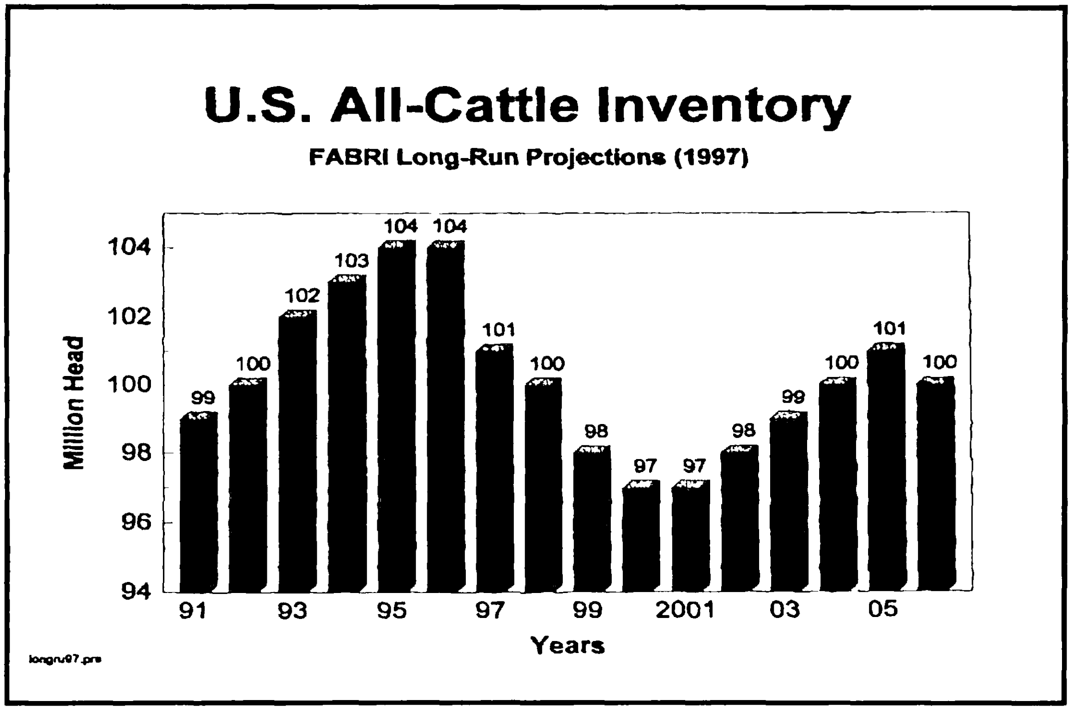
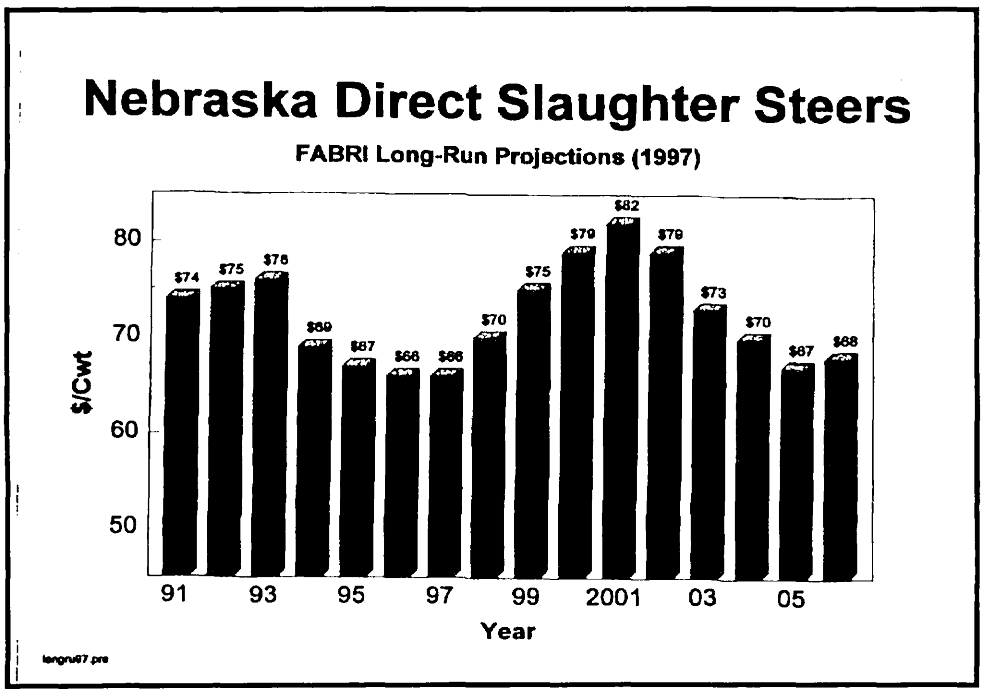


Figure 4: Nebraska Projected Direct Slaughter Prices



Cattle cycles cause beef price cycles. FAPRI also projects Nebraska Direct Slaughter Steer prices (see Figure 4). During the '90s, slaughter cattle prices peaked in 1993 and then decreased through 1996. Slaughter cattle prices are projected to increase from 1997 through year 2001 and slaughter cattle prices are projected to decrease from year 2002 through year 2005. Beef prices tend to be the highest around the beginning of each decade and tend to bottom out during the middle of each decade. Clearly, as one goes through a decade, the "n" shaped cattle cycle causes a "U" shaped beef price cycle.

What Happen To Commercial Cow-Calf Herds During the Last Cattle Cycle?

It would be useful to take a brief look at how well beef cow operators faired economically during the last cattle cycle. A study of what happen in the last cattle cycle should help us prepare for what beef cow producers might expect in this current beef price cycle. The key question that needs to be addressed is: Can you produce your way through a beef price cycle?

In the last cattle cycle (1979-1989), the beef industry focused primarily on increasing calf weaning weights. The beef industry assumed that profits were highly correlated with weaning weights.[2] The Industry emphasized cross breeding and more exotic blood. In many parts of the country, cow size and the milking ability of cows increased and in some cases, increased dramatically. I have had the good fortune to analysis some of these high producing herds and the data shows some impressive performance increases. Clearly, the beef industry did a lot of things right.

. Figure 5 illustrates the dramatic improvements made in North Dakota's weaning weights. I believe that these weaning weights are indicative of the U.S. and Canadian herds in general. I call your attention to the time frame of Figure 5. This chart goes from the peak of one beef price cycle in 1979 to the peak of the next beef price cycle in 1989.

Weaning weights started out the decade of the '80s at 450, 467, and 470 pounds. Weaning weights ended up the decade at 536, 525, and 560 pounds. That's 10 pounds per calf per year or 100 pounds per calf in the decade of the '80s. As stated before, in the decade of the '80s, beef cow producers did a lot of things right.

Figure 6 illustrates the economic performance of North Dakota's beef cow herds during this same 10-year 1979-1989 time period. Beef cow profits started out the cycle with $175

---

[2] North Dakota's unpublished research suggests that during the 1990s, that profitability of IRM Cooperator herds was not highly correlated with weaning weights. The calculated R squared from regressing profit on weaning weight of the IRM-FARMS 1994 database was 0.20. This suggests that 20 percent of the profitability variation from herd to herd was explained by weaning weight. This also implies that 80 percent of the herd to herd variation was due to something else other than weaning weights. Production costs appear to be a big part of this something else. Producers are encouraged to focus a considerable amount of their management energies towards measuring and monitoring unit costs of porduction.

per cow profits in 1979. Profits decreased rapidly in 1980 to $59 per cow and stayed low for the next 6 years. By 1986 profits had started back up only to end the decade at $195 per cow in 1987, $175 per cow in 1988, and at $140 per cow during 1989. The key point of Figure 6 is the decade-long "U" shaped profit curve. There will be another decade-long "U" shaped beef cow profit curve in the '90s. Last year, 1996, should have been the low in this decade's "U" shaped profit curve.

So... What Does A Commercial Cattleman Have To Help Him Cope With The Financial Implications Of Today's Cattle Cycle?

From 1988 through 1992 the National Integrated Resource Management Program was designed and published by National Cooperative Extension and the National Cattlemen's Association IRM Subcommittee. This new IRM Program was originally described as:

> A goal setting process that gave ordinary producers information to become competitive, efficient international businessmen.[3]

The concept of IRM was quite simple. Financial records were to be combined with production records into a single management information system that generated one set of management signals for the herd manager. This management information system was to take beef cow producers through the beef price cycle of the '90s into year 2000 and beyond.

The critical aspects of this new national IRM Educational Program was the integration and standardization of Critical Success Factors (CSF) for running a high production and a high profit beef cow herd. Emphasis was placed on the integration of 1) beef cow production, reproduction, and genetics, 2) range management, 3) animal health, and 4) financial management.

[3] Martin Jorgensen, Feedstuffs, May 14, 1990. An Ideal, South Dakota Rancher.

Figure 5: CHAPS Average Weaning Weights
During Last Cattle Cycle

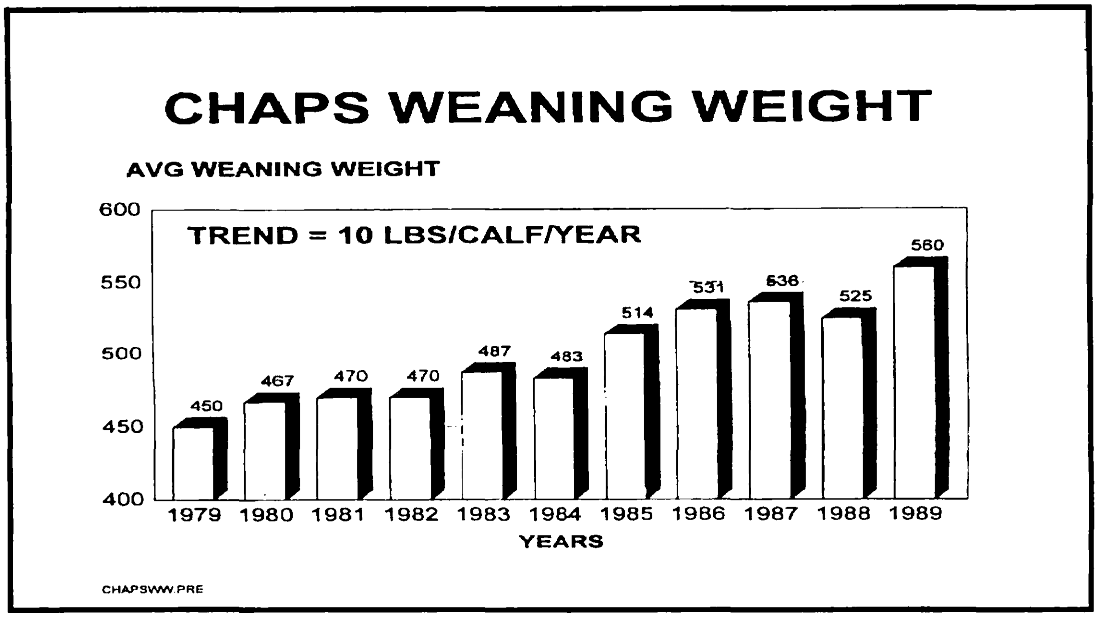
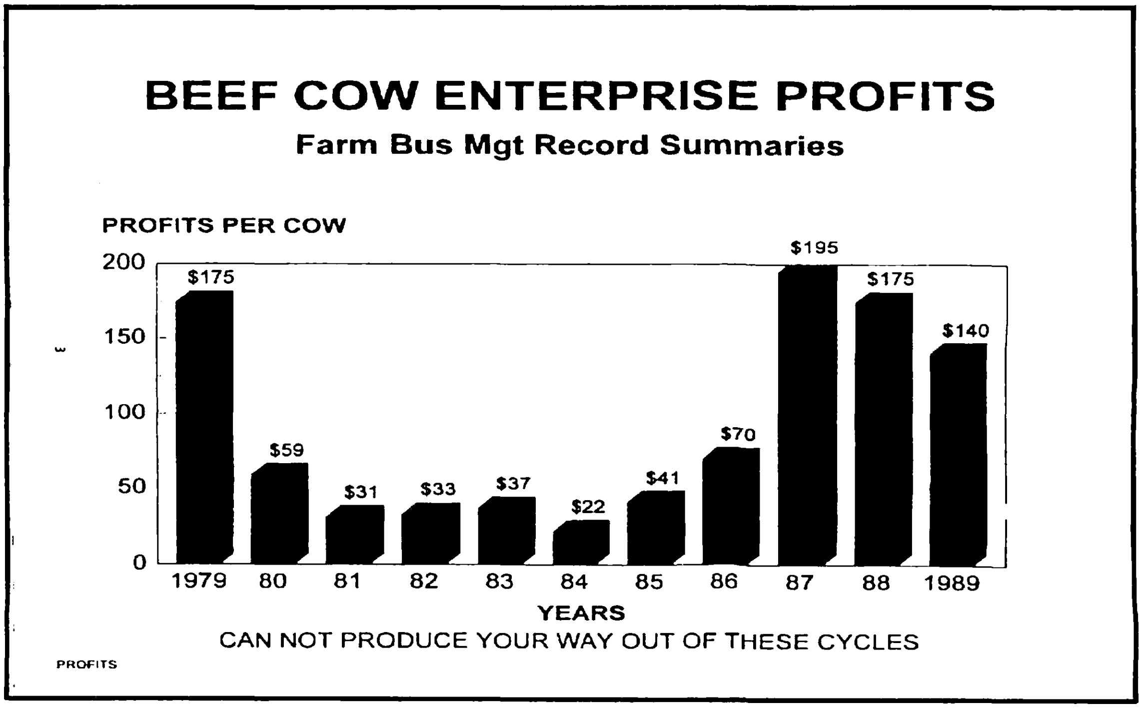


Figure 6: North Dakota Beef Cow Profits
During Last Cattle Cycle



S

PA Guidelines Published

A Standardized Performance Analysis (IRM-SPA) set of guidelines was developed, adopted, and published in 1992. Standardized production, reproduction, economic, and financial measures were included. These SPA Guidelines included a basic set of production, reproduction, and economic measures that each state was to use in setting up their state's IRM Educational Programs.

To illustrate an example of the standardized reproduction measures that were defined, let's take a look at the "females exposed" measure. This measure is the denominator for many of the standardized reproductive efficiency measures adopted. While one could quickly suggest that "females exposed" is simply the total number of females in the inventory on bull turn out day, the rancher committee members, however, said that they had some females exposed to the bull that they fully intended to not keep for calving. The only reason that they were exposed to the bull is that they were raising their current calf. Second, breeding cattle were bought and sold all during the year so that there had to be some adjustment to the number of females exposed.

The CHAPS SPA certification process further defined which cows are to be included and excluded in the "SPA Adjusted Females Exposed." CHAPS identifies seven reasons for cows leaving the herd. They are: 1) cows died, 2) sold because of age, 3) sold because of physical defects, 4) sold because of poor fertility or open, 5) sold because of inferior calves, 6) sold as replacement stock, and 7) sold for unknown reasons. The three categories of cows leaving the herd that can not be subtracted out of the females exposed are: number 1— cows died, number 3 — sold because of physical defects, and number 4 — sold because of poor fertility or open cows. The other four sold-categories can be subtracted out of the females exposed when one is calculating "SPA Adjusted Females Exposed."

Figure 7 presents a worksheet designed to help beef cow producers calculate "SPA Adjusted Females Exposed." It is designed to aid a beef cow producer in determining what females are subtracted out and what females are added in to calculate a "SPA Adjusted Females Exposed " for their herd.

Let me just summarize this section by saying that the SPA Guidelines were developed by NCBA and the Cooperative Extension Service and were approved and published in 1992. All states are now focusing their IRM Educational Programs towards these guidelines. Each state's educational program, however, is slightly different.

Figure 7: SPA Adjusted Females Exposed — A Work Sheet

BEGINNING BREEDING INVENTORY DATE 6/ 9/91 mod date: 4/26/93
Reported Calf Starting Date 3/20/92 YEAR: 1992

1. Total females exposed at the beginning of the breeding season ... 191

2. Culled exposed females not intended to be calved but in the exposed herd at breeding time .... ______

3. Exposed females sold or transferred out before the breeding seasons ends .... ______

4. Exposed females purchased or transferred-in during the breeding season .... ______

ADJUSTMENTS AFTER BREEDING SEASON END

Before The Calving Season Begins:

5a. Open females sold or transferred-out after the breeding season ....culled 6 hd and cows died 2 ... 8

5b. Pregnant females sold or transferred-out after the breeding season .... ______

5c. Exposed females sold or transferred-out after the breeding season without pregnancy testing 15

5d. Total (5a+5b+5c) ... 23

6. Exposed and pregnant females purchased or transferred -in after the breeding season .... ______

After The Calving Season Begins:

7. Females sold or transferred-out with nursing calves between calving and weaning .... ______

8. Females purchased or transferred-in with nursing calves between calving and weaning .... ______

SPA ADJUSTED FEMALES EXPOSED

9. Adjusted exposed females including sales, transfers, and purchase of pairs, exposed, and pregnant females 176
(1-2-3+4-5b-5c+6-7+8)

Note: Exposed female numbers should include all replacement heifers as well as adult breeding cows. Female numbers should not be adjusted for death loss.

Form adopted from McGrann, et. al., "Production Performance Calculations Software For the Cow-Calf Enterprise," Texas Agricultural Extension Service, Sept 19, 1991, Version 1.2, pp 25-26.

SPA Software Available

The term SPA is also applied to two national software packages developed by Dr. Jim McGrann, Texas A&M University. There is a SPA-Production software package designed to conduct a basis analysis of the production and reproduction aspects of a beef cow herd. The Second software package, called SPA-Financial, is designed to conduct a comprehensive financial and economic analysis of the beef cow herd. This software is available from your State Extension Service or directly from Texas A&M University.

Other software packages are also available in selected regions of the country. North Dakota has the Cow Herd Analysis Performance System (CHAPS) that has been available for 15 plus years. North Dakota also has its IRM-Farms (Financial And Reproductive Management System) software that is being used with IRM Cooperators . Minnesota has the FINPACK total farm analysis software with a 20 year plus history. North Dakota also uses FINPACK on another 170-200 beef herds annually. Iowa State University has a beef cow enterprise analysis software that has been available for 10 years or more. University of Kentucky has recently developed a beef cow IRM software analysis package. I am sure that there are other state software packages that I am not personally aware of. The point here is that beef cow producers nation-wide have access to one or more software packages designed to provide IRM-SPA production and financial analyses.

Integration — What Is It?

A simple illustration of what is meant by an integrated business analysis is presented in Figures 8 and 9. It is my assessment that during the last cattle cycle, beef cow producers were primarily pursuing herd performance measures centered around increasing weaning weights (see Figure 8). The over-riding assumption was that profits and weaning weights were highly correlated. As illustrated in Figure 5, the growth in average weaning weights during the last decade was impressive. What would be your herd'scurrent numbers if you filled in Figure 8? What would they have been 12 years ago?

With the establishment of the national IRM-SPA Guidelines in the early '90s, astute beef cow producers are now pursuing herd profitability measures of their beef cow herds (see Figure 9 for an example). Emphasis in on determining production traits that enhance herd profitability. Costs of production is becoming a routine business performance measure and these producers know their unit costs of producing a hundred weight of calf. More and more producers are comparing their unit costs of production with other ranchers' unit costs of production. They are answering the two questions list at the beginning of this paper.

Figure 8: Typical Management Measures Of The '80s

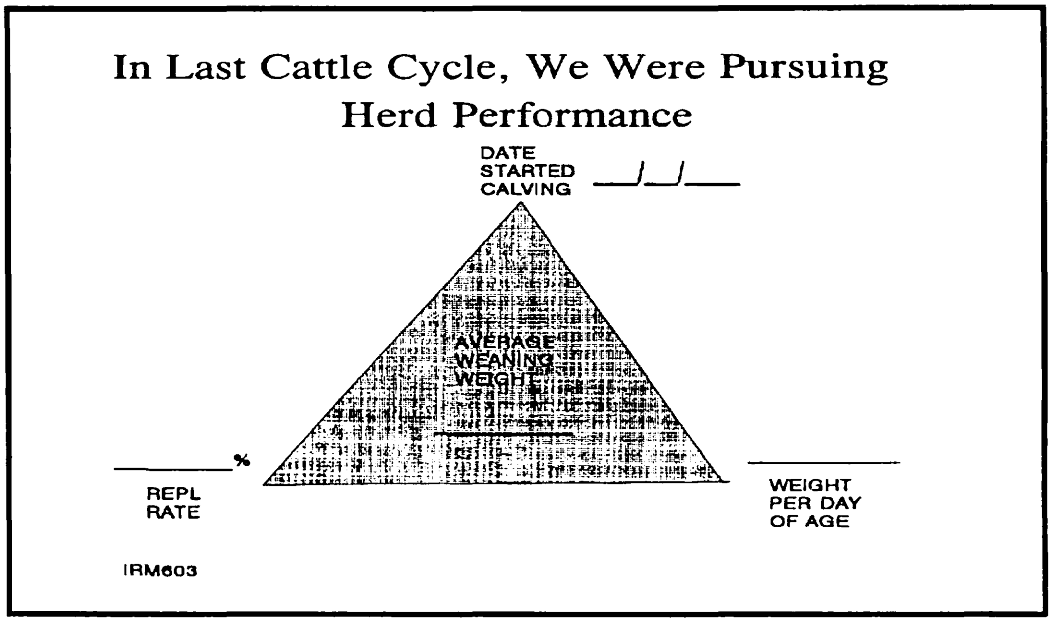
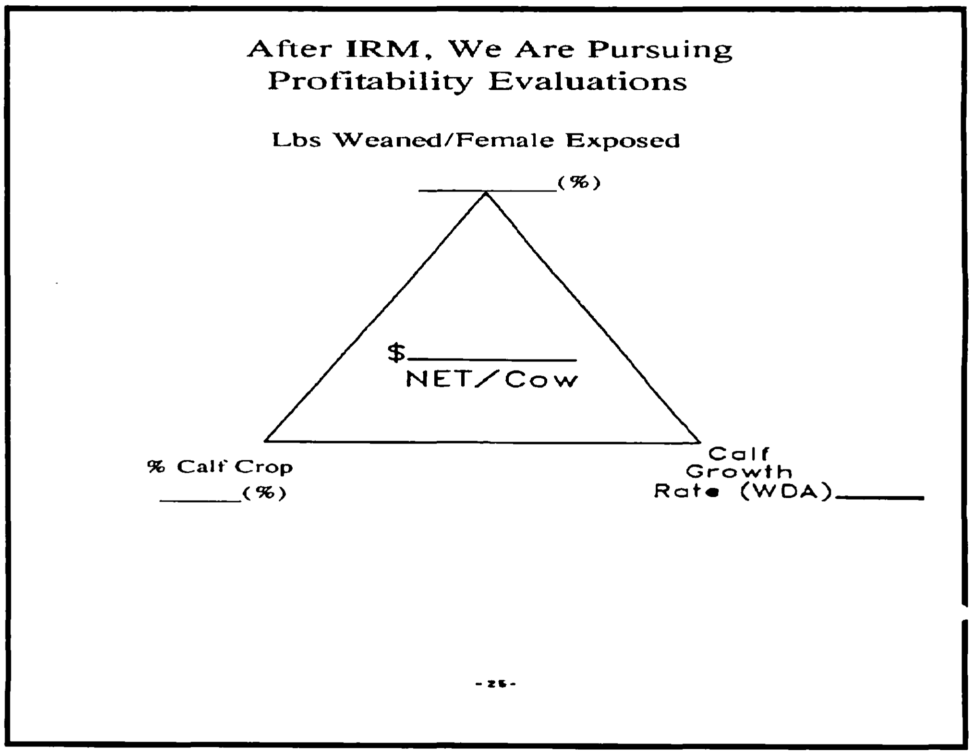


Figure 9: Example Profitability Measures Of the '90s



Summary

Beef cattle cycles, and the resulting beef price cycles, have a dramatic impact on beef cow profitability. The dramatic change in beef cow profits since 1990 has to be attributed to the current cattle cycle and the resulting beef price cycle. Cattle cycles are so important that it behooves each and every beef cow producer to become familiar and understand cattle cycles and their resulting beef price cycles. We are currently having another beef price cycle in the decade of the '90s and we have just went through the toughest times of this decade's beef price cycle.

Times are tough in today's beef cow businesses. Tough times call for some tough decisions. Beef cow producers are encouraged to answer two questions about their beef cow herd. First, what does it cost me to produce a hundredweight of calf? Second, am I a low cost or high cost producer?

If your management information system does not give you specific answers to these two questions, then you should consider jointing your state's Integrated Resource Management (IRM) Program. IRM-Standardized Performance Analysis (SPA) Guidelines were developed, approved, and published to help beef cow producers answer these two key questions

While the IRM-SPA analysis is designed to provide a complete analytical analysis of your beef cow herd, the real pay off comes from the management decisions triggered by the IRM- SPA analysis. A IRM-SPA analysis sets the stage for decisions based on "on-farm herd facts" rather than the more traditional "gut feelings."

The SPA analysis is not the end in itself, it is a means to the end. The end product of an SPA analysis is the management changes triggered by the analytical analysis. I encourage state extension services to put additional educational emphasis on the process of using SPA determined "herd facts" to make management changes.

Texas a&M University designed and published SPA-Production and SPA-Financial software based on the SPA Guidelines. In addition, other states have designed specific software packages tailored to that state's unique IRM educational programs. All states' educational programs and software are based around the National SPA Guidelines. The National SPA Database is maintained at Cattle FAX, NCBA, Denver, Colorado.

There are over 460 herd currently in the National SPA Database and it is gaining herds each year. As this national database expands, we will be able to compare the economic performance of beef cow herds region by region. The low cost and high cost regions will be come visible and should provide us some insights in to the changing geographical distribution of beef cow herd in the next decade. I don't know about you, but I want to be a low cost producer in a low cost region.

MINUTES
LIVE ANIMAL AND CARCASS EVALUATION COMMITTEE
MAY 16, 1997
DICKINSON, NORTH DAKOTA

The meeting was called to order by Chairman John Crouch at 2:00 p.m. The following presentations were made and are included elsewhere in these proceedings.

1. "The Stability of Frame Score in Brahman Cattle", Dr. Sally Northcutt, Oklahoma State University

2. "Association of Animal Ultrasound Practitioners Activity Update", Cindy Nagel, President-AAUP, Springfield, South Dakota and Dr. Tommy Perkins, Southwest Missouri State University

3. "Carcass EPD from Ultrasound Measurements on Live Cattle", Dr. John Hough, American Hereford Association

4. "Comparison of Ultrasound Technologies", Dr. William Herring, University of Missouri

5. "Ultrasound Proficiency Testing Update", Dr. Doyle Wilson, Iowa State University

Following the speakers, spirited discussion was held relative to the controversy surrounding proficiency testing for each trait separately, namely fat thickness, ribeye area and percent intramuscular fat, or requiring technicians to be proficient in all three traits in order to be certified as proficient.

At the conclusion of discussion, as indicated by a show of hands, the overwhelming majority of those present favored that proficiency testing be administered in two categories:

1. Those technicians certified as proficient in collecting ultrasound data for the seedstock industry must simultaneously achieve passing scores in three traits; i.e., external fat thickness, ribeye area, and percent intramuscular fat.

2. Technicians who achieve passing scores in the two traits of external fat thickness, and percent intramuscular fat will be determined proficient in gathering data for use in feedlots.

The meeting adjourned at 4:30 p.m.

Respectfully Submitted,

John Crouch, Chairman

FRAME SCORE IN BRAHMAN CATTLE

Sally L. Northcutt and H. Glen Dolezal
Department of Animal Science, Oklahoma State University

The beef cattle industry has a history of changes in frame size and cattle type. Seedstock breeders have addressed the issue of "how big is too big", and commercial cattle producers have recognized the need for optimizing cow size. Mature size is composed of closely related measures of weight and height; however, the relationship among these traits is not clearly understood. Studies of mature size in beef cows have estimated lifetime growth curves for weight through maturity. Other reports have considered the influence of body size on the biological efficiency of cows.

Brahman breeders have noticed that their cattle tend to increase in frame score as they advance in age. This is noticed particularly in groups of showstring cattle. The Beef Improvement Federation (BIF) Guidelines contain frame score tables used by many breeders. These frame score guidelines imply that "most animals should maintain the same frame score throughout their life, while their actual height increases with age." Also, the guidelines indicate that "the frame score will change for animals that mature earlier or later compared with average animals." To investigate this further, American Brahman Breeders Association and Oklahoma State University evaluated 1,168 hip heights from a showstring herd (Herd A), representing bulls from 6 to 21 months of age. For the 222 bulls with repeated measures, each bull had an average of five hip heights taken in the herd. Brahman height trends were evaluated in comparison with BIF frame score equations derived from the BIF Guidelines table for bulls 5 to 21 months of age. The average hip height was 59.7 inches at 18 months of age, which fits the BIF frame 8 category.

Figure 1 presents the distribution of Herd A bull hip heights by frame score at 12, 18, and 21 months of age. Notice that at 21 months of age, a high percentage of the bulls falls into the frame score 8, 9, and 10 categories. Figure 2 depicts the prediction line using the BIF frame score 7, 8, and 9 equations and the line corresponding to Brahman herd data (Herd A). The Herd A height data were used to develop a prediction equation for bulls 6 to 21 months. The linear and quadratic terms were significantly different ($P < .01$) between the Herd A equation and the BIF 7, 8, and 9 equations. Results indicated that the Brahman bulls did not fit the BIF frame score equation, particularly past 12 to 14 months of age. The BIF table does a better job for yearling Brahman bulls than for older bulls. The intercepts were different ($P < .01$), except between the BIF frame 8 and Herd A equations ($P > .50$).

The Herd A equation was tested using 279 hip height records from a second herd (Herd B). No differences were detected between predicted and observed hip height values ($P > .50$). Results indicated that the Herd A equation had predictive value in describing hip heights in Herd B.

Based on these cattle populations, the BIF frame score chart is more appropriate for yearling Brahman bulls than for 18 and 21 month old bulls. Data suggest that post-yearling height change is more rapid in the Brahman bulls than the BIF equation would predict. Results are not to suggest a separate frame score table for Brahman cattle, but do recommend the use of the BIF table as a guide for yearling Brahman bulls. The challenge to Brahman breeders is to identify moderate-frame bulls to supply to commercial bull buyers. These buyers, in turn, must match the appropriate cattle size to suit the needs for efficient reproduction, cow maintenance needs and carcass weight targets of their herds.

Figure 1. Distribution of Hip Heights by BIF Frame Score (Herd A)

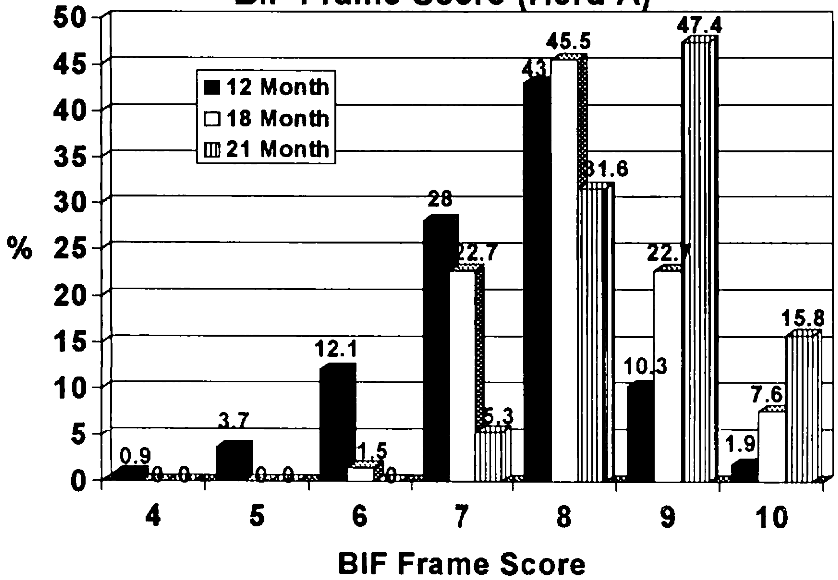
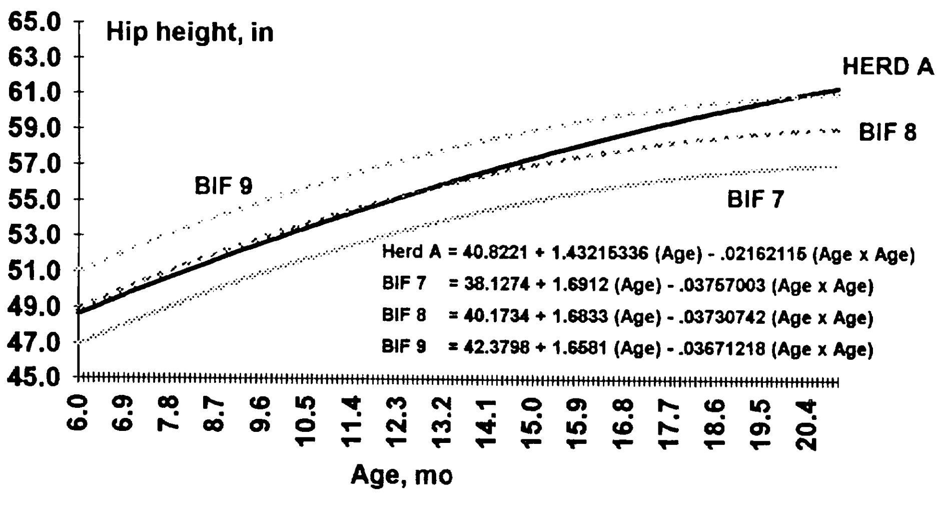


Figure 2. BIF Frame *versus* Herd A



Comparison of Four Real-Time Ultrasound Systems That Predict Intramuscular Fat in Beef Cattle

W. O. Herring[1], M. D. MacNeil[2], L. A. Kriese[3], J. K. Bertrand[4], and J. Crouch[5]
[1]University of Missouri, Columbia, [2]USDA-ARS, Miles City, MT, [3]Auburn University, AL, [4]University of Georgia, Athens, and [5]American Angus Association, St. Joseph, MO

Marbling score continues to be an important factor in determining carcass value. Through feedyard management or genetic selection, ultrasound may provide an opportunity to improve marbling score in beef carcasses. Today, there are several commercially available ultrasound systems that predict intramuscular fat in beef cattle. However, before 1995 no studies had been conducted to compare the accuracy and precision of these systems. Therefore, the BIF Live Animal and Carcass Evaluation Committee recommended that a series of studies be conducted to evaluate the various systems. The first two studies were reported by Kriese et al. (1996). This final study was conducted in Miles City, MT. These evaluations reflect the state of technological development as of October, 1996, and subsequent modifications of these systems may alter their performance.

Materials & Methods

Cattle used in this study were Line 1 Hereford (n=48; MacNeil et al., 1992) and CGC composite (n=32; Newman et al., 1993a,b) steers. Intact bulls were fed from weaning to approximately one year of age on corn silage based diets supplemented with additional concentrates (primarily barley) and 10% chopped hay. At one year of age they were identified as culls due to either low performance or excessive birth weight and then castrated using the Callicrate system[1]. These steers were turned out to graze on native range at Miles City, Montana where they grazed as a group until August 21 when they were returned to the feedlot for finishing. Coming off pasture they weighed 438 kg (SD =33 kg). The finishing ration consisted of 80% well-eared corn silage, 10% corn grain, and 10% barley.

Four commercially available real-time ultrasound (**RTU**) software systems were represented in this study. These systems all estimated intramuscular fat by applying image analysis procedures to a region of interest located within the longissimus area of the echogram. To allow the best possible representation of each RTU software system, each company was allowed to select and send two sonographers experienced with their individual systems. The software systems and sonographers represented included: 1) Animal Ultrasound Services, Inc., Ithaca, NY (**AUS1** and **AUS2**); 2) CPEC, Oakley, KS (developed by Kansas

---

[1] Mention of a proprietary product does not constitute a guarantee or warranty of the product by the University of Missouri, USDA, Auburn University, University of Georgia, American Angus Association, or the authors and does not imply approval to the exclusion of other products that may be suitable.

$$RMSE = \sqrt{\frac{\sum (U-C)^2}{n}}$$

where n is the number of observations, U is the RTU systems prediction and C is EE or marbling score converted to EE using Savell et al. (1986) hereafter referred to as **CMARB**. The RMSE was the most conservative statistic generated, not only determining how well a system ranked animals, but also the degree of accuracy.

Secondly, bias for each system was also calculated:

$$bias = \frac{\sum (U - C)}{n}$$

Bias is the mean error for each system, and provides an indication of the average direction and magnitude of error.

Finally, the standard error of prediction (**SEP**) was calculated:

$$SEP = \sqrt{\frac{\sum (U-C-bias)^2}{n-1}}$$

This statistic is used by the Beef Improvement Federation as a RTU technician certification guideline (GPW, 1995). The SEP is similar to RMSE, except SEP corrects for each system bias. Since genetic evaluations account for contemporary group effects, SEP would be the most important statistic for evaluating the systems for use in genetic prediction programs.

To further evaluate the proficiency of the different RTU systems and account for appropriate sources of variation, two linear models were used. Before the analyses, RTU system predictions were corrected for each of the respective systems' biases. In other words, each system bias (shown in table 3 and 4) was deviated from each system prediction to determine which systems would produce data most appropriate for genetic evaluations. Two dependent variables, EEADIFF and MADIFF, were then analyzed:

EEADIFF = | RTU system prediction - bias - EE |
MADIFF = | RTU system prediction - bias - CMARB|

State University) (**CPEC1** and **CPEC2**); 3) Critical Vision, Inc., Atlanta, GA (developed by Iowa State University) (**CVIS1** and **CVIS2**) and 4) Classic Ultrasound Equipment, Tequesta, FL (**PIE1** and **PIE2**). For AUS and CVIS, images were acquired with an Aloka 500V system equipped with a 3.5 MHz, 17 cm transducer (distributed by Aloka USA, Inc., Wallingford, CT). For PIE, images were captured with a Pie Scanner 200 system equipped with a 18 cm transducer (distributed by Classical Ultrasound Equipment, Tequesta, FL). Images from CPEC were captured with an Aloka 210 system equipped with a 12.5 cm transducer (distributed by Aloka USA, Inc., Wallingford, CT). While the CPEC system predicted marbling score, all other systems predicted percentage intramuscular fat.

Animals were scanned over 3 days. Cattle were sent to slaughter in four groups of 20 head each, beginning the day after the final scanning session and every 7 days thereafter. Quality and yield grade components were determined 36 to 48 hours after slaughter by an experienced grader. After grading, a slice of the longissimus muscle (2.5 cm thick) was taken from the 12-13th rib interface to determine percentage ether extractable fat (**EE**).

Marbling score and EE fat were used as the objective measurements to determine accuracy. Since CPEC predicts marbling score, the equation developed by Savell et al. (1986) to convert marbling score to EE was used where appropriate:

$$\% \text{ ether extractable fat} = (\text{marbling score} - 1) \times 1.27 - .8043$$

where marbling score was: ...Slight^{90}=4.9; Small^{00}=5.0;...;Modest^{00}=6.0;...;etc. The CPEC predictions and USDA marbling scores were converted to EE using the equation described above. Therefore, all predictions and objective measurements were in EE units.

Several simple statistics were used to evaluate system proficiency. Spearman rank correlations were calculated for system predictions with marbling score and EE. Rank correlations assist in determining the similarity of the ranking of two variables, and can sometimes cause misleading conclusions, since correlations are dependent upon the variation of each variable. Tests between and among correlations were calculated as shown by Snedecor and Cochran (1976).

To further evaluate precision and overcome problems associated with variance dependence, three additional statistics were generated. The first was root mean squared error (**RMSE**; Herring et al., 1994):

However, after correcting for bias, the CPEC and CVIS systems were the most precise. When determined by CMARB, the CPEC and CVIS systems were not only the most precise, but also the most accurate. This is primarily due to the small degree of systematic bias expressed by both of those systems. While lower SEP values are more important in genetic evaluation programs, systems must also be accurate if they are to be used for determining slaughter dates for marketing.

When analyzed with a linear model, technician within system was significant for both EEADIFF ($P < .001$) and MADIFF ($P < .001$). Those least squares means are presented in table 5. These values agree with the correlation analysis and other simple statistics. Using Tukey's Studentized Range Test (α=.05) , for either EEADIFF or MADIFF, CPEC and CVIS systems were not different from each other but were more accurate than AUS and PIE. Also, PIE predictions were more accurate than those of AUS.

Provided in figure 1 are scatter plots of each of the system predictions with EE. The PIE and AUS systems are randomly scattered while CVIS and CPEC predictions for a general linear trend. Finally, it is easily seen that CPEC1 predictions were the most accurate.

Implications

Accuracy differences are present among commercially available RTU systems that predict intramuscular fat. System accuracies have ranked the same in all studies performed. Based on these data, ultrasound provides tremendous opportunity as a tool for feedyard management and national genetic evaluation programs.

These dependent variables reflect the average error, independent of bias, for each RTU system. The model accounted for effects of system, technician within system, slaughter date, animal within slaughter date, system by slaughter date, system by animal within slaughter date, and slaughter date by technician within system. The main effect of animal and all animal interactions were assumed random. Therefore, system and system by slaughter date were tested by system by animal within slaughter date. Slaughter date was tested by animal within slaughter date. All other effects were tested by the residual. The GLM procedure of SAS (1985) was used for this analysis.

Results and Discussion

A description of the live animal carcass data are provided in table 1. Since these steers were castrated at a year of age, fat and muscle traits more likely represent those that would be found in bulls than fed slaughter steers. This is evidenced by the small mean fat thickness of .61 cm and low mean marbling score of 4.5 (Slight^{50}).

Correlations of ultrasound predictions with EE and marbling score are provided in table 2. Systems generally ranked the same regardless of which objective measurement was used. Although not shown, there was a Spearman rank correlation of .74 between EE and marbling score. Initially, 95% confidence intervals were calculated for each technician within system correlation (Snedecor and Cochran, 1976; data not shown). Based upon those confidence intervals, CPEC and CVIS systems were grouped into a higher precision class while AUS and PIE were grouped into a lower precision class. Thereafter, a series of *z* tests were performed as described by Snedecor and Cochran (1976) using correlations with EE. The null hypothesis that CPEC1, CPEC2, CVIS1, and CVIS2 are from the same ρ was rejected ($P < .001$). However, the hypothesis that CPEC2, CVIS1, and CVIS2 were estimated from the same ρ was accepted ($P > .10$). A final test that CPEC1 and CVIS2 estimates were drawn from the same population was rejected ($P < .001$). Therefore, the CPEC and CVIS systems were more precise than either AUS or PIE. Also, CPEC1 was the most precise system-technician combination tested.

Presented in tables 3 and 4 are other simple statistics used in determining accuracy and precision using both EE and CMARB. A low RMSE would indicate a system is both accurate and precise. However, a system could have a large RMSE due only to systematic error (or bias). Cochran and Cox (1957) define accuracy as the closeness with which a measurement approaches its true value. They also define precision as the repeatability of the measurements. Those authors further note that a measurement may be of high precision but of low accuracy. Finally, they note that if bias is large, a measurement may be of high precision but of low accuracy. Therefore, a low SEP would indicate that a system is ranking animals correctly. The CPEC1, CPEC2, CVIS1, CVIS2, and PIE1 systems were similar in magnitude for RMSE when determined by EE.

Table 1. Description of live and carcass data.

Trait	Mean	Std. Dev.	Min	Max
Live wt.,kg	530	37	461	606
Carcass Wt., kg	298	16	157	342
Fat, cm	.61	.26	.13	1.52
Ribeye, cm^2	78.1	8.29	60.0	102.6
Marbling[a]	4.5	.5	3.4	6.1
Ether, %	2.46	.69	1.09	4.63

[a]4.0=Slight[00]: 5.0=Small[00]: etc.

Table 2. Correlations between ultrasound predictions and objective measurements of intramuscular fat.

	% Ether Extract	Marbling Score
AUS1	.08	.09
AUS2	-.11	-.03
CPEC1	.82	.63
CPEC2	.52	.45
CVIS1	.50	.46
CVIS1	.56	.48
PIE1	-.21	-.11
PIE2	-.04	.04

Literature Cited

Cochran, W. G. and G. M. Cox. 1957. Experimental Design (2nd Ed.). John Wiley and Sons, New York.

GPW. 1995. Proceedings for the Fifth Genetic Prediction Workshop. Beef Improvement Federation. Kansas City, Missouri.

Herring, W. O., D. C. Miller, J. K. Bertrand, and L. L. Benyshek. 1994. Evaluation of machine, technician, and interpreter effects on ultrasonic measures of backfat and longissimus muscle area in beef cattle. J. Anim. Sci. 72:2216-2226.

Kriese, L. A., W. O. Herring, J. K. Bertrand, and J. Crouch. 1996. Examination of intramuscular fat technology and ultrasound ribeye area EPD selection studies. *In* Proceedings of First Annual Symposium and Workshop for Beef Ultrasound Technicians. Kansas City, MO. December 9-10, 1996.

MacNeil, M.D., Urick, J.J., Newman, S., and Knapp, B.W. 1992. Selection for postweaning growth in inbred Hereford cattle: the Fort Keogh, Montana Line 1 example. J. Anim. Sci. 70:723.

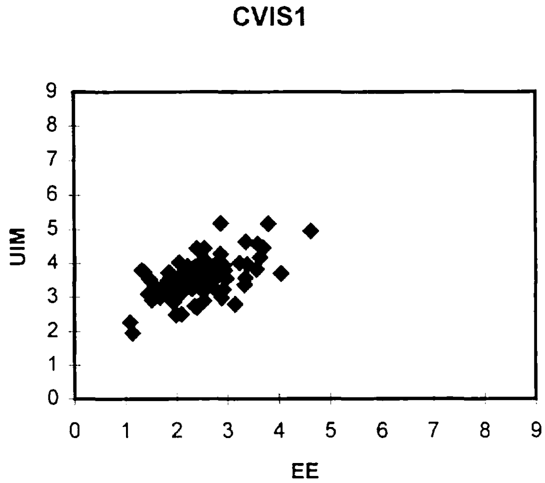
Newman, S., M. D. MacNeil, W. L. Reynolds, B. W. Knapp, and J. J. Urick. 1993a. Fixed Effects in the formation of a composite line of beef cattle: I. Experimental design and reproductive performance. J. Anim. Sci. 71:2026.

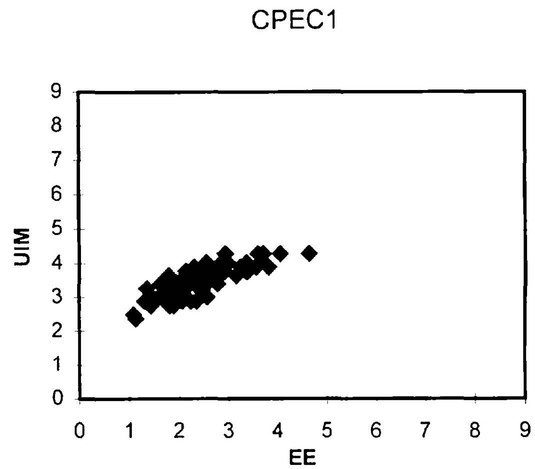
Newman, S., M. D. MacNeil, W. L. Reynolds, B. W. Knapp, and J. J. Urick. 1993b. Fixed Effects in the formation of a composite line of beef cattle: II. Pre- and postweaning growth and carcass composition. J. Anim. Sci. 71:2033.

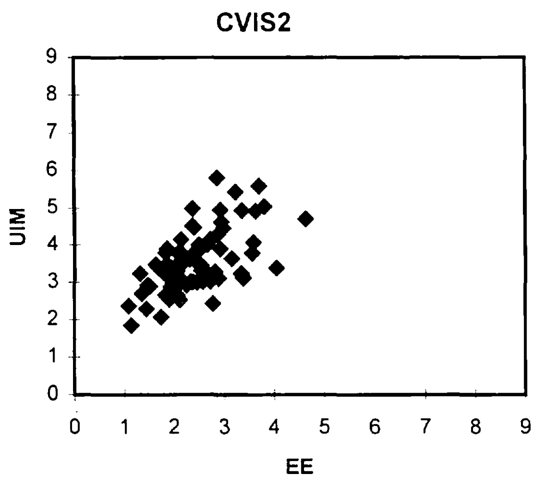
SAS. 1985. SAS User's Guide: Statistics. (Version 5 Ed). SAS Inst. Inc., Cary, NC.

Savell, J. W., H. R. Cross, and G. C. Smith. 1986. Percentage ether extractable fat and moisture content of beef longissimus muscle as related to USDA marbling score. J. of Food Sci. 51:838.

Snedecor, G. W. and W. G. Cochran. 1976. Statistical Methods (6th Ed.). The Iowa State University Press, Ames.


CVIS1
UIM
EE
0 1 2 3 4 5 6 7 8 9


CPEC1
UIM
EE
0 1 2 3 4 5 6 7 8 9


CVIS2
UIM
EE
0 1 2 3 4 5 6 7 8 9

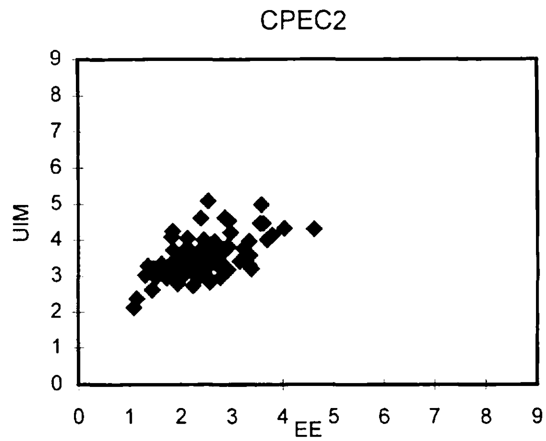

CPEC2
UIM
EE
0 1 2 3 4 5 6 7 8 9

Figure 1. Graphical representation of each of the system predictions and percentage ether extractable fat.

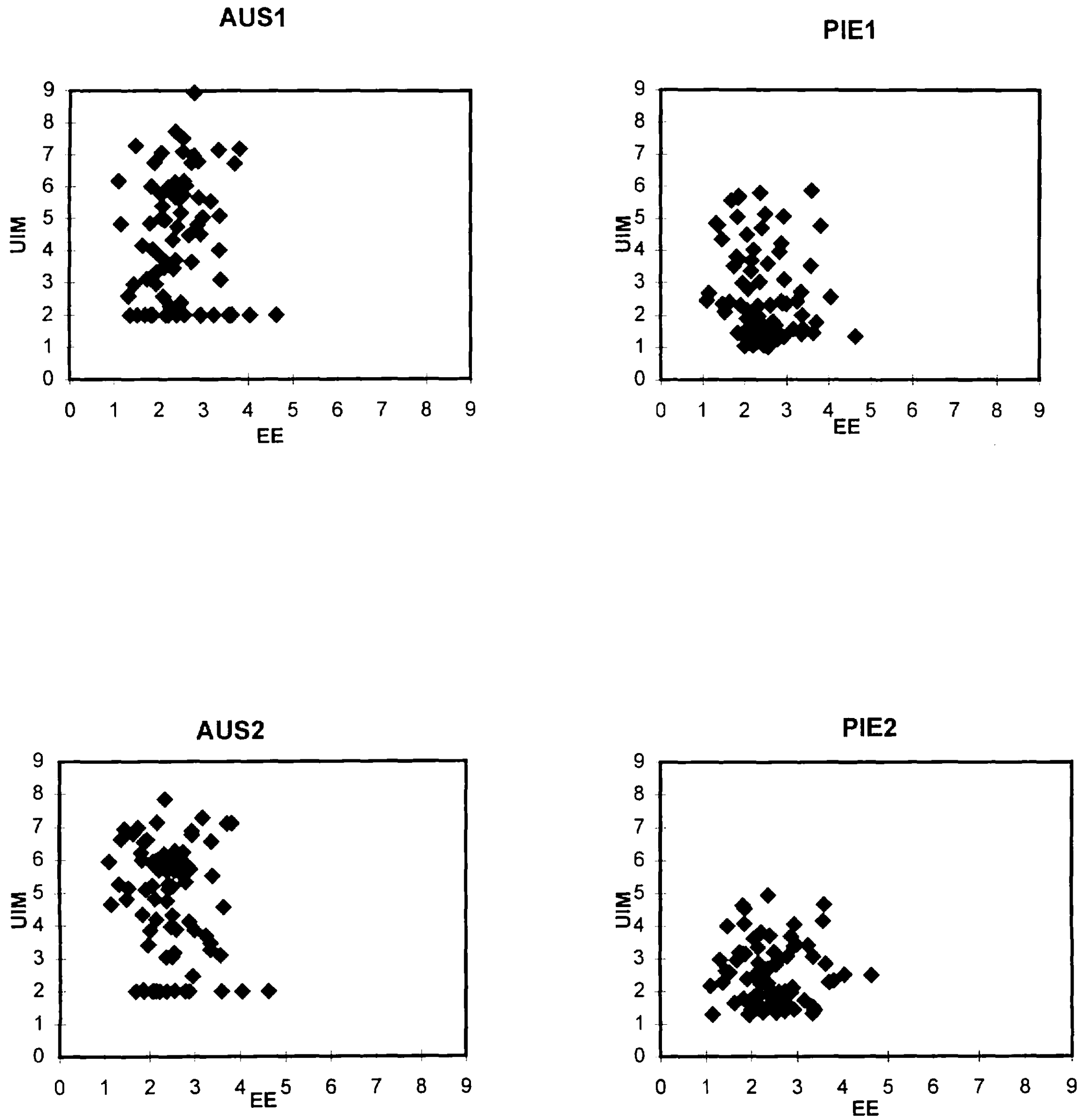


Table 3. Simple measurements of RTU system proficiency determined by ether extractable fat.

RTU System	RMSE	Bias	SEP
AUS1	2.80	1.97	2.00
AUS2	3.02	2.30	1.97
CPEC1	1.12	1.04	.42
CPEC2	1.23	1.08	.59
CVIS1	1.24	1.09	.60
CVIS2	1.30	1.11	.69
PIE1	1.68	.23	1.68
PIE2	1.17	.02	1.18

Table 4. Simple measurements of RTU system proficiency determined by USDA Marbling Score.

RTU System	RMSE	Bias	SEP
AUS1	2.06	.78	1.92
AUS2	2.17	1.11	1.88
CPEC1	.52	-.15	.50
CPEC2	.62	-.10	.62
CVIS1	.58	-.10	.58
CVIS2	.69	-.07	.69
PIE1	1.88	-.96	1.63
PIE2	1.61	-1.16	1.12

Table 5. Least squares means by technician within system for EEADIFF and MADIFF.

System	EEADIFF		MADIFF	
AUS1	1.64	± .06	1.60	± .07
AUS2	1.67	± .06	1.61	± .07
CPEC1	.33	± .06	.39	± .07
CPEC2	.46	± .06	.50	± .07
CVIS1	.47	± .06	.47	± .07
CVIS2	.55	± .06	.53	± .07
PIE1	1.42	± .06	1.31	± .07
PIE2	.97	± .06	.92	± .07

AMERICAN HEREFORD ASSOCIATION GENETIC EVALUATION PROGRAM FOR CARCASS TRAITS

John Hough, American Hereford Association

The American Hereford Association has launched a new program designed to calculate carcass EPDs this year. The EPDs will be based primarily on ultrasound measurements taken on yearling breeding cattle. The demand for carcass EPDs in the commercial cattle industry has grown to the point that purebred breeders are challenged to produce this information. There are trade-offs using ultrasound data from breeding cattle versus actual data taken from steer carcasses. However, based on considerable investigation by the AHA board of directors and staff, as well as advice from various researchers, it is felt the advantages of using ultrasound technology outweigh the shortcomings.

Plans are to calculate EPDs for rib eye area, backfat thickness and percent intramuscular fat (marbling). Any genetic estimate or EPD can only be calculated from data sent to the association. Carcass EPDs can only be calculated from data sent to AHA by Hereford cattlemen. AHA strongly encourages its breeders to immediately begin collecting ultrasound data on yearling cattle. Without carcass data, carcass EPDs cannot be calculated. EPDs can only be generated on cattle with legitimate carcass measurements and their parents.

How does a breeder collect this ultrasound data, and what guidelines must be followed? Breeders cannot simply measure cattle at random and expect usable results to be generated. Without an organized plan, progress will be minimal. Ultrasound data should be collected on yearling cattle between 330-430 days of age. Both bulls and heifers should be measured. It has not been determined if it is better to measure one sex over the other. More accurate EPDs can be calculated on a wider range of cattle if both sexes are measured. The research community is not in total agreement on some guidelines, but with appropriate raw data, future modifications can be made. Information requested to be collected includes animal identification, management code, ribeye area, fat thickness, percent intramuscular fat (marbling), weight, date measured, ultrasound technician, equipment and procedures used. Not everyone has the ability nor the equipment to collect useful ultrasound measurements. A great deal of knowledge and expertise is necessary. Only ultrasound data collected by certified technicians will be accepted into the genetic analysis.

The ultimate goal of carcass data collection is to gain knowledge about carcass traits of the cattle we produce. EPDs for rib eye area, fat thickness and intramuscular fat (marbling) will be calculated by the University of Missouri in cooperation with the University of Georgia. The main thrust of the data collection involves ultrasound measurements from yearling bulls and heifers. In addition, actual data collected from steer carcasses could also be utilized in a multiple-trait genetic analysis. However, we anticipate the majority of the genetic information will be derived from ultrasound.

BEEF CATTLE ULTRASOUND PROFICIENCY TESTING AND EVALUATION

Doyle E. Wilson
Iowa State University, Ames

Programs for ultrasound proficiency testing and evaluation have been developed for real-time ultrasound technicians as a means of maintaining standards for image collection and interpretation within the industry. This program also identifies proficient technicians through what has been referred to as certification. The proficiency testing also serves as a means of technician continuing education and training.

BIF has supported and provided guidelines for ultrasound proficiency testing and evaluation programs. These programs have been conducted at Texas A&M, Auburn University, and Iowa State University (ISU). Persons meeting "standards" of accuracy for the traits evaluated have received what, historically, has been referred to as BIF Certification. A list of currently certified technicians is available to the seedstock industry and is update after each proficiency testing and evaluation program. Being "certified" means that breed associations will accept the technician's ultrasound data as bona fide.

Proficiency testing at ISU has extended over the years of 1993 to 1997. The first beef cattle testing program at ISU was held in conjunction with a swine ultrasound testing program, but in subsequent years has been held independent of swine testing. The proficiency testing programs have been held on an annual basis in the May and June time frame.

The first beef cattle proficiency testing programs were for 12-13th rib fat thickness and ribeye area. Percent intramuscular fat (PIMF) was added as an optional trait for certification in 1996. Technicians were also given the opportunity to be evaluated for rump fat thickness accuracy in 1996. Technicians are not required to pass proficiency in the rump fat trait measurement in order to obtain "certification" status.

Technicians scan 20 to 22 animals as a part of the testing program. The animals used at ISU have been primarily feedlot steers, with a limited number of bulls and heifers. All of the animals receive two different alias identification numbers. One set of alias numbers are used for the first scan, after which the animals are brought back through the chute system with the second alias number and in a different order. Two previously certified technicians also scan all of the animals. The measurements of the reference technicians are used to help set the standards for passing. The animals are slaughtered at a commercial packing facility within 24 hours after the proficiency testing program. Marbling score is recorded by a USDA grader after a 24 hr chill. Carcass 12-12th rib fat thickness and ribeye area is measured by two qualified and disinterested persons.

There are three statistics used to measure ultrasound proficiency: standard error of prediction (SEP), standard error or repeatability (SER) and bias. Passing standards for the 1996 proficiency testing program are given in Table 1. Technicians are also given a written examination with a 70% as the passing level.

Table 1. Proficiency passing standards for 1996.

	SEP	SER	Bias
12-13th rib fat thickness, in.	.10	.10	.10
Ribeye area, sq. in.	1.20	1.20	1.20
PIMF, %	1.20	1.10	.70

The resources required to conduct an ultrasound proficiency test are extensive. ISU has historically used 50 animals to begin with and then sorted these animals down to 40-44 head. The cattle have always come from ISU breeding project resources, supplemented from time to time by cattle from the ISU Beef Teaching Herd. ISU faculty, staff and hourly support are used to supply the majority of the labor. Hourly labor costs are in part paid for from the registration fee charged to technicians. BIF and breed association representatives have always been a part of the proficiency testing program, serving to help oversee and manage the testing. ISU has had an open door policy relative to having software and equipment representative and technical support personnel available during the testing program.

Financial support for proficiency testing has come primarily through ISU subsidizing. BIF has provided financial support, as has the American Angus Association. The registration fee for the years 1993-6 was $250; for the 1997 proficiency test, the fee was set at $300. These dollars are used to help defray transportation expenses at ISU during the testing program, mailing expenses, chute rental, meals, oil and miscellaneous supplies, transportation of cattle to the packing facility, discounts on bull carcasses, percent intramuscular chemical analysis, and reimbursement of reference technician expenses.

In 1993, 14 persons attended the proficiency testing, 11 (79%) achieved the passing criteria. In 1994, 19 persons attended with 11 (59%) passing. Twenty-two of 37 persons passed the 1995 testing (58%). In 1996, 10 technicians passed the 12-13th rib fat thickness and ribeye area criteria, 13 passed the fat thickness, ribeye area and PIMF. There were three additional technicians previously certified for fat thickness and ribeye area that also passed the PIMF criteria in 1996.

As has historically happened with proficiency testing, new things are added each year in an attempt to make the program better. For 1997, time constraints for collecting images are being set at 3 minutes per animal. Also, if technicians are sharing equipment during the same scanning session, then a disinterested third party will be used to run computers or system equipment if needed. Only technicians, ISU personnel and industry support personnel (breed association representatives and equipment representatives) will be allowed in the scanning facility. Standards for passing will be set by ISU staff and interested breed association representatives.

Individual and detailed proficiency testing results are maintained as confidential. It is planned that the 1997 results for 12-13th rib fat thickness and ribeye area will be available the week of May 26. The PIMF results are to be available by the week of June 16. ISU will offer two levels of certification: (1) Seedstock Proficiency- fat/rea/PIMF and (2) Feedlot Proficiency - fat/PIMF.

ISU makes available individual results back to each individual technician. A list of technicians meeting the proficiency standards are published and made available on the ISU Department of Animal Science Extension/Ultrasound homepage.

Proficiency testing for beef cattle ultrasound technicians has been conducted by ISU as a service to the beef cattle industry. The tests have been conducted in accordance with standards set forth by BIF. The tests have also been conducted in the "fairest" and "least ambiguous" manner possible.

Association of Animal Ultrasound Practitioners Report
Presented by Cindy Nagel, President

1. Name of organization has changed from "National Animal Ultrasound Practioners Association" to "Association of Animal Ultrasound Practitioners" - due to IRS complications.

2. The mission statement for the Association is to - advance the science of ultrasound technology dedicated to establishing and maintaining high standards of education while uniting those individuals and organizations for the betterment of the livestock industry.

3. Seven Board of Directors: Cindy Nagel, President; Craig Hays, V. President; Jason McLennan, Secretary; Mel Pence,Treasurer; Tommy Perkins, BIF Representative; Rethel King, At Large Director; and Lorna Pelton, At Large Director.

4. Association Committies: Certification - Chaired by Craig Hays; Marketing - Chaired by Lorna Pelton; Technology - Chaired by Cindy Nagel; On Going Education and Training - Chaired by Jason McLennan.

5. Two types of Membership: Regular Members: existing individuals or those who are interested in becoming animal ultrasound practitioners. Associate Members: individuals or organizations interested in the promotion of ultrasound technology.

6. Dues: Regular Member - $25.00/year Associate Member - $250.00/year

7. Present time we have around 30 paid members. To become a member please send your dues to: Dr. Mel Pence
Tri County Vet Service
101 170th ST.
Clearfield, Iowa 50840

"Association of Animal Ultrasound Practitioners Update"

Tommy Perkins, Ph.D.
Department of Agriculture
Southwest Missouri State University

Cindy Nagel
Midwest Sonatech, Inc.

A meeting of ultrasound technicians for estimation of beef cattle carcass composition was held in early December, 1996. The meeting was titled "1st Annual Symposium and Workshop for Beef Ultrasound Technicians". The workshop took place at the Embassy Suites in Kansas City, Missouri with 54 participants in attendance. The attendees represented seventeen states and three foreign countries (Australia, Brazil, and Canada). Fifteen speakers provided information on topics ranging from "Results of intramuscular fat comparison studies" to "Understanding and applying carcass EPD's" to "Technician marketing strategies" to "Issues in the Evolving Certification/Recertification process". A contest on "Clever Innovations" was also held for those technicians submitting entries.

Those in attendance voted on an association name, elected a Board of Directors and elected officers for the initial kick-off of the group. The initial name selected for the association was the North American Animal Ultrasound Practitioners Association (NAAUPA). The association name has changed several times since the December meeting. Some examples include the Animal Ultrasound Practitioners Association (AUPA) and the National Animal Ultrasound Practitioners Association (NAUPA). However, the membership is in the process of approving of the "Association of Animal Ultrasound Practitioners (AAUP)" as the official name of the association. Those individuals elected to the Board of Directors and officers are shown below:

Board of Directors

Craig Hays
Rethel King
Jason McLennan
Cindy Nagel
Lorna Pelton
Mel Pence
Tommy Perkins

Officers

President - Cindy Nagel
Vice President - Craig Hays
Secretary - Jason McLennan

Treasurer - Mel Pence
BIF Rep. - Tommy Perkins

The membership in attendance also developed and approved of an official mission statement shown below:

> **"The Purpose of This Association Shall be to Advance the Science of Ultrasound Technology Dedicated to Establishing and Maintaining High Standards of Education While Uniting Those Individuals and Organizations for the Betterment of the Livestock Industry"**

Committees were identified to include Certification, Marketing, Technology, Education and Training and Organization. Break out sessions were held for each committee for the development of goals and objectives. The goals and objectives were summarized by each chairperson and shared with the entire membership at the conclusion of the meeting.

Membership dues were set at $25.00 for general membership and $250.00 for associate membership. About thirty individuals have paid dues to date into the association. Additionally, By-Laws for the association have been formulated and will be voted upon this summer by the membership.

John Hough, American Hereford Association, hosted the meeting and put together a set of proceedings. The proceedings will be used quite extensively by current and future technicians because of the wealth of information included invited speakers.

A second association meeting was organized and hosted by Southwest Missouri State University (SMSU) and held March 24, 1997 in Springfield, Missouri. The meeting was held prior to the Beef Improvement Federation (BIF) Precertification Ultrasound Training provided by Tommy Perkins and SMSU.

The attendees included six Directors, eighteen paid members, one breed association representative and six guests. Those in attendance enjoyed presentations on ultrasound systems and software by Jim Stouffer from Animal Ultrasound Services, Inc. and Craig Thompson from Critical Vision, Inc.

The only business conducted at this meeting included the Certification Committee Meeting. The session was moderated by Chairperson Craig Hays. Below is a list of issues discussed and approved at the committee meeting:

-Extend Length of Certification Term
-Establish Quality Control Committee
-Develop Archive of Images
-Randomize Testing of Image Quality

-Require Educational Development
-Establish Grievance Committee
-Consider Technician Probation Period
-Address Interference Problems at Certification
-Allow Single Trait Certification
-Allow Certification Twice Per Year

The next association meeting will be held in September, 1997 at a location to be determined at a later date.

AGE AT PUBERTY IN THE BEEF HERD AND SUBSEQUENT LIFETIME REPRODUCTION

Robert Williams
The University of Georgia

INTRODUCTION

Reproductive traits of the beef cow generally have low heritabilities and are difficult to record and interpret and therefore have not been included in National Cattle Evaluations to the extent as growth traits. Non-genetic management practices, such as proper levels of nutrition and culling of open cows, have been the primary reason reproductive efficiency of the cow herd has increased, and many producers have made improvement in their herds. However, further increasing reproductive efficiency may still offer the greatest opportunity for maximizing profit. In a recent evaluation of the Limousin breed, infertility was identified as the primary reason Limousin cows are culled, accounting for just under 25% of all identified cullings (Anderson, 1996). While most producers recognize the value of reproductive efficiency in the beef herd, little emphasis is traditionally placed on reproductive efficiency when selecting replacements. Traditionally, replacement heifers are selected visually for size and appearance.

The measure of reproduction for most producers is usually expressed only as success or failure, while in fact this may not be the most suitable measure for the genetic improvement for reproduction because these binary traits are not easily modeled and because of possible interactions. Expression of many reproductive traits may be easily masked by production and environmental effects. For example, in the Limousin study, as a group, cows that were culled because they were open, had the highest average Expected Progeny Differences (EPD) for birth weight, weaning weight, yearling weight and total maternal as compared to the average EPD for groups of cows culled for other reasons. This suggests that genetics for increased levels of growth and maternal performance may increase the percentage of cows that are culled for reproductive failure (Anderson, 1996). Furthermore, all else being equal, differences in inherent fertility are more pronounced in poor environments than in good environments. Heavy milking cows with high inherent fertility may calve regularly in good environments, but in poor environments they may have worse reproductive performance than inherently less fertile, but lighter milking cows (Martin, 1992).

Traits that influence lifetime reproductive performance of the cow need to be identified and measured relatively early in life. Selecting for pubertal traits in both the male and female may be a suitable means to genetically increase reproductive efficiency in the beef herd. This paper reviews literature for age at puberty in the beef heifer as a trait to increase fertility in the beef herd, scrotal circumference as an indirect measure for age at puberty, and a relatively new trait, reporductive tract score, as another trait to measure pubertal status in the beef heifer.

REVIEW OF LITERATURE

Age at Puberty

Literature heritability estimates for Age At Puberty (AP) are listed in Table 1 and ranged from .10 to .67. Heritability estimates for AP are generally higher than estimates for many other reproductive traits. Various researchers have reported that individual sires influence percentage of heifers reaching puberty by both age and weight categories (Laster et al., 1976; Laster et al., 1979; Wiltbank et al., 1966). This along with the relatively high heritability for AP indicates that the percentage of heifers reaching puberty by a given age or weight could be affected by selection of sires within a breed. However, such selection practices are only meaningful if they are associated with increases in age at first calving and/or lifetime reproductive efficiency in the beef herd. Furthermore, AP is one trait that is relatively immune from interactions with other traits. This is probably because AP is expressed before a cow is in production (Martin, 1992).

Breed and Breed of Sire Differences for Age at Puberty. Breed groups are an important source of variation in heifer weights and AP (Dow et al., 1982). Martin et al. (1992) reported that larger mature size and faster-gaining breed groups reach puberty at later ages than breed groups that were of smaller mature size and slower-gaining. Furthermore, Laster et al. (1979) reported that breeds selected for milk production or for both milk production and beef characteristics reach puberty at younger ages than breeds with similar growth rates and mature size that have been selected for beef but not selected for higher levels of milk production. Several studies have shown similar differences among breed of sire groups for age and weight at puberty (Laster et al., 1976; Dow et al., 1982; Gregory et al., 1978; Gregory et al., 1979). Sacco et al. (1987) concluded that crossbred heifers were younger at puberty, had shorter gestation periods and calved at younger ages than straightbred heifers. In general, crossbred heifers reach puberty at younger ages and heavier weights, and calve earlier than straightbred heifers.

Age at Puberty and Pregnancy Percentage. MacKinnon et al. (1990) analyzed data from a tropical beef herd over three calf crops for correlated responses to selection for high and low line estimated breeding values for pregnancy rate. Scrotal circumference was significantly higher in high line bulls between 9 and 18 months of age. Pregnancy rates of heifers were 12% higher in the high line than in the low line despite similar average live weights at mating. This study concluded that accelerated sexual maturity in both heifers and bulls has occurred as a result of selection for lifetime cow fertility and that such selection did not alter the progeny's growth rate.

In a Nebraska study (Gregory et al., 1979), Brahman crosses were significantly older and heavier than Hereford, Angus, Sahiwal, Pinzgauer and Tarentaise sire breed groups. However, pregnancy rates were significantly higher at 550 days for Brahman , Sahiwal and Pinzgauer crosses than Angus-Hereford crosses. Laster et al. (1976) reported no significant differences among sire breeds for pregnancy percentage, while Dow et al. (1982), had similar results, reporting that pregnancy rates at 24 months of age were not significant among breed groups. However, the start of the breeding season was at 19.5 months of age and this rate of sexual development would not be acceptable in most management programs. It appears that most heifers are mature enough at a given point during the breeding season to conceive and that AP does not adversely affect pregnancy rates. However, if nutrition is limiting, direct selection for AP may be more beneficial for improving pregnancy percentage. It has been shown that heifers developed more slowly on diets with lower energy density, reached puberty at significantly older ages, and had lower pregnancy rates than did heifers developed more rapidly when both were exposed to breeding as yearlings (Wiltbank et al. 1966, 1969). Thus, it appears that an increase in pregnancy from selection for AP must be assessed in relation to available levels of nutrition and management.

Selection for Age at Puberty. Morris et al. (1993) evaluated three selection herds and a control herd of Angus cattle in New Zealand. Selection was first applied to 1982 born animals; single selection objectives were scrotal circumference (SC), AGE+, and AGE-, where '+' and '-' indicate selection for greater or lesser AP. The purpose of the paper was to report on the genetic parameters for AP in heifers, weight at puberty in heifers, scrotal circumference, 13 month weight and calving day, to compare the performance of young animals in the selection and control herds, and to assess prospects of achieving a correlated response in calving rate. Heritability estimates were .15, .30, .24 and .33 for AP, weight at puberty in heifers, SC, and 13 month weight, respectively . A genetic correlation between AP and SC of -.81 ± 0.38 was reported. The response to selection for AP after nine years of selection was 16.5 days between the AGE+ and AGE- herds. The direct response to selection for SC during the same period was 1.6 cm above the control. Lifetime cow reproduction should respond to selection for decreased AP and increased SC.

Age at Puberty and Subsequent Reproduction. When cows calve first at 2 years of age rather than 3 years of age or older, economic efficiency can be improved (Núñez-Dominguez et al. 1991). Early initial calvers are superior to their late calving cohorts in subsequent reproduction and productive performance (Rege and Famula, 1993). Producers that place a high priority on having a high proportion of their heifers pregnant early in a fixed breeding season are justified.

Morris and Cullen (1994) estimated genetic correlations between pubertal traits of males and females for yearling and lifetime pregnancy rates in beef cows up to 5 mating/calving years for each cow, using 269 paternal half-sib groups. The genetic correlations between age at first estrus with yearling and lifetime pregnancy rates were -.30 and -.29, indicating favorable associations. Other studies exist, although limited, that indicate similar relationships between AP and subsequent lifetime reproduction. Laster et al. (1979) in a study that included female calves produced by breeding numerous sire breeds to Hereford and Angus cows reported that pregnancy was higher in heifers from Hereford dams than in those from Angus dams even though there was a 35 day advantage in AP for Angus dams. This same study also reported that the correlation between AP and percentage pregnant was relatively low (r = -.42) while there was a high association (r= -.75) between AP and percentage calving the first 25 days of the calving season. Splan et al. (1996) found similar results in 2,936 crossbred heifers. Estimated genetic correlations indicated that selection for

AP resulted in slightly increased calving rates in heifers. Lesmeister et al. (1973) reported that heifers tending to conceive early in their first breeding season tend to calve earlier throughout the remainder of their productive lives than later conceiving heifers. Werre and Brinks (1986) reported favorable correlations among line of sire AP means with heat cycle of conception for the first four lactations. These correlations indicate that heifers from lines of cattle with earlier puberty tended to conceive earlier each year through four breedings. This same study also found favorable relationships between AP and adjusted weaning weights and most probable producing ability.

Patterson et al. (1992) used records of AP and length of the postpartum interval to estrus for heifers calving first at 2 years of age to determine the relationship between the two reproductive traits. This study suggested a negative relationship between AP and length of interval to estrus after parturition. Heifer calves that weigh more reach puberty at younger ages and experience longer postpartum intervals compared to lighter contemporaries.

Selection for early maturity should contribute to profit in the beef herd, but management programs have a significant effect on subsequent reproduction and must be considered in selection of replacement females. It has been shown that cows calving earlier in their first season produce more pounds of calf in their lifetime than cows calving later the first time. Unfortunately, direct selection for AP in females is seldom practiced because of the time and labor required to obtain necessary data (Anderson et al., 1991a).

Indirect Selection for Age at Puberty in Females

As indicated earlier, age at puberty, when defined as the age of first behavioral estrus, has been shown to be desirably associated with reproductive efficiency in the beef cow. However, because of the nature of collecting data on AP, indirect selection for AP would likely be more feasible in the current industry. Land (1973) indicated that the quantitative expression of sexual activity in males and females may be genetically correlated. Anderson et al. (1991a) summarized research on Reproductive Tract Scores (RTS) as a measure of pubertal status in the beef heifer. And T. E. Kiser (personal communication) has indicated that a possible relationship may exist between the diameter of the ovaries in females and SC in males and can be measured using ultrasound technology. Ultrasound is an accurate method of measuring the growth and diameter of ovaries in the beef heifer, and this relationship should be given further research consideration.

Scrotal Circumference. Land (1973) investigated the relationship between males and females in two species, the mouse and the sheep. In the mouse, Land reported a .97 correlation between mean testis weight and mean ovulation rate of five mouse lines selected for ovulation rate. In sheep, Land examined the growth rate of the testis diameter of pure and crossbred males and reported that the testis diameter was greater in the breed with the higher ovulation rate. Subsequently numerous researchers have investigated the relationship between scrotal measurements in the male and AP in the female. Koots et al. (1994) reported a weighted mean heritability for SC of .48 across 25 studies. The favorable relationship between

SC in males and reproductive traits in females is well documented. Morris et al. (1992) reported estimates for heritability and genetic correlations for SC and AP. Scrotal circumference measurements were taken on bulls at an average age of 8, 11 and 13 months. Puberty was recorded for heifers from ages 8 to 14 months. Heritabilities for SC were .50, .33 and .29 for the three respective age groups, while heritability for AP was .33. Genetic correlations between SC and AP were -.11, -.41 and -.60 for the three age groups of bulls. Toelle and Robinson (1985) estimated genetic correlations between SC in the male and female reproductive traits with data from two Hereford herds involved in long term selection programs. This study reported favorable relationships between pregnancy rate and SC in yearling bulls using both half-sib and sire-daughter analysis procedures. Swanepoel et al. (1992) estimated relationships of lifetime fertility of Bonsmara cows with growth and SC of their calves. Cows were divided into long calving interval and short calving interval groups according to their average lifetime calving interval. Scrotal circumference of calves from the short calving interval group were significantly larger than bull calves from the long calving interval group at 12 and 15 months of age. This study concluded that high lifetime fertility is not incompatible with growth and a desirable relationship exists between SC and lifetime fertility. These and other similar studies have concluded that increases in SC were associated with increases in female fertility.

Most breed associations are currently reporting EPD for SC in their sire evaluations. Moser et al. (1996) selected 9 pair of Limousin bulls based on phenotypic SC measurements that represented an 8 cm difference in adjusted yearling SC. Each pair of bulls originated from the same contemporary group and had similar EPD for growth traits. No significant line differences were reported in heifer progeny for AP when lines were formed based on high or low yearling phenotypic SC measures. However, when bulls were sorted into high, average and low line groups based on SC EPD, a significant difference was reported for AP between the high line SC EPD and the other two lines. In agreement with earlier discussion, AP is not always associated with increased pregnancy percentage, this study reported no significant differences in pregnancy percentage when bulls were grouped based on phenotypic measures of SC or SC EPD.

Scrotal circumference is an easily measured trait in bulls. It has been shown that selection for increased SC is associated with decreased AP in females and increased lifetime reproductive performance of the cow herd. Furthermore, favorable relationships have been reported between SC and growth traits (Bourdon and Brinks, 1986). Scrotal circumference is a useful tool for indirect selection of female reproduction, those breeds not currently reporting EPD for SC should consider including it in their analysis.

Reproductive Tract Score. Field records for AP are seldom recorded, primarily because of the nature of collecting the necessary data. Anderson et al. (1991a) summarized data from Colorado State University on Reproductive Tract Scores (RTS) as a trait that can be used to estimate pubertal status of the beef heifer by rectal palpation of the uterine horns and ovaries. There are obvious benefits from RTS for making beef heifer management decisions because of the favorable response to synchronized breeding and to breeding season pregnancy rates (Table 3). Heifers with more mature reproductive tracts had higher pregnancy rates and calved earlier. There, also appears to be some genetic potential to RTS as a measure of puberty in the beef female.

Heifers are assigned a value from 1 to 5 as described in Table 2. A RTS of 1 is assigned to heifers with infantile tracts and are likely the furtherest from cycling at the time of examination. Heifers given a RTS of 2 are thought to be closer to cycling than those scoring 1, primarily due to the presence of small follicles and slightly larger uterine horns and ovaries. Those heifers assigned a RTS of 3 are thought to be on the verge of cycling, based on slight uterine tone, in addition to the presence of follicles. Heifers assigned a score of 4 are presumably cycling as indicated by good uterine tone, uterine size, and follicular growth. However, unlike heifers that are assigned a RTS of 5, heifers scoring a 4 lack an easily distinguished corpus luteum, due to the stage of the estrous cycle.

Anderson et al. (1991a) summarized results from his MS Thesis at Colorado State University and reported a moderate heritability of .32 $\pm$ 0.17 for RTS. This estimate is within the range of literature estimates for AP and indicate that RTS should respond favorably to selection pressure. This same study reported favorable genetic correlations of -0.37, 0.20, 0.31, and 0.53 between RTS and birth weight, weaning weight, yearling weight and pelvic area, respectively. Breed differences were observed. Generally, breeds selected for milk also had higher reproductive tract scores and this is in agreement with the current literature for AP summarized here.

In a separate study, Anderson (1991b) reported a heritability of .24 $\pm$ 0.13 for RTS on an age constant basis. Reproductive tract score was significant and favorably associated with pregnancy status after the first breeding season, day of first and second calving, and progeny weaning weight. but not pregnancy status after the second breeding season. This study also reported that heifers with RTS of 4 and 5 calved approximately one week, two weeks and one month earlier than heifers receiving a RTS of 3, 2, and 1, respectively.

Patterson and Bullock (1995) reported on data from 2,664 heifers using RTS as a means of evaluating heifer development. Measurements were obtained within 2 weeks prior to administration of the 14-17 day melengestrol acetate, prostaglandin system to synchronize estrus. Heifers were observed for estrus and inseminated within 12 hours after standing estrus. Heifers with RTS of 4 and 5 were significantly heavier, had larger pelvic areas, and response to estrus than those heifers recieving a score of 1, 2, or 3. Heifers with RTS of 2, 3, 4 and 5 had significantly higher percentages for synchronized conception rate, synchronized pregnancy rate and pregnancy rate at the end of the breeding season than those heifers scoring a 1.

Reproductive tract scores are a useful tool for the producer to help in decision making for the replacement heifer. The poor reproductive performance of heifers with RTS of 1 indicate the importance of indentifying and culling these heifers before the breeding season begins. The time or age at which heifers are examined depends on the desired use and the particular heifers to be evaluated. Variation within a group of heifers is only temporary, depending upon the age and maturity pattern of the heifers. For breeding, heifers should be evaluated efficiently early enough to make necessary adjustments in the ration or start of the breeding season. If the primary use is to place selection pressure on AP, the best time to evaluate heifers is when about half of the heifers are believed to be cycling. Scoring should coincide well with general processing as part of a yearling heifer evaluation and health program.

CONCLUSIONS AND IMPLICATIONS TO GENETIC IMPROVEMENT OF BEEF CATTLE

Heritability estimates for age at puberty suggests positive response to selection. The literature, although limited, indicates that age at puberty and scrotal circumference are favorably associated to subsequent yearling and lifetime reproduction of the beef female and selecting for pubertal traits in both the male and female can effectively increase percentage of heifers calving early in their first season and subsequently throughout their productive lives. In addition, selection for pubertal traits does not appear to be incompatible with growth traits.

Reproductive tract scores appear to be moderatly heritable and favorably associated to decreased age at puberty in the beef heifer, increased pregnancy rate in the heifer, and day of first and second calving. Researchers should investigate further, the genetic value of reproductive tract scores measured either by rectal palpation or ultrasound as methods to evaluate pubertal status of the beef heifer.

Measurement of most lifetime reproductive traits become available late in a cows life and the low heritability of most reproductive traits slow the rate of genetic improvement in the beef cow herd. Researchers have indicated that lifetime cow reproduction should respond favorably to selection for decreased age at puberty in the heifer and increased scrotal circumference in the male. Selecting for pubertal traits in both the male and female may be an economical means for beef producers to genetically increase reproductive efficiency in the beef herd.

BIBLIOGRAPHY

Anderson, K. J., D. G. LeFever, J. S. Brinks, and K. G. Odde. 1991a. The Use of Reproductive Tract Scoring in Beef Heifers. Agri-Practice 12:4.

Anderson, K. J.. 1991b. Abstract of Dissertation. Colorado State University, Fort Collins.

Anderson, K. J.. 1996. Reasons Limousin Cows are Culled. Limousin World, May 1996.

Bourdon, R. M. and J. S. Brinks. 1986. Scrotal Circumference in Yearling Hereford Bulls: Adjustment Factors, Heritabilities and Genetic, Environmental and Phenotypic Relationships with Growth Traits. J. Anim. Sci. 62:958.

Dow, J. S., J. D. Moore, and C. M. Bailey. 1982. Onset of Puberty in Heifers of Diverse Beef Breeds and Crosses. J. Anim. Sci. 55:1041.

Gregory, K. E., D. B. Laster, L. V. Cundiff, R. M. Koch and G. M. Smith. 1978. Heterosis and Breed Maternal and Transmitted Effects in Beef Cattle. II. Growth Rate and Puberty in Females. J. Anim. Sci. 47:1042.

Gregory, K. E., D. B. Laster, L. V. Cundiff, G. M. Smith and R. M. Koch. 1979. Characterization of Biological Types of Cattle-Cycle III: II. Growth Rate and Puberty in Females. J. Anim. Sci. 49:461.

Kiser, T. E.. 1997. Personal correspondence. Department of Animal and Dairy Sciences, University of Georgia, Athens, GA 30602.

Koots, K. R., J. P. Gibson, C. Smith, and J. W. Wilton. 1994. Analysis of Published Genetic Parameter Estimates for Beef Production Traits. 1. Heritability. Anim. Breed. Abstr. 62:309.

Land, R. B.. 1973. The Expression of Female Sex-Limited Characters in the Male. Nature, 241:208.

Laster, D. B., G. M. Smith and K. E. Gregory. 1976. Characterization of Biological Types of Cattle IV. Postweaning Growth and Puberty of Heifers. J. Anim. Sci. 43:63.

Laster, D. B., G. M. Smith, L. V. Cundiff and K. E. Gregory. 1979. Characterization of Biological Types of Cattle (Cycle II) II. Postweaning Growth and Puberty of Heifers. J. Anim. Sci. 48:500.

Lesmeister, J. L., P. J. Burfening and R. L. Blackwell. 1973. Date of First Calving in Beef Cows and Subsequent Calf Production. J. Anim. Sci. 36:1.

MacKinnon, M. J., J. S. Hetzel, N. J. Corbet, R. P. Bryan and R. Dixon. 1990. Correlated Response to Selection for Cow Fertility in a Tropical Beef Herd. Anim. Prod. 50:417.

MacNeil, M. D., L. V. Cundiff, C. A. Dinkel and R. M. Koch. 1984. Genetic Correlations Among Sex-Limited Traits in Beef Cattle. J. Anim. Sci. 58:1171.

Martin, L. C., J. S. Brinks, R. M. Bourdon and L. V. Cundiff. 1992. Genetic Effects on Beef Heifer Puberty and Subsequent Reproduction. J. Anim. Sci. 70:4006.

Morris, C. A., R. L. Baker and N. G. Cullen. 1992. Genetic Correlations Between Pubertal Traits in Bulls and Heifers. Liv. Prod. Sci. 31:221.

Morris, C. A., G. L. Bennett and D. L. Johnson. 1993. Selecting on Pubertal Traits to Increase Beef Cow Reproduction. Proc. of the New Zealand Soc. of Anim. Prod. 53:427.

Morris, C. A. and N. G. Cullen. 1994. A Note on Genetic Correlations Between Pubertal Traits of Males or Females and Lifetime Pregnancy Rate in Beef Cattle. Liv. Prod. Sci. 39:291.

Moser, D. W., J. K. Bertrand, L. L. Benyshek, M. A. McCann, and T. E. Kiser. 1996. Effects of Selection for Scrotal Circumference in Limousin Bulls on Reproductive and Growth Traits of Progeny. J. Anim. Sci. 74:2052.

Núñez-Dominguez, R., L.V. Cundiff, G. E. Dickerson, K. E. Gregory and R. M. Koch. 1991. Lifetime Production of Beef Heifers Calving First at Two vs Three Years of Age. J. Anim. Sci. 69:3467.

Patterson, D. J. and K. D. Bullock. 1995. Using Prebreeding Weight, Reproductive Tract Score, and Pelvic Area to Evaluate Prebreeding Development of Replacement Beef Heifers. Proc. Beef Improvement Fed. 27th Res. Symp. Annu. Mtg. Sheridan, Wyoming. p 174.

Patterson, D. J., L. R. Corah, J. R. Brethour, J. J. Higgins, G. H. Kiracofe, and J. S. Stevenson. 1992. Evaluation of Reproductive Traits in Bos taurus and Bos indicus Crossbred Heifers: Relationship of Age at Puberty to Length of the Postpartum Interval to Estrus. J. Anim. Sci. 70:1994.

Rege, J. E. O., and T. R. Famula. 1993. Factors Affecting Calving Date and Its Relationship With Production Traits of Hereford Dams. Anim. Prod. 57:385.

Sacco, R. E., J. F. Baker, and T. C. Cartwright. 1987. Production Characters of Primiparous Females of a Five-Breed Diallel. J. Anim. Sci. 64:1612.

Smith, B. A., J. S. Brinks and G. V. Richardson. 1989. Estimation of Genetic Parameters Among Reproductive and Growth Traits in Yearling Heifers. J. Anim. Sci. 67:2886.

Splan, R. K., L. V. Cundiff and L. D. Van Vleck. 1996. Genetic Parameters for Growth and Reproductive Traits of Crossbred Heifers. J. Anim. Sci. 74(Suppl. 1) (Abstr).

Swanepoel, F. J. C., G. W. Seifert and P. C. Lubout. 1992. The Relationship of Lifetime Fertility of Bonsmara Cows With Growth and Scrotal Circumference of Their Calves. Proc. Aust. Assoc. Anim. Breed. Genet. 10:362.

Toelle, V. D. and O. W. Robison. 1985. Estimates of Genetic Correlations Between Testicular Measurements and Female Reproductive Traits in Cattle. J. Anim. Sci. 60:89.

Tosh, J. J., R. A. Kemp and D. R. Ward. 1996. Estimates of Genetic Parameters for Pelvic Area and Age at Puberty in Beef Heifers. J. Anim. Sci. 74(Suppl. 1) (Abstr).

Werre, J. F. and J. S. Brinks. 1986. Relationships of Age at Puberty With Growth and Subsequent Productivity in Beef Heifers. J. Anim. Sci. (Abstr).

Wiltbank, J. N., K. E. Gregory, L. A. Swiger, J. E. Ingalls, J. A. Rothlisberger and R. M. Koch. 1966. Effects of Heterosis on Age and Weight at Puberty in Beef Heifers. J. Anim Sci. 25:744.

Wiltbank, J. N., C. W. Kasson and J. E. Ingalls. 1969. Puberty in Crossbred and Straightbred Beef Heifers on Two Levels of Feed. J. Anim. Sci. 29:602.

Table 1. Literature heritability estimates for Age at Puberty.

Source		h^2	± SE
Laster et al.	1979	0.41	.17
MacNeil et al.	1984	0.61	.17
Werre & Brinks	1986	0.67	.68
Smith et al.	1989	0.10	.17
Morris et al.	1992	0.33	.12
Morris et al.	1993	0.15	.09
Tosh et al.	1996	0.32	NA
Splan et al.	1996	0.43	NA

Table 2. Description of Reproductive Tract Score[a]

		Ovaries			
		Approximate Size			
RTS	Uterine Horns	Length (mm)	Height (mm)	Width (mm)	Ovarian Structure
1	Immature < 20 mm no tome	15	10	8	No palpable follicles
2	20-25 mm diameter no tome	18	12	10	8 mm follicles
3	25-30 mm diameter slight tone	22	15	10	8-10 mm follicles
4	30 mm diameter good tone	30	16	12	> 10 mm follicles CL possible
5	> 30 mm diameter good tone, erect	> 32	20	15	>10 mm follicles CL present

[a] From: Anderson KJ:MS Thesis, Colorado State University, 1987.

Table 3. Relationship of Reproductive Tract Score with reproductive traits in yearling heifers[a]

	Reproductive Tract Score				
Trait	1	2	3	4	5
Response to synchronization, %[b]	46	77	80	91	89
Preg. rate to synchronized breeding, %[b]	3	23	34	54	51
Preg. rate at end of breeding season, %[b]	28	74	78	93	85
Conception date, days[c]	19	10	2	4	0

[a] From Anderson et al. 1991.

[b] Average of four trials.

[c] Average of three trials and average number of days into the breeding season compared to RTS 5.

Genetic Improvement for Sex-Specific Traits in beef Cattle

Rebecca K. Splan
University of Nebraska-Lincoln
Lincoln, NE 68583-0908

Introduction

Beef cattle producers are increasingly concerned with the efficiency of their enterprises. To remain competitive, beef breeders must continue to improve both the reproductive efficiency of their cow herds as well as efficiency in production of the market animal. High levels of reproductive performance are essential because breeding females comprise a large part of the total beef cattle population and require a major portion of available resources. Low reproductive rates decrease total calf production, thereby decreasing returns on the producer's investment in the cow herd. Reproductive efficiency is also essential when making genetic improvement. Reduced calf crops increase the percentage of cows that must be saved for replacement and thus decrease the potential for genetic progress (Cundiff and Gregory, 1977). Production of lean growth is obviously of primary importance because it is the product consumers purchase and thereby shapes market trends and prices. Consumers have targeted products low in fat and high in nutritive value as preferred purchase items and producers must deliver a carcass that meets these criteria. Calves that are inferior for lean growth represent significant economic loss. Improvement of both reproductive and carcass traits is therefore an important goal for today's beef breeder.

The potential for change in these economically important traits is largely dependent on their genetic variation and correlations among them (Mohiuddin, 1993). If heritability is greater than zero, improvement can be made through selection. High heritabilities also imply more effective selection. Genetic correlations determine the directions and magnitudes of change caused by selection. They are used when selection is for more than one trait or when expected responses to selection are calculated. Producers need to be aware of possible antagonistic relationships among traits so that they may appropriately modify their breeding programs to incorporate these relationships. If unfavorable genetic correlations exist between female productivity and male carcass value, producers may need to employ selection indices that incorporate both reproductive and carcass traits (Cundiff and Gregory, 1977; Neibel and Van Vleck, 1982) or use specialized sire and dam lines (Smith, 1964).

The objective of this paper is to review literature concerning the relationships between female reproductive traits and male carcass traits in beef cattle. Knowledge of these correlations is essential for efficient cattle production.

Review of Literature

Currently, there is a paucity of information regarding relationships between traits measured on females and those measured on males (Dickerson et al., 1974; MacNeil et al., 1984; Koots et al., 1994b; Marshall 1994). Effective selection demands that these relationships be known, or production will not be optimized. Numerous studies have reported estimates of genetic or phenotypic parameters for reproductive, growth or carcass traits (reviews by Mohuiddin, 1993; Koots et al., 1994a,b), but few studies have reported estimates of the relationships among these groups of traits. Previous attempts to incorporate sex-specific characteristics into multiple-trait selection schemes have required the synthesis of parameter estimates from a variety of sources (Dickerson et al., 1974), due to lack of large data sets with both female and male traits measured and sufficient analytical methods to handle such large numbers of animals. Only recently have computer programs become available to estimate genetic correlations among different traits measured on related animals of different sexes (Boldman et al., 1995). However, despite the apparent lack of research on correlations among sex-specific traits in beef cattle, a few studies may provide some insight into these genetic relationships.

Recent work by Splan (1996) indicates that selection for certain traits in one sex may have adverse effects on traits observed in the opposite sex. Data from 3459 heifers and 4080 of their steer paternal half-sibs were obtained from the U. S. Meat Animal Research Center in Clay Center, NE and used to estimate genetic parameters of and among female growth and reproductive traits and male carcass traits. Table 1 illustrates estimates of genetic correlations among several female growth and reproductive traits and male carcass traits. Genetic correlations were moderate to high and positive for adjusted 205-d and 365-d heifer weights with the male carcass traits of hot carcass weight, estimated kidney, pelvic and heart fat percentage, ribeye area, adjusted fat thickness and taste panel flavor. These correlations indicate that heavier females have steer siblings with larger amounts of lean muscle as well as fat, presumably due to their own increased size. Heifer weights were also positively associated with fat percentage, negatively correlated with retail product percentage, and had little relationship with bone percentage. This implies that while measured amounts of lean increase in steers as heifer weights increase, retail product as a percentage of carcass weight decreases, while fat thickness and fat percentage increase. These results may represent an antagonistic relationship for beef cattle producers who often make selection decisions on the basis of weaning or yearling weight. In addition, selection for heavier female weaning weight may be associated with decreased tenderness of steer carcasses, as measured by both taste panels and the Warner-Bratzler shear force test.

Age at puberty in females was not correlated with any carcass trait except perhaps spuriously with the sensory traits of flavor and tenderness. Calving rate, defined as whether or not the heifer produced a live calf at parturition as a two-year-old, was positively correlated with measures of carcass fatness, such as fat percentage, estimated kidney, pelvic and heart fat percentage, adjusted fat thickness and marbling score, and was negatively correlated with bone percentage. This implies selection against fatness in steers may result in females that produce fewer live calves at parturition. Finally, calving difficulty was positively correlated with Warner-Bratzler shear force and negatively associated with taste panel tenderness. Care should be taken in consideration of the estimates of genetic correlations involving calving rate, taste panel flavor and taste panel juiciness, however, due to the undoubtedly large standard errors associated with them. The heritabilities of all three traits were estimated to be very low, and both sensory traits were represented by relatively few observations. Both of these factors would contribute to large standard errors for the estimates of genetic correlations.

A study by MacNeil et al. (1984) also yields evidence of unfavorable genetic relationships between female productivity and male carcass traits. Data from 187 sires with approximately four female and five male progeny each were used to estimate genetic correlations. It should be noted that these data were a subset of the group of animals previously mentioned in work by Splan (1996). Table 2 shows estimates of genetic correlations from MacNeil et al. (1984). These estimates imply selection for postweaning daily gain may result in heifers older and heavier at puberty. Selection would also result in females with higher conception rates, shorter maternal gestation length, reduced maternal calving difficulty, increased maternal birth weight and reduced maternal preweaning gain. These females would also be heavier as mature cows.

Selection of cattle with decreased fat cover has received considerable attention in recent years. While this practice may yield more desirable carcasses in market animals, an unfavorable response may result for female productivity. Results from MacNeil et al. (1984) suggest that selection for reduced fat trim in steers at a constant age would result in increased female age and weight at puberty, increased female mature weight, reduced maternal fertility, reduced maternal preweaning gain and increased maternal gestation length, calving difficulty and birth weight. These results are in agreement with those from Koch et al. (1982), which imply selection for decreased fat trim should result in heifers that reach puberty later but have greater calving difficulty. Speer (1993) also noted that sires selected to reduce fat in steer progeny may also produce daughters that are larger at maturity.

Finally, MacNeil et al. (1984) postulated that correlated responses from selection for heavier retail product or carcass weight in steers at a constant age are likely to be increased female age and weight at puberty, increased female mature weight, improved fertility, increased maternal gestation length and lower maternal preweaning gain. These females would also produce heavier calves but have reduced calving difficulty. The apparent inconsistency of a larger calf with less difficulty may be explained by the larger relative size of the female herself. This is supported by results from Koch et al. (1982), which indicate selection for increased retail product or carcass weight should result in heifers that are older at puberty and have less difficulty at parturition. Work by Speer (1993) also implies selection for increased ribeye area and decreased quality grade scores on a weight-constant basis would result in decreased mature weights of cows.

SUMMARY

As stated at the 1996 BIF Annual Meeting, "*Use of any data for the genetic improvement of carcass merit needs to include potential effects on reproduction and maternal ability to prevent the loss of functional efficiency in the cow herd*" (Green, 1996; emphasis in original). So far, there has been a disturbing lack of information linking the two generally well-documented areas of carcass merit in the male and reproduction in the female. This shortage of knowledge can only hinder progress in an industry were producers cannot afford to allow important information to be unused. Clearly there is a need for more studies to estimate genetic parameters among these sex-specific traits. What few applicable studies exist indicate selection for traits measured in one sex of beef cattle may yield unfavorable responses in traits measured in the opposite sex.

Antagonisms do not necessarily mean genetic improvement cannot be made in both traits simultaneously. However, antagonisms may indicate progress may be slowed in one or both traits as compared to selection for a single trait (Marshall, 1994). In order to generate a cost-effective product that meets consumer demands, producers need to be aware of correlated responses to selection (Bruns, 1994). Selection and breeding programs reflecting these genetic antagonisms may therefore become more prominent in the beef industry.

Various methods have been proposed to deal with economically important, but antagonistic, traits in beef cattle. One approach that might be employed is that of developing specialized sire and dam lines. Terminal sire lines with emphasis on carcass merit to be crossed with maternal dam lines selected for reproductive efficiency may be a viable option (Green, 1996). Speer (1993) noted that breeds that excel solely in carcass leanness typically have females that are older at puberty and have lower levels of efficiency. Breeds characterized by females with high fertility and maternal ability also tend to generate steers that are intermediate or poor in carcass composition traits. Use of breeds in particular roles could increase genetic progress for both types of traits. Another possibility is the use of index-selected general purpose populations (Smith, 1964). By incorporating both productivity and carcass traits into a selection scheme in generalized breeds, or those that are average or slightly above for all traits, genetic progress may also be made. Obviously, economic analysis of these and other approaches is needed in order to determine which system is most efficient or economically advantageous to the beef producer.

In conclusion, beef producers should realize that although more information needs to be gathered with respect to the relationship between female reproductive and male carcass traits, currently available evidence suggests there may be antagonistic genetic correlations among the important traits. These genetic relationships need to be accounted for in selection schemes and breeding programs. The opportunity for genetic progress exists in both female productivity and male carcass value, but may be achieved only with a thorough understanding of the relationship between both types of traits.

LITERATURE CITED

Bruns, K. W. 1994. Correlated response in growth, reproduction and maternal traits to selection for carcass and meat traits in beef cattle. Proc. Beef Improvement Federation 26th Research Symposium & Annual Meeting.

Boldman, K. G., L. A. Kriese, L. D. Van Vleck, C. P. Van Tassell and S. D. Kachman. 1995. A manual for the use of MTDFREML. A set of programs to obtain estimates of variances and covariances [draft]. U.S.D.A., A.R.S.

Cundiff, L. V. and K. E. Gregory. 1977. Beef cattle breeding. Agr. Info. Bull. No. 286.

Dickerson, G. E., N. Kunzi, L. V. Cundiff, R. M. Koch, V. H. Arthaud and K. E. Gregory. 1974. Selection criteria for efficient beef production. J. Anim. Sci. 39:659.

Green, R. D. 1996. Carcass EPDs: Put up or shut up!! Proc. Beef Improvement Federation 28th Research Symposium & Annual Meeting.

Koch, R. M., L. V. Cundiff and K. E. Gregory. 1982. Heritabilities and genetic, environmental and phenotypic correlations of carcass traits in a population of diverse biological types and their implications in selection programs. J. Anim. Sci. 55:1319.

Koots, K. R., J. P. Gibson, C. Smith and J. W. Wilton. 1994a. Analyses of published genetic parameter estimates for beef production traits. 1. Heritability. Anim. Br. Abstr. 62:309.

Koots, K. R., J. P. Gibson and J. W. Wilton. 1994b. Analyses of published genetic parameter estimates for beef production traits. 2. Phenotypic and genetic correlations. Anim. Br. Abstr. 62:825.

MacNeil, M. D., L. V. Cundiff, C. A. Dinkel and R. M. Koch. 1984. Genetic correlations among sex-limited traits in beef cattle. J. Anim. Sci. 58:1171.

Marshall, D. M. 1994. Breed differences and genetic parameters for body composition traits in beef cattle. J. Anim. Sci. 72:2745.

Mohiuddin, G. 1993. Estimates of genetic and phenotypic parameters of some performance traits in beef cattle. Anim. Br. Abstr. 61:495.

Neibel, E. and L. D. Van Vleck. 1982. Selection with restriction in cattle. J. Anim. Sci. 55:439.

Smith, C. 1964. The use of specialized sire and dam lines in selection for meat production. Anim. Prod. 6:337.

Speer, N. C. 1993. Genetic relationships between sex-specific traits in a crossbred beef cattle population. Ph.D. Dissertation. Colorado State Univ.

Splan, R. K. 1996. Genetic parameters for sex-specific traits in beef cattle. M. S. Thesis. University of Nebraska-Lincoln.

Table 1. Estimates of genetic correlations between female reproductive and male carcass traits[a]

			Female traits		
Male traits	Adj. 205-d weight	Adj. 365-d weight	Age at puberty	Calving rate	Calving difficulty
Hot carcass weight	.89	.83	.08	.13	.04
Retail product percentage	-.19	-.31	-.01	-.21	.12
Fat percentage	.18	.30	.01	.30	-.15
Bone percentage	-.02	-.08	-.01	-.52	.21
Ribeye area	.38	.31	.04	.18	.09
Est. kidney, pelvic & heart percentage	.35	.40	.01	.37	-.06
Adj. fat thickness	.35	.38	.01	.38	-.07
Marbling score	.22	.15	-.03	.39	-.06
Warner-Bratzler shear force	.31	.09	-.02	.13	.25
Taste panel tenderness	-.21	-.01	-.30	.09	-.32
Taste panel juiciness	1.00	1.00	-.97	1.00	-1.00
Taste panel flavor	.29	.52	-.33	1.00	-1.00

[a]Adapted from Splan (1996).

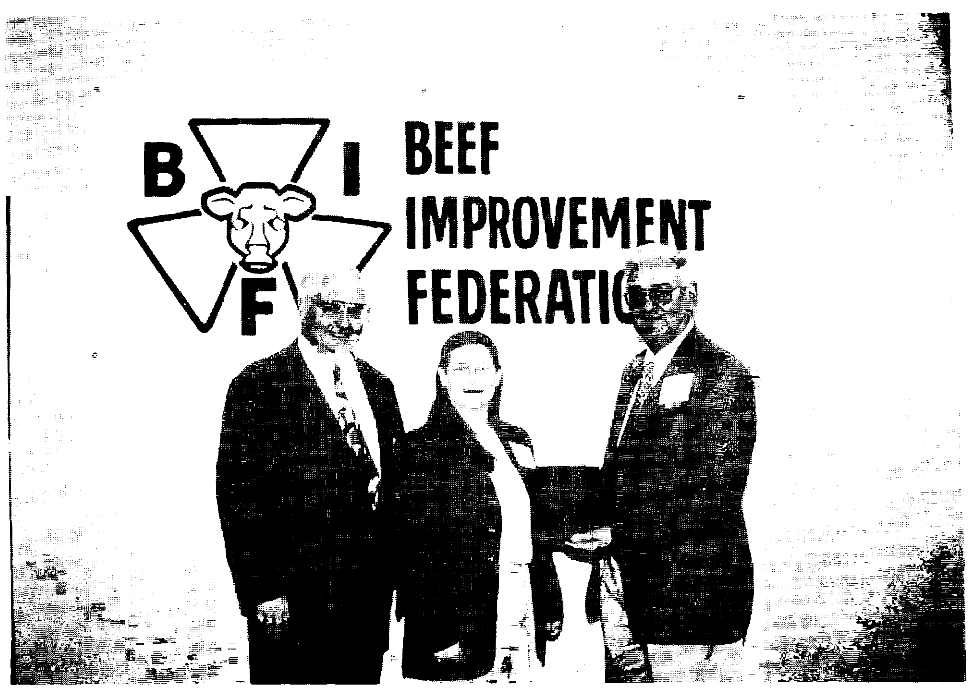
Table 2. Estimated genetic correlations between growth and composition traits measured on males and reproduction and productivity traits measured on female half-sibs[a]

Female traits	Male traits: Postweaning daily gain	Carcass weight	Fat trim	Retail product
Age at puberty	.16	.17	-.29	.30
Weight at puberty	.07	.07	-.31	.08
Conceptions/service	1.33	.61	.21	.28
Gestation length	-.10	.03	-.07	.13
Calving difficulty	-.60	-.31	-.36	-.02
Birth weight	.34	.37	-.07	.30
Maternal preweaning daily gain	-1.02	-1.00	-1.25	-.26
Mature weight	.07	.21	-.09	.25

[a]Adapted from MacNeil et al. (1984).

Frank Baker Memorial Scholarship Essay Award Recipients

Robert Williams
Larry Cundiff, Robert Williams, Burke Healey



Rebecca K. Splan
Burke Healey, Rebecca Splan, Larry Cundiff

Estimates of Heritabilities and Genetic Correlations For Carcass and Yearling Ultrasound Measurements in Brangus Cattle

D.W. Moser[1], J.K. Bertrand[1], I. Misztal[1], L.A. Kriese[2], L.L. Benyshek[1]
[1]University of Georgia
Athens, [2]Auburn University, Alabama

Carcass measurements of 12th rib fat (CARCFAT), ribeye area (CARCREA), and weight (CARCWT) on 2,028 Brangus and Brangus-sired fed steers and heifers and yearling weights (YWT) and ultrasound measurements of 12th rib fat (USFAT) and ribeye area (USREA) on 3,583 yearling Brangus breeding bulls and heifers were analyzed to estimate heritabilites and genetic correlations. A six-trait animal model and an average information restricted maximum likelihood algorithm were used. The analysis accounted for effects of contemporary group, breed of dam and age at slaughter or measurement. Heritabilities (diagonal), genetic correlations (above diagonal), and phenotypic correlations (below diagonal) are listed in the table below. Heritability of USFAT in breeding cattle was lower than CARCFAT, and variation of ultrasound measurements of fat thickness was considerably lower. Standard errors ranged from .01 to .06 for heritabilities and from .07 to .18 for genetic correlations. As in previous studies, the genetic correlation between fat thickness and ribeye area was negative in carcass data, but positive for ultrasound measurements, but both correlations were near zero. Genetic correlations between corresponding carcass and ultrasound traits were positive and moderate in magnitude. The relatively strong and favorable genetic relationships between CARCFAT and USFAT (.69) and between CARCREA and USREA (.66) indicate that ultrasound measurements of 12th rib fat and ribeye area in breeding cattle will be useful in predicting genetic values for carcass fatness and muscling.

	CARCFAT	CARCREA	CARWT	USFAT	USREA	YWT
CARCFAT	**.27**	-.05	-.10	.69	.12	-.19
CARCREA	-.03	**.39**	.12	.15	.66	.60
CARCWT	.22	.40	**.59**	-.15	.41	.61
USFAT				**.11**	.13	.11
USREA				.11	**.29**	.49
YWT				.13	.41	**.40**

Key Words: Beef cattle, Genetic parameters, Ultrasound

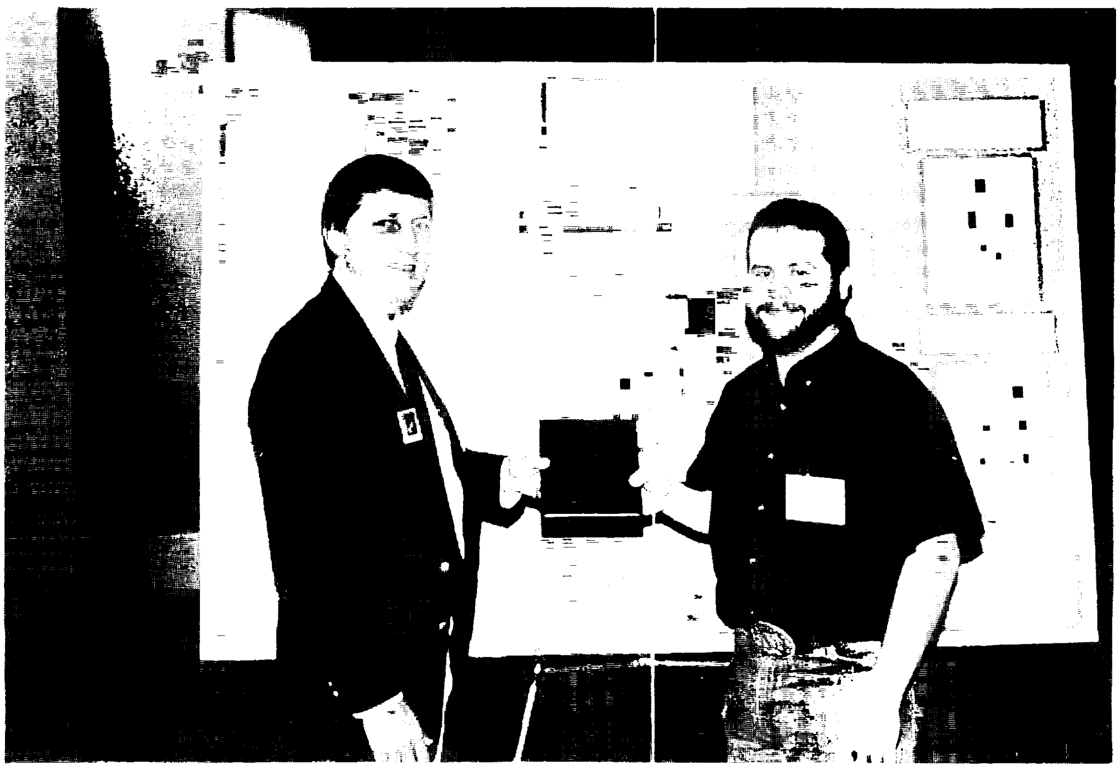
Additive Genetic Relationships Between Heifer Pregnancy, Subsequent Rebreeding and Stayability in Angus Females

S.P. Doyle*, B.L. Golden, J.S. Brinks, R.G. Mortimer, R.D. Green
Colorado State University
Fort Collins, Colorado

The objective of this study was to determine the nature of additive genetic relationships between heifer pregnancy (HP), subsequent rebreeding (SR) and stayability (ST) in an experimental population of Angus females. Data included pedigree information for 20,445 animals with observations for HP on 1,310 Angus heifers, for SR on 789 Angus two-year-olds, and for ST (the probability of a female having five calves given she becomes a dam) on 3, 109 Angus females from the John E. Rouse Colorado State University Beef Improvement Center, Saratoga, WY. Additive genetic groups were used in determining the relationships among these fertility traits. Breeding value predictions were obtained for each trait using a maximum *a posteriori* (MAP) probit threshold model. Additive genetic groups were then formed on one trait's breeding values and used in the prediction of another trait's breeding values. When HP additive genetic groups were included in the genetic prediction of SR, MAP procedures failed to converge. When HP additive genetic groups were included in the genetic prediction of ST, the high HP group exhibited high ST with the moderate HP group exhibiting low ST. When SR additive genetic groups were included in the genetic prediction of HP, animals grouped on moderate SR breeding values exhibited the lowest percent probability for HP; however, interpretation of results involving SR requires caution due to the use of a h^2 from an analysis of SR with a 53.7% convergence rate. When SR additive genetic groups were used in the prediction of ST breeding values, the high SR group exhibited higher ST compared to both low and moderate SR genetic groups. When ST additive genetic groups were fit into the genetic prediction of HP, group differences were nonsignificant and may have been due to random chance. The high ST group exhibited low HP with the moderate ST group exhibiting high HP. When ST additive genetic groups were used in the prediction of SR breeding values, the high ST genetic group exhibited higher SR compared to the low and moderate ST additive genetic groups. The additive genetic relationships among HP, SR and ST were non-linear. The potential non-linear relationships seen between HP, SR and ST indicate that selection for improved female fertility will be most effective by having genetic predictions of all three traits.

Key: Beef Cattle, Pregnancy, Fertility

Dan Moser, 1st Place
Burke Healey, President; Dan Moser; Larry Cundiff



Patrick Doyle, 2nd Place
Ron Bolze, Executive Director; Patrick Doyle

Minutes of Beef Improvement Federation
Midyear Board of Directors Meeting
Barclay Lodge
YMCA of the Rockies
Estes Park, Colorado
October 3 and 4, 1996

The Beef Improvement Federation Board of Directors held it's Midyear Board meeting at the Barclay Lodge, YMCA of the Rockies in Estes Park, Colorado on October 3 and 4, 1996.

Board members present for the meeting were Burke Healey, President, Ron Bolze, Executive Director, Bill Able, Willie Altenburg, Kent Anderson, Don Boggs, John Crouch, Larry Cundiff, Jed Dillard, Jim Doubet, S.R. Evans, Jr., Galen Fink, Ronnie Green, Roger Hunsley, John Hough, Gary Johnson, Dan Kniffen, Lee Leachman, Mike Schutz, Norman Vincel and Richard Willham. Board members not in attendance were Glenn Brinkman, Roy McPhee and Ronnie Silcox.

Also attending the meeting were Larry Corah, KSU Beef Extension Specialist and Facilitator of the BIF Future Focus effort, Lisa Kriese, Auburn Beef Extension Specialist and host of the 1996 Birmingham Convention, Kris Ringwall, NDSU Beef Extension Specialist and host of the 1997 Dickinson Convention and Herb McLane, Executive Director, Canadian Beef Breeds Council.

FUTURE FOCUS TASK FORCE DISCUSSION - President Healey opened the Future Focus discussion session at approximately 3:40 pm on Thursday, October 3, 1996. Copies of the Executive Summary of the BIF Future Focus Task Force meeting held June 28, 1996, at the KCI Embassy Suites in Kansas City, Missouri, were distributed. Facilitator, Larry Corah, briefly summarized the recommended courses of action and breakout sessions. Random discussion followed with much reference to BIF's mission statement and/or objectives as found in the By-Laws. Hunsley questioned if the discussion of BIF's strengths versus weaknesses was organizational versus producer driven. It was suggested that conventions include separate producer oriented and more technical academic oriented sessions. Discussion of committee structure revealed the need for the appointment of individuals to mission oriented, action teams which could function outside the conventions structure. Conventions would then serve exclusively for technology transfer. Convention restructuring discussion involved spring versus summer format, awards continuation, trade show pros and cons, computer software displays, hands-on workshops, state level Beef Cattle Improvement Association (BCIA) displays, new technological tools display, poster sessions for graduate students possibly as part of the Frank Baker Memorial Award contest and evening question and answers sessions featuring speakers from the morning general sessions. Standing committee discussion involved the creation of action teams designed to address an issue of relevance at the time. The action teams would be dynamic, evolving over time with a life expectancy necessary to resolve the issue. Action team chairmen would be appointed from the Board with a known tenure. The Board would review individual committee relevance on a committee by committee basis.

Facilitator Corah concluded his comments by citing BIF's past accomplishments and with encouragement to continue to provide leadership for greater uniformity in Beef Cattle Improvement programs. President Healey thanked Corah for his involvement in the BIF Future Focus effort. President Healey then dismissed the group for the evening.

The Board of Directors reconvened at 8:12 am, Friday, October 4, 1996. President Healey recognized Bill Able representing the American-International Charolais Association in Doug Husfeld's absence.

1997 CONVENTION UPDATE - Kris Ringwall, North Dakota State University (NDSU) Beef Extension Specialist and host of the 1997 Convention scheduled for May 14-17, 1997, in Dickinson, North Dakota, provided an update on the Convention planning process. Kris was in the process of developing a pre-registration brochure to be included as part of the next BIF Update mailing.

1998 CONVENTION UPDATE - Mike Schutz reported that Canadian Beef Improvement (CBI) was no longer operational and that he would no longer represent the Canadian beef cattle industry on the Board. He introduced Herb McLane, Executive Director of the Canadian Beef Breeds Council as the Canadian connection for 1998 Convention planning. McLane indicated that numerous committees were already operational and that he looked forward to serving in this capacity. Discussion followed involving a potential Convention date change to be held in close proximity to the Calgary Stampede. Vincel moved and Altenburg seconded to change the dates of the 1998 BIF Convention to Tuesday, June 30 - Friday, July 3. Motion carried. President Healey thanked Schutz for his involvement with the Board and wished him luck with future endeavors. He also encouraged a close working relationship with Herb McLane in preparation for the 1998 Convention in Calgary, Alberta, Canada.

FUTURE FOCUS REVISTED - President Healey reconvened discussion on the Future Focus recommendations. Willham provided his views on how and why BIF has evolved to the organization it is today and some visions for the future. President Healey prioritized further Future Focus discussion to follow the following order: committee structure, genetic improvement and whole herd level production and financial data collection, educational efforts, genetic evaluation of end product characteristics, research focus, genetic prediction, standardization of methodology and annual convention restructuring.

Committee Structure (#2) - Discussion involved open versus closed committee format. Dillard moved and Crouch seconded empowering the committee chairman to appoint a steering committee or action team which would develop committee recommendations for Board approval. Motion carried. Leachman moved and Doubet seconded to review individual committees and chairman every three years with the option to extend. Motion carried.

Genetic Improvement and Whole Herd Level Production and Financial Data Collection (#1 & #4) - Boggs suggested that these two recommendations involved systems economic analysis and whole herd versus individual analysis. Kniffen discussed the NCBA supported modeling research effort involving Tom Jenkins and Rick Bourdon. Hunsley and Able expressed concern about breed association adopting and/or application of whole herd reporting. Anderson moved and Dillard seconded acceptance of these two Future Focus recommendations. Motion carried.

Educational Efforts and Regional Meetings (#3) - Crouch questioned if the regional secretaries really have the time or resources to conduct regional educational events. Enhanced Cooperative Extension Service involvement was discussed. Dillard suggested that BIF's Homepage on the World Wide Wed should enhance our educational efforts. Leachman challenged the individual committee chairmen to utilize technology from world wide sources. Kniffen suggested future Board meetings at locations where new technology is available. Kniffen moved and Evans seconded to encourage world wide participation, however, to continue to hold the annual convention in North America. Motion carried. Vincel moved and Boggs seconded to accept this recommendation. Motion carried.

Genetic Evaluation of End Product Characteristics (#6) - Healey questioned if this was really BIF's role or would it more effectively and appropriately be handled by NCBA. It was suggested to change the word "capture" to "measure". Altenburg moved and Fink seconded to accept this recommendation. Motion carried.

Research Focus (#7) - After minimal discussion, Dillard moved and Hough seconded acceptance of this recommendation. Motion carried.

Genetic Prediction (#9) - Consensus was that this was and should continue to be BIF's central theme and true mission. Dillard moved and Kniffen seconded to accept this recommendation. Motion carried.

Standardization of Methodology (#8) - Again, the consensus was that one of BIF's objectives was and should continue to be greater uniformity and standardization of beef improvement programs. Kniffen moved and Crouch seconded acceptance of this recommendation. Motion carried.

Annual Convention Restructuring (#10) - It was concluded that this was the same as #5 which was discussed and accepted previously.

Future Focus discussion was concluded at 10:45 am. President Healey would revise the Executive Summary to reflect approved changes and develop a news release to be distributed to beef cattle publications nationwide.

MIDYEAR BOARD MEETING - President Healey called the meeting to order at approximately 4:05 pm on Friday, October 4, 1996, and the following items of business were transacted. John moved and Kniffen seconded to clear the agenda. Motion carried.

Minutes of Previous Meeting - Copies of the minutes from the previous Board meeting held May 15, 1996, at the Sheraton Civic Center, Birmingham, Alabama, were distributed by Bolze. Kniffen moved to approve and wave reading of the minutes. Dillard seconded and the minutes were approved.

Financial Report - Bolze provided copies of the Statement of Assets, Liabilities and Fund Balance (Cash Basis); and copies of the Statement of Revenues and Expenses (Cash Basis) for the period of time including January 1, 1996 - October 5, 1996. With most of the cash reserves committed to a Certificate of Deposit with a maturity date of Spring, 1997, insufficient funds were present in the checking account to cover short term, projected expenses. Hough moved and Altenburg seconded Executive Director authorization to borrow up to $10,000 to cover immediate cash needs. Motion carried. Dillard moved and Kniffen seconded acceptance of the financial report. Motion carried.

Executive Travel - Crouch moved and Altenburg seconded approval of $1000 for Executive Director travel. Motion carried.

1996 Convention Financial Report - Lisa Kriese, Auburn Beef Extension Specialist and host for the 1996 BIF Convention held in Birmingham, Alabama on May 15-18, 1996, provided copies of the 1996 Convention financial report. Lisa reported that 329 people attended the Convention and that the Alabama Beef Cattle Improvement Association had $2,427.55 left after paying all bills. The Board expressed gratitude to Kriese and her associates who planned, coordinated and implemented a highly successful BIF Convention.

1997 Dickinson Convention Report - Johnson, Chairman of the 1997 Dickinson Convention planning committee, consisting of Ringwall, Healey, Altenburg, Crouch, Hough, Anderson and Bolze, reported that the committee had met previously that day. Also in attendance were Able, Dillard, Evans, Fink and Kniffen. Ringwall, North Dakota State University Beef Extension Specialist and host of the 1997 Convention, distributed a tentative Convention program and budget. The 1997 Convention is scheduled for May 14-17, 1997, at the Dickinson, North Dakota Hospitality Inn. The Convention theme will center around "Cattle Traditions, Emotions and Business". The Convention will start with a Wednesday evening National Association of Animal Breeders (NAAB) Symposium with program content and speakers to be announced later. The Board discussed the various topics and potential back-up speakers. Kniffen moved and Evans seconded acceptance of the 1997 Convention program content. Motion carried. Ringwall committed to brochure development in time for the next BIF Update mailing in late November. Bozle agreed to make initial contact with proposed speakers. Green agreed tc chair a poster session designed for greater graduate student involvement. Ringwall solicited Board input into the appropriateness of a trade show. Kriese questioned time constraints. Kniffen questioned if anyone involved had the time to effectively coordinate the trade show. Healey questioned if BIF really wanted to be involved with the commercialism. Fink indicated that the coffee sponsors (AI firms) represent commercial companies. Leachman moved and Crouch seconded that the trade show not be held in conjunction with the Convention. Motion carried. Ringwall indicated that the North Dakota Purebred Council would likely display a showcase of live animals, however, away from the Convention site and likely on the grounds of the experiment station.

Whole Herd Reporting - Hough distributed a draft version of BIF recommendations to national level breed associations concerning Whole Herd Reporting (WHR). Evans requested breed association positions on WHR from those breed representatives in attendance. Crouch reported that the American Angus Association has not addressed the issue. Hough reported that current computer constraints have prevented the American Hereford Association adoption of WHR. Leachmen reported that the Red Angus Association of America had initiated WHR and already implemented the process. Anderson reported that the North American Limousin Foundation would address the issue at a January, 1997 Board meeting. Able reported that the American International Charolais Association Board has already voted not to implement WHR. Doubet indicated that the American Salers Association has a fee structure of $2.50/hd for each female still on the active list. Hough indicated the WHR concept goes beyond fee structure. Evans reported that the Angus herd management software requires current inventories and that many Angus breeders use the software to transfer performance data to the association. Leachman moved and Doubet seconded to accept the draft version of BIF's recommendations on WHR and that a copy be sent to every national level dues paying breed association in the United States and Canada. Motion carried.

Nominating Committee - President Healey appointed the Nominating Committee to include Brinkman, Chairman, Green, Hough and Healey.

Awards Committee - President Healey appointed the Awards Committee to include Vincel, Chairman, Altenburg, Anderson, Dillard and Silcox. Vincel reported that the 1997 Convention seedstock and commercial nominee introduction process will be part of the Thursday morning general session following a business discussion of seedstock and commercial production. The committee would handle Pioneer, Ambassador and Continuing Service Awards. The Executive Director would handle the seedstock and commercial producer evaluation process.

The Midyear Board meeting was adjourned for the evening.

President Healey reconvened the Midyear Board meeting at 8:12 am, Saturday, October 5, 1996.

Future Direction of Canadian Performance Programs - With the termination of Canadian Beef Improvement, the question was raised about what role BIF could or should play in future Canadian performance program developments. With the likelihood of more Canadian breed associations sharing their data bases for international evaluations conducted by land grant universities in the United States, it was suggested that Canadian performance direction was already progressing. However, Schutz indicated that historically, the evaluation of performance records on commercial cattle has been a significant part of the Canadian program and he suggested that a letter be written to Charles Gracey. Altenburg moved and Dillard seconded that a letter be sent to Charles Gracey offering BIF support of genetic evaluation of, not only breed association data, but also commercial data. Motion carried.

Standing Committee Reports -

A. Biotechnology - Ronnie Green, Chairman

Green reported that Sue Denise, University of Arizona, Jerry Taylor, Texas A & M and he were developing a Biotechnology fact sheet in laymen's terminology for later Board review and approval. No Board action required.

B. Central Test and Growth - Ronnie Silcox, Chairman

In Silcox's absence, no report was given. No Board action required.

C. Genetic Prediction - Larry Cundiff, Chairman

Cundiff needed to leave the Midyear Board meeting early, so Willham reported that the WRCC-100 Regional Beef Cattle Genetics Research Committee was involved with genetic prediction, across breed EPDs and index selection - all of which would be reported upon at the 1997 Convention. No Board action required.

D. Integrated Genetic Systems - John Hough, Chairman

Hough distributed copies of an agenda of the Index Selection Workshop developed by Rick Bourdon and Scott Newman and scheduled for November 14-16 in Estes Park, Colorado. Hough indicated that a proceedings would be printed. The Board had previously approved $1000 financial support of the workshop. No Board action required.

E. Live Animal and Carcass Evaluation - John Crouch, Chairman

Crouch distributed copies of an agenda of the Ultrasound Technicians Workshop scheduled for December 9 and 10 at the KCI Embassy Suites, Kansas City, Missouri. Crouch also reported on the last ISU Ultrasound Certification Workshop which attracted 43 participants and resulted in 19 certifications. Crouch reported that, currently, 41 individual were certified for ultrasonic evaluation of external fat and ribeye area (including those certified in 1995). Evans questioned if standardization of ultrasound software could be a reality. Crouch reported that Lisa Kriese and William Herring have compared software packages and the results would be presented at the workshop. Crouch indicated that North American Ultrasound Practicianers Association would likely be formed. Crouch expressed concern that technicians feel that BIF would prefer limited involvement. Green suggested continued involvement to help insure unbiased results. Evans requested information on the current status of machine grading of beef carcasses (video image analysis) and suggested discussion in a committee meeting. Healey suggested that Del Allen would be an appropriate speaker due to Excel Corporation's experience. Crouch praised ultrasound application at feedlot reimplantation time, however, cited that most commercial feedlots would still prefer whole pen merchandising. No Board action required.

F. Reproduction - Bruce Cunningham, Chairman

In Cunningham's absence, Hough reported that the Reproduction and System's Committees should consider meeting jointly. No Board action required.

Standing Committee Changes and Recommendations

A. Biotechnology - Green expressed that this committee was in its infancy, requiring great synthesis and invisioned an expanded BIF educational role involving Marker Assisted Selection (MAS), DNA fingerprinting, standardization issues, sexed semen, etc. Hough suggested that the Board play a larger role in committee efforts and the expansion of Biotechnology to include other technologies. Anderson moved and Evans seconded to change the name of this committee to "Emerging Technologies" committee. Motion carried. Green would remain as Chairman and the committee would be reevaluated in three years at the Midyear Meeting (1999).

B. Central Test and Growth - Leachman moved and Dillard seconded to visit with Silcox and if no strong objectives existed, the committee should be dissolved. Johnson questioned who would revise the central test portion of the "Guidelines for Uniform Beef Improvement Program" for the next revision. Willham amended the original motion to reconstitute a central test writing committee for the next Guidelines revision. Vincel seconded the amendment. Amendment passed. Original motion carried. Green questions what role BIF could play in standardizing information generated by centralized heifer development facilities. Evans questioned if sire group differences in fertility could potentially have genetic evaluation applications.

C. Genetic Prediction - Leachman moved and Doubet seconded continuation of this committee for one year. Committee continuation would be evaluated at the Midyear Board meeting in 1997. Cundiff would remain chairman. Motion carried.

D. Integrated Genetic Systems - Green suggested that whole herd analysis was the current committee issue. Leachman suggested whole herd analysis and index selection/multiple trait selection as two current, yet diverse issues. Hough moved and Altenburg seconded abolishing the "Integrated Genetic Systems" and "Reproduction" committees and replacing them with "Whole Herd Analysis" and "Multiple Trait Selection". Motion carried. Johnson moved and Leachman seconded to approve Healey's appointments of Hough and Anderson as Chairmen of Whole Herd Analysis (2 years until review, 1998) and Multiple Trait Selection (3 years until review, 1999), respectively. Motion carried.

E. Live Animal and Carcass Evaluation - Leachman moved and Kniffen seconded to continue the committee with Crouch as chairman for one year and re-evaluate in 1997. Motion carried.

F. Reproduction - The Reproduction Committee was abolished during discussion of Integrated Genetic Systems.

Hough moved and Willham seconded that committees and/or chairmen scheduled for re-evaluation be discussed at the Midyear Board meetings. Motion carried.

BIF Operating Budget for 1997 - Bolze distributed copies of a proposed 1997 BIF operating budget showing 1) 1996 approved budget; 2) 1996 income and expenses to date; and 3) 1997 proposal. Changes in the 1996 budget included $1000 financial support to each of two workshops later in 1996 (Index Selection and Ultrasound Technicians); and 2) $1000 for Executive Director travel. Changes in the 1997 proposed budget included 1) $600 for poster session winners; and 2) $2000 for support of various yet-to-be determined workshops. Altenburg moved and Crouch seconded for revised 1996 and 1997 budget approval. Motion carried.

Convention Poster Session - Green questioned if the Frank Baker Memorial Essay Contest and Competitieve poster session should be tied together. Hough cited Convention time constraints. Leachman moved and Vincel seconded $600 for Poster Session Awards (1st-$300, 2nd-$200, 3rd-$100). Motion carried. Vincel moved and Altenburg seconded to include this in the approved budget for 1997. Motion carried.

1997 Midyear Board Meeting - Bolze reported that the Estes Park, YMCA of the Rockies, Barclay Lodge was available October 17-19, 1997. Healey reported that Jim Schaefer from the NOBEL Foundation near Ardmore, Oklahoma had extended an invitation to use their facilities October 10-12 or 24-26, 1997. Discussion followed citing advantages for both locations. Fink moved and Evans seconded acceptance of the NOBEL Foundation invitation for October 10-12, 1997. Motion carried.

Old Business - President Healey called for the presentation of any old business. None was presented.

New Business - President Healey called for the presentation of any new business. Green reported that Tom Field, CSU, and Steve Radakovich had expressed concern about inadequate performance data being utilized in collegiate livestock judging contests. Field had prepared a survey to be sent to judging contest superintendents and Animal Science department chairmen. Anderson cited that a BIF fact sheet concerning the use of performance data in judging contests has been available for a few years. Altenburg moved and Leachman seconded for BIF and CSU to jointly distribute the survey. Motion carried. Altenburg suggested that survey results be reported at the Convention. Anderson agreed to have the information presented in the Multiple Trait Selection committee.

There being no further business, President Healey adjourned the 1996 BIF Midyear Board meeting at 10:45 p.m.

Respectfully Submitted, RB
Ron Bolze, Executive Director
Beef Improvement Federation

BEEF IMPROVEMENT FEDERATION

ANNUAL REPORT

DECEMBER 31, 1996

ROGER D KOUGH
ACCREDITED BUSINESS ACCOUNTANT
190 WEST 6TH STREET
COLBY, KANSAS 67701
(913) 462-3182

Beef Improvement Federation
Ron Bolze, Executive Director

I have compiled the accompanying Statement of Assets, Liabilities and Fund Balance - Cash Basis - of The Beef Improvement Federation, a not for profit organization, as of December 31, 1996 and the related Statement of Revenues and Expenditures - Cash Basis - for the twelve months then ended. The financial statements have been prepared on the cash basis of accounting, which is a comprehensive basis of accounting other than generally accepted accounting principles.

A compilation is limited to presenting, in the form of financial statements, information that is the representation of the officers of the Federation. I have not audited or reviewed the accompanying financial statements and, accordingly, do not express an opinion or any other form of assurance on them.

Management has elected to omit substantially all of the disclosures required by generally accepted accounting principles. If the omitted disclosures were included in the financial statements, they might influence the user's conclusions about the Federation's financial position, results of operation, and cash flows. Accordingly, these financial statements are not designed for those who are not informed about such matters.

The effects on these financial statements of the above described adjustments, required under generally accepted accounting principles have not been determined by management.

Respectfully Submitted,

Roger D Kough

Roger D. Kough

May 14, 1997

BEEF IMPROVEMENT FEDERATION

STATEMENT OF REVENUES AND EXPENDITURES
CASH BASIS

For The Twelve Months Ending December 31, 1996

REVENUES

Dues	$ 10,451.90	
Proceedings & Guidelines	7,163.04	
Interest	2,247.13	
Mid-Year Board Mtg Reimbursements	4,008.88	
Total Revenues		$ 23,870.95

EXPENDITURES

Guideline Revisions	$ 10,348.46	
BIF Home Page	600.00	
Bank Charges	103.67	
Board Meetings	3,353.43	
Convention	2,685.87	
Future Focus	3,143.78	
Genetic Prediction Workshop	1,972.88	
Miscellaneous	58.89	
Multitrait Analysis Workshop	1,000.00	
NAILE Awards	297.00	
Office Supplies	206.21	
Postage & Freight	5,048.23	
Printing	635.00	
Professional Fees	305.00	
Telephone	279.94	
Travel - Executive Director	1,000.00	
Ultrasound Certification Workshop	2,207.20	
Total Expenditures		33,245.56
Excess of Expenditures over Revenues		$ 9,374.61

See Accountant's Compilation Report

BEEF IMPROVEMENT FEDERATION

STATEMENT OF ASSETS, LIABILITIES AND FUND BALANCE
CASH BASIS

December 31, 1996

ASSETS

Cash In Bank	$ 0.00
Certificate of Deposit	47,765.62
Total Assets	$ 47,765.62

LIABILITIES & FUND BALANCE

Bank Overdraft	$ 163.09
Fund Balance - December 31, 1995	56,977.14
Current Year Deficit	(9,374.61)
Total Fund Balance - December 31, 1996	47,602.53
Total Liabilities and Fund Balance	$ 47,765.62

See Accountant's Compilation Report

AGENDA

BIF Board of Directors Meeting
Hospitality Inn
Dickinson, North Dakota
Wednesday, May 14, 1997

1) Clear Agenda - Burke Healey
2) Minutes of Previous Meeting - Ron Bolze
3) Financial Report - Ron Bolze
4) Membership Report - Ron Bolze
5) Report of Dickinson Convention - Kris Ringwall and Keith Helmuth
6) Plans for the 1998 Convention in Calgary - Herb McLane
7) Proposal for 1999 Convention in Virginia - Norm Vincel / Ike Eller
8) Ultrasound Technicians Workshop Report - John Hough
9) Multiple Trait Selection Workshop Report - Kent Anderson
10) International Committee for Animal Recording (ICAR) - W.G. Wisman
    Director of Regelgeving Veeverbetering Mederland RVN and President of ICAR- Ron Bolze
11) Standing Committee Reports - Plans for the Convention
    a) Emerging Technologies - Ronnie Green
    b) Genetic Prediction - Larry Cundiff
    c) Live Animal and Carcass Evaluation - John Crouch
    d) Multiple Trait Selection - Kent Anderson
    e) Whole Herd Analysis - John Hough
12) Frank Baker Scholarship Awards - Larry Cundiff
13) Poster Sessions - Ronnie Green
14) Election of New Officers - Nominations Committee - Glenn Brinkman, Chairman
15) Awards - Awards Committee - Norm Vincel, Chairman
16) Plans For New Director Caucuses - Norm Vincel
17) Executive Director Replacement - Ron Bolze
18) Midyear Board Meeting - October 10-12, Noble Foundation, Ardmore, OK
19) Appointment of 1998 Convention Program Committee - Burke Healey
20) New Business - Burke Healey
21) Adjourn

Minutes of Beef Improvement Federation
Board of Directors Meeting
Hospitality Inn
Dickinson, North Dakota
May 14 - 17, 1997

The Beef Improvement Federation Board of Directors held it's Convention at the Hospitality Inn in Dickinson, North Dakota on May 14 through 17, 1997.

Board members present for the meeting were Burke Healey, President; Gary Johnson, Vice President; Ron Bolze, Executive Director; Willie Altenburg, Kent Anderson, Don Boggs, John Crouch, Larry Cundiff, Jed Dillard, Jim Doubet, S.R. Evans, John Hough, Roger Hunsley, Lee Leachman, Herb McLane, Ronnie Silcox, Norm Vincel and Richard Willham. Board members not in attendance were Bill Able, Glenn Brinkman, Larry Corah, Galen Fink, Ronnie Green and Roy McPhee.

Also attending the meeting were Chad Stine representing Bill Able and the American International Charolais Association; Kris Ringwall, Keith Helmuth and Ron Bowman, representing the 1997 Convention hosts; Ike Eller, representing the 1999 proposed Convention hosts; and W.G. Wisman, representing the International Committee on Animal Recording (ICAR) from the Netherlands.

President Healey called the meeting to order at approximately 2:15 pm on Wednesday, May 14, 1997 and the following items of business were transacted.

President Healey called for self introductions.

President Healey cleared the agenda with nothing new added to the list of agenda items for discussion. Willham moved and Dillard seconded agenda approval. Motion carried. Bolze circulated a Board of Directors listing for correction of addresses, phone and fax numbers and for inclusion of e-mail addresses where appropriate.

Minutes of the Previous Meeting - Bolze distributed copies of the minutes from the previous midyear Board meeting held October 3 and 4, 1996, at the Barclay Lodge, YMCA of The Rockies, Estes Park, Colorado. Hunsley moved to approve as presented and waive reading of the minutes. Willham seconded and the minutes were approved as written.

Financial Report - Bolze distributed copies of the Statement of Assets, Liabilities and Fund Balance (cash basis) for December 31, 1996 and May 14, 1997. Bolze also provided copies of the Statement of Revenues and Expenses (cash basis) for the periods of time including January 1, 1996 - December 31, 1996 and January 1, 1997 - May 14, 1997. Dillard moved and Crouch seconded acceptance of the 1996 financial report. Motion carried. Altenburg moved and Dillard seconded acceptance of the 1997 financial report. Motion carried.

Membership Report - Bolze distributed copies of the membership report. The report showed that 31 state organizations, 27 breed associations and 18 other firms or individuals had paid membership dues as of May 14, 1997. Concern was expressed that dues notices had not been received. Bolze indicated that dues solicitation notices had been mailed to all previously paid member organizations the second week of December, 1996, along with Seedstock and Commercial Award nomination materials. Second notices were sent to all unpaid memberships in early April, 1997, along with telephone contact. It was suggested that first dues notices and award nomination materials be sent under separate cover. Evans moved to allow non-paid dues members to vote in subsequent caucuses for election of Board members. Crouch seconded and motion carried.

International Committee on Animal Recording (ICAR) - Bolze introduced Dr. W. G. Wisman, President of ICAR, from the Netherlands. Wisman shared some ICAR historical perspective beginning with dual purpose cattle milk recording in 1951 and evolving to multiple species recording of multiple traits today. Currently 42 member countries submit records for international evaluation. The structure of ICAR involves subcommittees, working groups and task forces charged with specific objectives. The beef cattle working group, entitled Interbull, currently involves 20 countries working on performance recording of milk traits and beef cattle genetic evaluations. Dr. Wisman suggested that BIF be represented at the next ICAR conference in New Zealand in 1998. Altenburg indicated that dairy bulls evaluated through Interbull were superior to U.S. dairy genetics and that beef production in most ICAR participating countries was dual purpose. Willham cited that , technically, ICAR represents the umbrella organization under which BIF should contribute. Hunsley expressed concern that ICAR promotes maximum milk/maximum growth concepts which logically fit dual purpose production. Altenburg expressed need to have input into establishing ICAR standards for greater uniformity in performance recording. Anderson stated that the North American Limousin Foundation recently communicated with six European countries which participate with ICAR. Altenburg expressed that BIF needs to be part of global evaluation and advised not to underestimate the power of ICAR's potential. Anderson stated that, ideally, global evaluations should be done in the U.S. Crouch suggested that ICAR involvement could contribute to more effective movement of semen and embryo's internationally. Willham moved and Hunsley seconded to appoint a committee to meet with Wisman during the Convention and report back to the Board Friday night. Motion carried. President Healey appointed the committee to include Hunsley, chairman, Crouch and Evans.

Plans for 1997 Convention - President Healey recognized Kris Ringwall and Keith Helmuth as Convention hosts. Ringwall introduced Ron Bowman, North Dakota Beef Cattle Improvement Association President, as one of many individuals playing a significant role in Convention planning and implementation. Bowman brought the Board up to date on Convention activities, preregistration numbers and sponsorships. The Board expressed thanks to Ringwall, Helmuth, Bowman, The North Dakota Beef Cattle Improvement Association, North Dakota State University, Dickinson State University and the North Dakota Stockmen's Association for a job well done. Ringwall indicated that a Letter of Intent had been signed opting for BIF to underwrite up to a $5000 convention loss in exchange for splitting convention profits.

Ultrasound Technicians Workshop Report - Hough reported on the first annual symposium and workshop for beef ultrasound technicians held at the KCI Airport Embassy Suites in Kansas City, Missouri, on December 9 and 10, 1996. The workshop was designed specifically for ultrasound technicians and attracted 50-60 people. The group established the North American Ultrasound Practitioners Association (NAUPA) with a board of directors, officers and by-laws. One of the objectives of the NAUPA was to assume responsibility for ultrasound certification in future years. Boggs suggested that it would be appropriate for the NAUPA to become a member of BIF.

Multiple Trait Selection Workshop Report - Anderson reported on the Multiple Trait Selection Workshop held at the YMCA of the Rockies near Estes Park, Colorado, on November 14-16, 1996. The workshop was designed specifically for university beef cattle geneticists, both domestic and foreign, and some national level breed association representation with 25-30 in attendance. Anderson stated that one objective was to explore technologies that have the potential to quantify the economic value of making genetic change over time. Australian researchers were present and demonstrated multiple trait selection software called Breed Object. Rick Bourdon presented the concept of physiological breeding values. Tom Jenkins reported on the current status of the NCBA/ IRM/ SPA production sponsored modeling efforts. Discussion followed concerning potential modeling software utilization and distribution. Leachman suggested taht BIF could potentially play a role in bridging the gap between software developers and the ultimate users.

Standing Committee Reports - Plans for the Convention

A. Genetic Prediction - Larry Cundiff, Chairman.

Cundiff reported that Gary Bennett, from USMARC and Keith Bertrand, from the University of Georiga, would discuss direct selection for calving ease and carcass characteristics, respectively. Doyle Wilson from Iowa State, would present heritabilities of fatness traits measured ultrasonically. John Pollak, Cornell University and Bruce Cunningham, American Simmental Association, would provide a Simmental multibreed evaluation update. Dale VanVleck, USMARC and Bruce Golden, Colorado State, would discuss across breed EPDs from a multibreed and a Red Angus prespective, respectively. The Genetic Prediction Committee would conclude with a panel discussion of future priorities involving Dave Nichols, John Hough, Lee Leachman and Kent Anderson. Cundiff saw no need for executive session action.

B. Emerging Technologies - Ronnie Green, Chairman.

In Ronnie Green's absence, Bolze reported that Donnell Brown would moderate the Emerging Technologies Committee meeting involving George Seidel, Colorado State, discussing sexed semen technology and Don Boggs, South Dakota State, leading a discussion of technologically oriented fact sheets that need to be written.

C. Live Animal and Carcass Evaluation - John Crouch, Chairman.

Crouch reported that Sally Northcutt, Oklahoma State, would discuss frame score prediction. Cindy Nagel, NAUPA President-elect, and Tommy Perkins, Southwest Missouri State, would present an update on the NAUPA. John Hough, American Hereford Association, would present EPD calculations on ribeye area, fat thickness and percent intramuscular fat. Doyle Wilson, Iowa State, would discuss certification for ultrasound proficiency.

D. Multiple Trait Selection - Kent Anderson, Chairman.

Anderson reported that the Multiple Trait Selection Committee would be launched with a panel discussion of multiple trait selection in practice including Roy Wallace, Select Sires, Doug Frank, American Breeders Service and Donnell Brown, R.A. Brown Ranch. Tom Jenkins, USMARC; Rick Bourdon, Colorado State and Mark Enns, University of Arizona, would then discuss new concepts in multiple trait selection. Mark Enns would then present selection indexes in practice with a New Zealand case study. The Committee meeting would conclude with an open discussion of future objectives for the Multiple Trait Selection Committee.

E. Whole Herd Analysis - John Hough, Chairman.

Hough reported that Harlan Hughes, North Dakota State, would discuss producer utilization of Standardized Performance Analysis (SPA). Bruce Golden, Colorado State, would present genetic evaluation of reproduction with whole herd reporting. Dick Gilbert and Jim Oltjen, Red Angus Association of America and the University of California-Davis, respectively, would elaborate on their general session presentations of whole herd analysis from a breed association and profit measure perspective. Hough would then conclude committee efforts with an open discussion of future committee direction and areas of emphasis.

Frank Baker Memorial Scholarship Awards - Cundiff, reporting for the committee, also including Hough, Silcox and Willham, stated three individuals submitted essays. These were ranked by the committee and award recipients were Robert Williams, University of Georgia and Rebecca Splan, University of Nebraska. Williams and Splan would receive recognition plaques and $500 cash awards at the awards banquet.

Election of New Officers - The Nominating Committee included Brinkman, chairman, Green, Hough and Healey. In Brinkman's absence, President Healey presented the nomination of Gary Johnson for President in 1997-98. Healey moved and Hough seconded the nomination by acclamation. Motion carried. President Healey presented the nomination of Jed Dillard for Vice President in 1997-98. Crouch moved and Evans seconded the nomination by acclamation. Motion carried.

Poster Competition - In chairman Green's absence, Bolze reported that two competitive abstracts had been submitted by graduate students and a single, non-competitive abstract had been submitted by Drs. Van Vleck and Cundiff from Nebraska. Green had coordinated a three man evaluation team to rank the two student submissions. Bolze reported that Dan Moser, University of Georgia and Pat Doyle, Colorado State, would receive first and second place, respectively, recognition monetary awards and plaques at the awards banquet. Boggs attributed minimal graduate student participation due to minimal major professor (advisor) attendance at the BIF Convention. Willham indicated that regional research projects (NC-196 and NC 1) provided alternative opportunities for graduate students to present results of research findings.

Awards Committee - Vincel, chairman of the Awards Committee, also consisting of Altenburg, Anderson, Dillard and Silcox, presented the following award recipients:

Ambassador Award - Bill Miller
Continuing Service Award - Glenn Brinkman
Russ Danielson
Gene Rouse
Pioneer Award - Larry Cundiff
Henry Gardiner
Jim Leachman

Bolze presented the following recipients of awards:

Outstanding Seedstock Producer Award (co-winners)
Thomas Angus Ranch, Bob Thomas Family - Baker, Oregon
Wehrmann Angus, Nicholas Wehrmann and Richard McClung - New Market, Virginia
Outstanding Commercial Producer Award
Merlin and Bonnie Anderson, Prairie Dog Creek Ranch, Dresden, Kansas

Caucus For the Election of New Directors - Vincel distributed copies outlining necessary caucus actions for the election of new directors according to the BIF by-laws. The eastern region had no director's positions expiring. In the central region, Johnson's seconded term was extended one year to accomodate his presidency, however, a directors position would be filled to maintain the rotation. The western region had no director's positions expiring. In the at-large positions, Lee Leachman's first term was expiring and he was eligible for reelection, however, he chose not to be considered for reelection. Therefore, the three regional caucuses needed to nominate an individual for the at-large position to be voted upon by the entire dues paying membership. In the breed association caucuses, Anderson's first term expired, and he was eligible for reelection. Bill Able had filled the one year of Doug Husfeld's unexpired term and was eligible for reelection. President Healey appointed Silcox, Boggs, Altenburg and Hunsley to chair the eastern, central, western and breed association caucuse, respectively.

Proposal for 1999 Convention - Vincel and Ike Eller, former BIF Executive Director, presented a proposal inviting BIF to hold their 1999 Convention at the Hotel Roanoke in Roanoke, Virginia, on June 16-19, 1999. Eller presented an approximate buget to be refined at a later point in time. They anticipated West Virginia support as Wayne Wagner had also expressed interest in hosting the event. After additional discussion, Hough moved and Crouch seconded acceptance of the Virginia proposal. Motion carried.

Executive Director Replacement - Bolze indicated that it was time for the Board to consider a replacement for the Executive Director's position. He indicated intentions of transferring responsibilities at the 1998 Convention in Calgary at which time it will have been five years in the position. Vice President Johnson, appointed a committee including Altenburg, chairman, Dillard, Crouch, Johnson and Bolze to actively seek a replacement and report back at the midyear Board meeting.

Midyear Board Meeting - Bolze indicated that through initial contact made by President Healey, tentative plans were to hold the midyear Board meeting at the Noble Foundation near Ardmore, Oklahoma, on Friday through Sunday, October 10-12, 1997. The 1998 Convention Program Planning Committee will meet Friday afternoon, October 10, 1997. Saturday, October 11, is reserved for the midyear Board meeting. Board members indicated that this was still a workable location and schedule.

1998 Convention Program Committee - Vice President Johnson appointed the 1998 Convention Program Committee to include Dillard, chairman, Hough, Anderson, Evans, McLane, Johnson and Bolze.

Canadian Representation on Board - Bolze reported that since Canadian Beef Improvement (CBI) was no longer operational, Mike Schutz would no longer represent the Canadian beef cattle industry on the Board. Herb McLane, Executive Director of the Canadian Beef Breeds Council would now serve in that capacity.

1998 Calgary Convention - McLane informed the Board of current and future plans for the 1998 BIF Convention scheduled for June 30-July 3, 1998, in Calgary, Alberta, Canada. He distributed a preliminary brochure for Board review. McLane shared additional information about travel and lodging accomodations. He requested that Dillard, Johnson and Bolze meet with a Canadian group later during the Dickinson Convention for further direction and input.

There being no further business, Vice President Johnson adjourned the meeting at 6:30 pm to be reconvened Friday night.

President Johnson reconvened the Board of Directors meeting at 8:55 pm Friday, May 16, 1997. President Johnson welcomed the new Board members including Richard Gilbert, Connee Quinn and James Smith, representing breed associations,central BCIA and at-large, respectively. Kent Anderson was reelected to a second three year term representing the breed associations. President Johnson presented a proposed agenda for the evening including: 1) Dickinson convention update; 2) Calgary convention update; 3) Committee report on ICAR; 4) fact sheet discussion; 5) Producer application committee; 6) NCBA/BIF co-sponsorship of regional educational events; 7) Committee reevaluation schedule and 8) Standing committee reports.

Dickinson Convention Update - Kris Ringwall reported that 495 Convention attendees had registered. He also provided last minute details for the tour. President Johnson applauded Ringwall for excellent attention to detail in conducting a flawless event.

1998 Calgary Convention Update - Herb McLane reported on some details which had been discussed at a meeting attended by McLane, Johnson, Dillard, Bolze and other Canadian representatives the previous day. Bolze indicated that a promotional piece would accompany the July BIF Update outlining lodging reservation specifics. Program chairman Dillard expressed the need for a common theme which would be presented to the Board at midyear. Ringwall expressed concern about registration mailings across the border. Healey expressed concern about potential challenges with U.S. and Canadian funds exchange rate. McLane announced that the hosting institution, Canadian Beef Breeds Council, would assume all financial responsibility, requiring no underwrite by BIF.

Committee Report on ICAR - Reporting for the committee also including Crouch and Evans, chairman Hunsley, reported that they had taken the opportunity to visit in greater detail with W.G. Wisman. Interbull, a committee of ICAR, ranks cattle on various performance traits similar to breed association data collection and evaluation with 35 countries currently involved. Hunsley and Evans encouraged involvement for later global summaries. Doubet moved and Hunsley seconded to seek membership in ICAR. Healey questioned membership do to having to conform to ICAR standards. Doubet removed his original motion and moved to appoint someone to attend the next ICAR Convention in New Zealand on January 28, 1998. Hunsley seconded and the motion carried. McLane offered to explore ICAR involvement in Canada. Altenburg, Dillard and Vincel discussed the U.S. Dairy Herd Improvement Association (DHIA) involvement with ICAR. Anderson stated that ICAR was involved with a recent international Limousin conference. Silcox offered to contact Larry Benyshek and Keith Bertrand who had expressed interest in attending the January ICAR Conference. President Johnson requested that the Committee of Hunsley, Crouch and Evans remain intact and report back at midyear.

Fact Sheet Discussion - Bolze reported on a fact sheet discussion which occurred as part of the Emerging Techonologies Committee meeting. Potential fact sheet topic areas included:

* Gender Determination of Semen, Embryos and Fetuses
* Effects of Genetics and Management on Tenderness
* DNA Fingerprinting and Genetic Markers
* Producer's Guide to Emerging Technologies
  (description of basic terms and procedures)
* Use of Ultrasound in Reproductive Management
* Ultrasound Evaluation of Carcass Traits
* Defining Contemporary Groups for Growth and Carcass Traits
* Innovative Methods for Presenting EPDs
* Selection Index Development and Utilization
* Impact of Bull Developmental Programs on Fertility
* Utilizing Carcass Data in the Commercial Cow Herd
* Heparin Binding Protein 5 (its relationship to fertility)
* Genetic Evaluation of Fertility and Longevity

President Johnson requested that Green and Boggs prioritize the list and report back at midyear.

Producer Applications Committee - Dillard reported that Joe Pascal, Texas A & M Beef Extension Specialist, had proposed a future Convention session on producer applications of new technologies. Hough suggested that this could potentially be a separate standing committee. Silcox suggested that it could be scheduled at the same time as the Genetic Prediction Committee meeting to attract a potentially different audience. Anderson suggested that every committee should include something practical of interest to individual producers. President Johnson tabled future discussion until midyear.

NCBA/BIF Co-sponsorship of Regional Educational Events - In the absence of Larry Corah, Bolze presented some thoughts on the potential of future NCBA/BIF co-sponsorship of regional educational events, in keeping with one of the primary recommendations resulting from the 1996 Future Focus efforts. Anderson questioned potential funding sources. Others questioned if NCBA would play an active role in the planning and/or promotion of educational events. Altenburg suggested that BIF plan such events with NCBA funding and promotion. Vincel suggested tabling this issue until midyear with Bolze reporting back to Larry Corah.

Committee Reevaluation Schedule - President Johnson informed the Board that the Genetic Prediction and Live Animal and Carcass Evaluation Committees would be reevaluated at midyear. Crouch stated that this was timely in that he would be exiting the Board in 1998 and that a chairman of the Live Animal and Carcass Evaluation Committee should be identified by midyear to allow for some transition time.

Standing Committee Reports

A. Emerging Technologies - Ronnie Green, Chairman

In Greens absence, Bolze reported that George Seidel from Colorado State had made an excellent presentation on the current status of sexing embryos and semen. Potential fact sheet discussion on new technologies followed. No Board action required.

B. Genetic Prediction - Larry Cundiff, Chairman

Cundiff reported that presentations made by Bennett, Bertrand, Wilson, Pollak, Cunningham, Van Vleck, Golden, Nichols, Hough, Leachman and Anderson were well received. No Board action required.

C. Multiple Trait Analysis - Kent Anderson, Chairman

Anderson reported that Tom Jenkins' follow-up discussion on new modeling technology after the morning's general session stimulated great discussion. The panel discussion featuring Brown, Frank and Wallace as well as presentations by Enns, Bourdon and McNeil were thought provoking. No Board action required.

D. Whole Herd Analysis - John Hough, Chairman

Hough reported that Harlan Hughes expressed concern that agricultural economists were minimally involved with BIF activities. Presentations by Golden, Gilbert and Oltjen provided greater insight into whole herd analysis advantages. No Board action required.

E. Live Animal and Carcass Evaluation - John Crouch, Chairman

Crouch reported that Cindy Nagel and Tommy Perkins brought committee attendees up to speed on activities of NAUPA. The NAUPA would be renamed the Association of Animal Ultrasound Practitioners (AAUP). Wilson presented the Iowa State certification procedures for ultrasound proficiency to be held May 20, 21 and 22, 1997 and reported that 57 technicians were preregistered. Discussion followed relative to two methods resulting in ultrasound proficiency:

1) Traits Coupled
   - A) Seedstock designation - external fat thickness, % intramuscular fat (marbling) and ribeye area all required for certification.
   - B) Feedlot designation - external fat thickness and marbling required (not ribeye)
2) Traits Totally Decoupled

Healey stated concern about potential litigation. BIF does not certify any production trait that is currently measured other than carcass traits. Crouch reassured the Board that "BIF certification" language would not be used as part of the Iowa State certification process. Vincel questioned if the AAUP could be the certifying organization. Healey questioned coupling of traits, suggested that, historically, BIF only sets guidelines and standards on how to measure individual traits and that BIF take no position on the coupling issue. Crouch reported that majority vote in the Live Animal and Carcass Evaluation Committee approved that Iowa State require certification in all three traits for seedstock designation. Evans suggested allowing the AAUP to decide the coupling/decoupling issue. Healey suggested that a letter be sent to Iowa State University stating that BIF only provides guidelines for ultrasound proficiency and that hosting institutions assume the roll of certification. Anderson questioned what the technicians want. Crouch stated that technicians want certification that bestows proficiency in traits according to BIF Guidelines.

Crouch has been working toward moving proficiency evaluation away from BIF to a more appropriate organization, however, BIF has not approved a set of guidelines which have been improved as a result of every certification process. Therefore, Crouch recommended that:

1) BIF encourage the further development and expansion of ultrasound proficiency testing programs
2) BIF encourage the Association of Animal Ultrasound Practitioners (AAUP) to adopt guidelines for proficiency testing.

Doubet moved to accept Crouch's recommendation. Vincel seconded and motion carried unanimously.

President Johnson requested that Crouch provide direction to the Board for ultrasound proficiency guidelines approval. Crouch reported that the guidelines were currently approved by the Live Animal and Carcass Evaluation Committee only. Crouch distributed copies of "Guidelines for Ultrasound Proficiency Testing and Evaluation". Crouch moved acceptance of the guidelines (as amended). Doubet seconded and motion carried.

Healey moved to send a letter to Doyle Wilson and Gene Rouse at Iowa State University, stating that BIF approved the Guidelines for Ultrasound Proficiency only and does not certify individuals. Vincel seconded and motion carried. Cundiff recommend enclosure of the approved guidelines in the letter. Bolze requested that he not be the individual signing the letter. President Johnson stated that he would assume the responsibility.

There being no further business, President Johnson adjourned the meeting at 11:05 pm, Friday, May 16, 1997.

Respectfully Submitted,

Ron Bolze,
Executive Director

BEEF IMPROVEMENT FEDERATION

INTERIM REPORT

MAY 14, 1997

ROGER D KOUGH
ACCREDITED BUSINESS ACCOUNTANT
190 WEST 6TH STREET
COLBY, KANSAS 67701
(913) 462-3182

Beef Improvement Federation
Ron Bolze, Executive Director

I have compiled the accompanying Statement of Assets, Liabilities and Fund Balance - Cash Basis - of The Beef Improvement Federation, a not for profit organization, as of May 14, 1997 and the related Statement of Revenues and Expenditures - Cash Basis - for the four and one half months then ended. The financial statements have been prepared on the cash basis of accounting, which is a comprehensive basis of accounting other than generally accepted accounting principles.

A compilation is limited to presenting, in the form of financial statements, information that is the representation of the officers of the Federation. I have not audited or reviewed the accompanying financial statements and, accordingly, do not express an opinion or any other form of assurance on them.

Management has elected to omit substantially all of the disclosures required by generally accepted accounting principles. If the omitted disclosures were included in the financial statements, they might influence the user's conclusions about the Federation's financial position, results of operation, and cash flows. Accordingly, these financial statements are not designed for those who are not informed about such matters.

The effects on these financial statements of the above described adjustments, required under generally accepted accounting principles have not been determined by management.

Respectfully Submitted,

Roger D Kough

Roger D. Kough

May 14, 1997

BEEF IMPROVEMENT FEDERATION

STATEMENT OF ASSETS, LIABILITIES AND FUND BALANCE
CASH BASIS

May 14, 1997

ASSETS

Cash In Bank	$ 17,186.92
Certificate of Deposit	40,000.00
Total Assets	$ 57,186.92

LIABILITIES & FUND BALANCE

Current Liabilities	$ 0.00
Fund Balance - December 31, 1996	47,602.53
Current Year Excess	9,584.39
Total Fund Balance - May 14, 1997	57,186.92
Total Liabilities and Fund Balance	$ 57,186.92

See Accountant's Compilation Report

BEEF IMPROVEMENT FEDERATION

STATEMENT OF REVENUES AND EXPENDITURES
CASH BASIS

For The Period Ending May 14, 1997

REVENUES

Dues	$ 9,293.38	
Proceedings & Guidelines	2,232.65	
Interest	1,703.64	
Total Revenues		$ 13,229.67

EXPENDITURES

Office Supplies	$ 2,265.06	
Bank Charges	21.16	
Printing	175.00	
Postage & Freight	1,184.06	
Total Expenditures		3,645.28
Excess of Revenues over Expenditures		$ 9,584.39

See Accountant's Compilation Report

BIF Member Organizations
& Dues for 1997

State BCIA's	Dues	Breeds	Dues
Alabama	100	American Angus	600
Colorado	100	American Brahman	200
Florida	100	American Chianina	200
Georgia	100	American Hereford	500
Illinois	100	American Int. Charolais	300
Indiana	100	American Gelbvieh	300
Iowa	100	American Maine Anjou	100
Kansas	100	American Red Brangus	100
Kentucky	100	American Red Poll	100
Maryland	100	American Salers	300
Minnesota	100	American Shorthorn	200
Michigan	100	American Simmental	500
Mississippi	100	American Tarentaise	100
Missouri	100	Barzona Breeders	300
New Mexico	100	Beef Booster Cattle Ltd.	100
New York	100	Beefmaster Breeders	300
North Carolina	100	Canadian Angus	100
Utah	100	Canadian Charolais	200
Virginia	100	Canadian Hays Converter	100
Washington	100	Canadian Hereford	100
West Virginia	100	Canadian Simmental	100
Wisconsin	100	International Brangus	300
Wyoming	100	North American Limousin	500
		N American South Devon	100
		Red Angus Assoc of AM	200
		Santa Gertrudis Breeders	200
		United Braford Breeders	200

Others	Dues	Others	Dues
21st Century Genetics	100	King Ranch	50
Accelerated Genetics	100	Manitoba Agriculture	100
American Breeders Service	100	National Assoc of Ani Breeders	100
Beef Improvement Ontario	100	National Cattlemen's Beef Assoc	100
Canadian Beef Breeds Council	100	NOBA, Inc	100
Composite Cattle Breeders	100	Ronald Schlegal	50
Connor State College	100	Select Sires	100
Great Western Beef Expo	50	Taylors Black Simmental	50
Integrated Genetic Management	100	Turner Brothers Farms	100

SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

John Crowe	CA	1972
Dale H. Davis	MT	1972
Elliot Humphrey	AZ	1972
Jerry Moore	OH	1972
James D. Bennett	VA	1972
Harold A. Demorest	OH	1972
Marshall A. Mohler	IN	1972
Billy L. Easley	KY	1972
Messersmith Herefords	NE	1973
Robert Miller	MN	1973
James D. Hemmingsen	IA	1973
Clyde Barks	ND	1973
C. Scott Holden	MT	1973
William F. Borror	CA	1973
Raymond Meyer	SD	1973
Heathman Herefords	WA	1973
Albert West III	TX	1973
Mrs. R.W. Jones, Jr.	GA	1973
Carlton Corbin	OK	1973
Wilfred Dugan	MO	1974
Bert Sackman	ND	1974
Dover Sindelar	MT	1974
Jorgensen Brothers	SD	1974
J. David Nichols	IA	1974
Bobby Lawrence	GA	1974
Marvin Bohmont	NE	1974
Charles Descheemacker	MT	1974
Bert Crame	CA	1974
Burwell M. Bates	OK	1974
Maurice Mitchell	MN	1974
Robert Arbuthnot	KS	1975
Glenn Burrows	NM	1975
Louis Chestnut	WA	1975
George Chiga	OK	1975
Howard Collins	MO	1975
Jack Cooper	MT	1975
Joseph P. Dittmer	IA	1975
Dale Engler	KS	1975
Leslie J. Holden	MT	1975
Robert D. Keefer	MT	1975
Frank Kubik, Jr.	ND	1975
Licking Angus Ranch	NE	1975
Walter S. Markham	CA	1975
Gerhard Mittnes	KS	1976
Ancel Armstrong	VA	1976
Jackie Davis	CA	1976
Sam Friend	MO	1976
Healey Brothers	OK	1976
Stan Lund	MT	1976
Jay Pearson	ID	1976
L. Dale Porter	IA	1976
Robert Sallstrom	MN	1976
M.D. Shepherd	ND	1976
Lowellyn Tewksbury	ND	1976

SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

Harold Anderson	SD	1977	Buddy Cobb	MT	1978
William Borror	CA	1977	Bill Wolfe	OR	1978
Robert Brown	TX	1977	Roy Hunt	PA	1978
Glen Burrows	NM	1977	Del Krumwied	ND	1979
Henry, Jeanette Chitty	NM	1977	Jim Wolf	NE	1979
Tom Dashiell	WA	1977	Rex & Joann James	IA	1979
Lloyd DeBruycker	MT	1977	Leo Schuster Family	MN	1979
Wayne Eshelman	WA	1977	Bill Wolfe	OR	1979
Hubert R. Freise	ND	1977	Jack Ragsdale	KY	1979
Floyd Hawkins	MO	1977	Floyd Mette	MO	1979
Marshall A. Mohler	IN	1977	Glenn & David Gibb	IL	1979
Clair Percel	KS	1977	Peg Allen	MT	1979
Frank Ramackers, Jr.	NE	1977	Frank & Jim Willson	SD	1979
Loren Schlipf	IL	1977	Donald Barton	UT	1980
Tom & Mary Shaw	ID	1977	Frank Felton	MO	1980
Bob Sitz	MT	1977	Frank Hay	CAN	1980
Bill Wolfe	OR	1977	Mark Keffeler	SD	1980
James Volz	MN	1977	Bob Laflin	KS	1980
A.L. Frau		1978	Paul Mydland	MT	1980
George Becker	ND	1978	Richard Tokach	ND	1980
Jack Delaney	MN	1978	Roy & Don Udelhoven	WI	1980
L.C. Chestnut	WA	1978	Bill Wolfe	OR	1980
James D. Bennett	VA	1978	John Masters	KY	1980
Healey Brothers	OK	1978	Floyd Dominy	VA	1980
Frank Harpster	MO	1978	James Bryany	MN	1980
Bill Womack, Jr.	AL	1978	Charlie Richards	IA	1980
Larry Berg	IA	1978	Blythe Gardner	UT	1980

SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

Richard McLaughlin	IL	1980	Orville Stangl	SD	1982
Bob Dickinson	KS	1981	C. Ancel Armstrong	KS	1983
Clarence Burch	OK	1981	Bill Borror	CA	1983
Lynn Frey	ND	1981	Charles E. Boyd	KY	1983
Harold Thompson	WA	1981	John Bruner	SD	1983
James Leachman	MT	1981	Leness Hall	WA	1983
J. Morgan Donelson	MO	1981	Ric Hoyt	OR	1983
Clayton Canning	CAN	1981	E.A. Keithley	MO	1983
Russ Denowh	MT	1981	J.Earl Kindig	MO	1983
Dwight Houff	VA	1981	Jake Larson	ND	1983
G.W. Cronwell	IA	1981	Harvey Lemmon	GA	1983
Bob & Gloria Thomas	OR	1981	Frank Myatt	IA	1983
Roy Beeby	OK	1981	Stanley Nesemeier	IL	1983
Herman Schaefer	IL	1981	Russ Pepper	MT	1983
Myron Aultfathr	MN	1981	Robert H. Schafer	MN	1983
Jack Ragsdale	KY	1981	Alex Stauffer	WI	1983
W.B. Williams	IL	1982	D. John & Lebert Shultz	MO	1983
Garold Parks	IA	1982	Phillip A. Abrahamson	MN	1984
David A. Breiner	KS	1982	Rob Beiber	SD	1984
Joseph S. Bray	KY	1982	Jerry Chappel	VA	1984
Clare Geddes	CAN	1982	Charles W. Druin	KY	1984
Howard Krog	MN	1982	Jack Farmer	CA	1984
Harlin Hecht	MN	1982	John B. Green	LA	1984
William Kottwitz	MO	1982	Ric Hoyt	OR	1984
Larry Leonhardt	MT	1982	Fred H. Johnson	OH	1984
Frankie Flint	NM	1982	Earl Kindig	VA	1984
Gary & Gerald Carlson	NS	1982	Glen Klippenstein	MO	1984
Bob Thomas	OR	1982	A. Harvey Lemmon	GA	1984

SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

Lawrence Meyer	IL	1984	W.D. Morris & James Pipkin	MO	1986
Donn & Sylvia Mitchell	CAN	1984	Roy D. McPhee	CA	1986
Lee Nichols	IA	1984	Clarence VanDyke	MT	1986
Clair K. Parcel	KS	1984	John H. Wood	SC	1986
Joe C. Powell	NC	1984	Evin & Verne Dunn	CAN	1986
Floyd Richard	ND	1984	Glenn L. Brinkman	TX	1986
Robert L. Sitz	MT	1984	Jack & Gini Chase	WY	1986
Ric Hoyt	OR	1984	Henry & Jeanette Chitty	FL	1986
J. Newbill Miller	VA	1985	Lawrence H. Graham	KY	1986
George B. Halterman	WV	1985	A. Lloyd Grau	NM	1986
David McGehee	KY	1985	Matthew Warren Hall	AL	1986
Glenn L. Brinkman	TX	1985	Richard J. Putnam	NC	1986
Gordon Booth	WY	1985	R.J. Steward/P.C. Morrissey	PA	1986
Earl Schafer	MN	1985	Leonard Wulf	MN	1986
Marvin Knowles	CA	1985	Charles & Wynder Smith	GA	1987
Fred Killam	IL	1985	Lyall Edgerton	CAN	1987
Tom Perrier	KS	1985	Tommy Branderberger	TX	1987
Don W. Schoene	MO	1985	Henry Gardiner	KS	1987
Everett & Ron Batho	CAN	1985	Gary Klein	ND	1987
Bernard F. Pedretti	WI	1985	Ivan & Frank Rincker	IL	1987
Arnold Wienk	SD	1985	Larry D. Leonhardt	WY	1987
R.C. Price	AL	1985	Harold E. Pate	IL	1987
Clifford & Bruce Betzold	IL	1986	Forrest Byergo	MO	1987
Gerald Hoffman	SD	1986	Clayton Canning	CAN	1987
Delton W. Hubert	KS	1986	James Bush	SD	1987
Dick & Ellie Larson	WI	1986	R.J. Steward/P.C. Morrissey	MN	1987
Leonard Lodden	ND	1986	Eldon & Richard Wiese	MN	1987
Ralph McDanolds	VA	1986	Douglas D. Bennett	TX	1988

SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

Don & Diane Guilford & David & Carol Guilford	CAN	1988	Tom Mercer	WY	1989
Kenneth Gillig	MO	1988	Lynn Pelton	KS	1989
Bill Bennett	WA	1988	Lester H. Schafer	MN	1989
Hansell Pile	KY	1988	Bob R. Whitmire	GA	1989
Gino Pedretti	CA	1988	Dr. Burleigh Anderson	PA	1990
Leonard Lorenzen	OR	1988	Boyd Broyles	KY	1990
George Schlickau	KS	1988	Larry Earhart	WY	1990
Hans Ulrich	CAN	1988	Steven Forrester	MI	1990
Donn & Sylvia Mitchell	CAN	1988	Doug Fraser	CAN	1990
Darold Bauman	WY	1988	Gerhard Gueggenberger	CA	1990
Glynn Debter	AL	1988	Douglas & Molly Hoff	SD	1990
William Glanz	WY	1988	Richard Janssen	KS	1990
Jay P. Book	IL	1988	Paul E. Keffaber	IN	1990
David Luhman	MN	1988	John & Chris Oltman	WI	1990
Scott Burtner	VA	1988	John Ragsdale	KY	1990
Robert E. Walton	WA	1988	Otto & Otis Rincker	IL	1990
Harry Airey	CAN	1989	Charles & Rudy Simpson	CAN	1990
Ed Albaugh	CA	1989	T.D. & Roger Steele	VA	1990
Jack & Nancy Baker	MO	1989	Bob Thomas Family	OR	1990
Ron Bowman	ND	1989	Ann Upchurch	AL	1991
Jerry Allen Burner	VA	1989	N. Wehrmann / R. McClung	VA	1991
Glynn Debter	AL	1989	John Bruner	SD	1991
Sherm & Charlie Ewing	CAN	1989	Ralph Bridges	GA	1991
Donald Fawcett	SD	1989	Dave & Carol Guilford	CAN	1991
Orrin Hart	CAN	1989	Richard/Sharon Beitelspacher	SD	1991
Leonard A. Lorenzen	OR	1989	Tom Sonderup	NE	1991
Kenneth D. Lowe	KY	1989	Steve & Bill Florshcuetz	IL	1991

SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

R.A. Brown	TX	1991	Clarence, Elaine, Adam Dean	SC	1993
Jim Taylor	KS	1991	D. Eldridge & Y. Adcock	OK	1993
R.M. Felts & Son Farm	TN	1991	Joseph Freund	CO	1993
Jack Cowley	CA	1991	R.B. Jarrell	TN	1993
Rob & Gloria Thomas	OR	1991	Rueben, Leroy, Bob Littau	SD	1993
James Burns & Sons	WI	1991	J. Newbill Miller	VA	1993
Jack & Gini Chase	WY	1991	J. David Nichols	IA	1993
Summitcrest Farms	OH	1991	Miles P. "Buck" Pangburn	IA	1993
Larry Wakefield	MN	1991	Lynn Pelton	KS	1993
James R. O'Neill	IA	1991	Ted Seely	WY	1993
Francis & Karol Bormann	IA	1992	Collin Sander	SD	1993
Glenn Brinkman	TX	1992	Harrell Watts	AL	1993
Bob Buchanan Family	OR	1992	Bob Zarn	MN	1993
Tom & Ruth Clark	VA	1992	Ken & Bonnie Bieber	SD	1994
A.W. Compton, Jr.	AL	1992	John Blankers	MN	1994
Harold Dickson	MO	1992	Jere Caldwell	KY	1994
Tom Drake	OK	1992	Mary Howe di'Zerega	VA	1994
Robert Elliott & Sons	TN	1992	Ron & Wayne Hanson	CAN	1994
Dennis, David, Danny Geffert	WI	1992	Bobby F. Hayes	AL	1994
Eugene B. Hook	MN	1992	Buell Jackson	IA	1994
Dick Montague	CA	1992	Richard Janssen	KS	1994
Bill Rea	PA	1992	Bruce Orvis	CA	1994
Calvin & Gary Sandmeier	SD	1992	John Pfeiffer Family	OK	1994
Leonard Wulf & Sons	MN	1992	Calvin & Gary Sandmeier	SD	1994
R.A. Brown	TX	1993	Dave Taylor / Gary Parker	WY	1994
Norman Bruce	IL	1993	Bobby Aldridge	NC	1995
Wes & Fran Cook	NC	1993	Gene Bedwell	IA	1995

SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

Gordon & Mary Ann Booth	WY	1995
Ward Burroughs	CA	1995
Chris & John Christensen	SD	1995
Mary Howe de'Zerega	VA	1995
Maurice Grogan	MN	1995
Donald J. Hargrave	CAN	1995
Howard & JoAnne Hillman	SD	1995
Mack, Billy, Tom Maples	AL	1995
Mike McDowell	VA	1995
Tom Perrier	KS	1995
John Robbins	MT	1995
Thomas Simmons	VA	1995
D. Borgen & B. McCulloh	WI	1996
Chris & John Christensen	SD	1996
Frank Felton	MO	1996
Galen & Lori Fink	KS	1996
Cam, Spike, Sally Forbes	WY	1996
Mose & Dave Hebbert	NE	1996
C. Knight & B. Jacobs	OK	1996
Robert C. Miller	MN	1996
Gerald & Lois Neher	IL	1996
C.W. Pratt	VA	1996
Frank Schiefelbein	MN	1996
Ingrid & Willy Volk	NC	1996
William A. Womack, Jr.	AL	1996
Alan Albers	KS	1997
Gregg & Diane Butman	MN	1997
Blaine & Pauline Canning	CAN	1997
Jim & JoAnn Enos	IL	1997
Harold Pate	AL	1997
E. David Pease	CAN	1997
Juan Reyes	WY	1997
James I. Smith	NC	1997
Darrel Spader	SD	1997
Bob & Gloria Thomas	OR	1997
Nicholas Wehrmann & Richard McClung	VA	1997

SEEDSTOCK BREEDER OF THE YEAR

John Crowe	CA	1972
Mrs. R.W. Jones	GA	1973
Carlton Corbin	OK	1974
Leslie J. Holden	MT	1975
Jack Cooper	MT	1975
Jorgensen Brothers	SD	1976
Glenn Burrows	NM	1977
James D. Bennett	VA	1978
Jim Wolfe	NE	1979
Bill Wolfe	OR	1980
Bob Dickinson	KS	1981
A.F. "Frankie" Flint	NM	1982
Bill Borror	CA	1983
Lee Nichols	IA	1984
Ric Hoyt	OR	1985
Leonard Lodoen	ND	1986
Henry Gardiner	KS	1987
W.T. "Bill" Bennett	WA	1988
Glynn Debter	AL	1989
Doug & Molly Hoff	SD	1990
Summitcrest Farms	OH	1991
Leonard Wolf & Sons	MN	1992
R.A. "Rob" Brown	TX	1993
J. David Nichols	IA	1993
Richard Janssen	KS	1994
Tom & Carolyn Perrier	KS	1995
Frank Felton	MO	1996
Bob & Gloria Thomas	OR	1997
Wehrmann Angus Ranch	VA	1997

Thomas Angus Ranch
and the
Wehrmann Angus Ranch
Co-Winners of the
"1997 Outstanding Seedstock Producer Award"

FOR IMMEDIATE RELEASE

Thomas Angus Ranch and Wehrmann Angus named co-winners of the "1997 BIF Outstanding Seedstock Producer Award"

Dickinson, North Dakota - For the second time in the 29 year history of the Beef Improvement Federation (BIF), co-winners were named to receive BIF's Outstanding Seedstock Producer Award. Honored at the BIF Convention held at the Hospitality Inn in Dickinson, North Dakota were the Bob Thomas Family of Thomas Angus Ranch and Nicholas Wehrmann and Richard McClung of Wehrmann Angus.

Thomas Angus Ranch is a family owned business including Bob & Gloria Thomas; their son and daughter-in-law, Rob & Lori Thomas; and daughter and son-in-law, Kris & Andy Barr. Located near Baker, Oregon, the Thomas's are celebrating their fiftieth anniversary this year, getting their start in the Angus business in 1947 with three head of purebred cattle.

Today, the Thomases run 680 registered Angus cows in a similar fashion to their commercial customers while utilizing the most advanced industry innovations. Some of the innovative aspects of this ranching operation that have given the Thomases their staying power are 1) their focus and never ending commitment to the commercial cattle industry, 2) their use of proven, high accuracy sires in one of the most intensive, largest scale total A.I. programs in the nation, 3) their dedication to the product they produce, the beef industry and the environment.

Bob joined the American Angus Association in 1950. He was elected to the American Angus Association Board of Directors in 1985 and served two terms with distinction. During his tenure on the Board, Bob served on the Breed Improvement, Public Relations and the Planning and Industry committees.

The Thomas Angus Ranch Angus herd was enrolled in Angus Herd Improvement Records in 1978 and complete performance records have been meticulously kept since then. The Thomas Ranch program has emphasized optimum production with further emphasis on improving carcass quality and consistency. The success of the Thomas operation is reflected by the number of sires in commercial semen studs and by the outstanding bull sales hosted each year.

Documented performance is the primary focus at Thomas Angus Ranch. They have used EPDs and detailed individual performance records to produce functional cattle with strong maternal ability, excellent, growth and reliable calving ease.

Besides being performance oriented, Thomas Angus Ranch can be described as one of the most technologically advanced, yet down to earth operations in the country. They use the latest genetic and reproductive technology available to them and apply it on a larger scale than most anyone in the industry.

The scope and discipline of their A.I. program would be unimaginable to most other producers. In 1997, the results of that program will be nearly 700 calves in a 45 day calving season strictly through the use of A.I. These results are even more impressive considering the fact that their cow herd is managed under similar conditions to those of many of their commercial customers.

Bob and Gloria Thomas and family have truly made a huge and positive impact on the industry through the A.I. sires that they have owned and the hundreds of high quality bulls that they provide to their commercial customers on a yearly basis, but most importantly through their long time personal involvement and contributions to the industry.

Nick Wehrmann, owner of Wehrmann Angus, is an industrialist with a deep interest in the beef industry and brings strict business principles, discipline and organization to the operation. The managing partner, Richard McClung, is a West Virginia native, educated at West Virginia University and combines work ethic, integrity and common sense. These two individuals have taken Wehrmann Angus to an important and revered place as seedstock breeders in North America.

Wehrmann Angus today consists of 310 registered Angus cows from which 100 females are sold annually at auction and 135 bulls are sold annually with 60 of them being sold at auction at the farm and the balance being sold by private treaty. The production of this excellent herd, however, is greatly enlarged and will offer for sale more seedstock animals in the future because of the expanded use of embryo transfer.

Wehrmann Angus was established in 1975, in southwest Georgia. The registered Angus herd was started with performance cattle, mostly of Rito breeding from Jorgensen ranches in Ideal, South Dakota. The herd remained at the same location until July, 1986, at which time it moved to Virginia to Court Manor Farm at New Market. During those years in Georgia, the goal was to produce performance Angus cattle that would flourish on available forage in the deep south, and particularly in the harsh south Florida environment. Richard McClung became managing partner in 1978 and developed a volume bull market in the deep south, which is still enjoyed.

After 11 years in south Georgia, the herd moved July 1, 1986, to New Market, Virginia, to Court Manor Farm, which at that time, consisted of 1,300 acres and has now grown to 2,250 acres. After extensive pasture renovation and the construction of many miles of high tensile fence, barns, corrals and feeding systems, today Court Manor is an excellent cow operation.

Nick Wehrmann and Richard McClung have had a plan and have doggedly stuck to it. The plan called for selection and improvement based on traits of economic importance. Individual performance records and EPDs are gigantic tools for this operation. Newer measures included over the past 10 years include ultrasonically measured loineye area and backfat and marbling as well as pelvic measurements on all bulls and heifers and scrotal circumference on bulls.

Wehrmann Angus has been a strong cooperator with researchers at Virginia Tech and have been available to host field days and literally hundreds of groups who have come to tour this special seedstock operation.

Richard McClung has served as director of the Virginia Angus Association, director and president of Virginia BCIA, director of the American Angus Association and director of the Virginia Cattle Industry Board. He has spoken at numerous field days and educational meetings throughout the U.S., taking part in symposiums and conventions. He has also served as a judge from 1991 to 1993 at the National Western Stock Show in Denver.

The Beef Improvement Federation believes it is most appropriate to honor two such deserving Seedstock Producers with their 1997 BIF Outstanding Seedstock Producer Award

1997 BIF
SEEDSTOCK NOMINEES

Alan Albers
Albers AK Gelbvieh
Nashville, Kansas 67112

Albers AK Gelbvieh is a family-owned production business. Managed by Alan and Kathleen Albers, this Gelbvieh cow operation is located in Nashville, Kansas. For the past 21 years, Albers management style has been dictated by productivity and efficiency. Rather than allowing his breeding program to be swayed by industry fads, Albers concentrates on building a herd that will make a positive contribution to the beef industry. His focus has rewarded him with one of the top 10 maternal Gelbvieh herds in the nation.

Each year, Albers markets between 70 and 80 bulls, which are bred for calving ease, moderate size and easy fleshing. Bull calves that do not meet Albers' strict standards are placed in a steer test for evaluation. Through these tests, Albers has identified bloodlines in his herd that are superior in marbling, but do not put much exterior fat on the carcass. This finding encouraged Albers to create three types of marbling degrees within his herd. A Gelbvieh **Carcass Plus One** is an animal with one generation of proven marbling at 60% or better. A **Carcass Plus Two** is created by two generations of proven marbling, while a **Carcass Plus Three** animal is derived by linebreeding two bloodlines that have shown the highest ability to marble.

All available by-products of AK Gelbvieh's farming operation are used to maintain the cowherd. The cattle are managed as if they are a commercial cowherd, receiving no special treatment to achieve added performance. Wheat pasture is used for heifer and bull development.

Albers' determination to help improve the beef industry includes being a active leader. He played an integral part in organizing the Kansas Gelbvieh Association and served as its first president. Albers was also the driving force behind the revision of the American Gelbvieh Association's performance program. In the 1980s, Albers worked diligently as a member of the productivity committee to push for an udder scoring program to correct the Gelbvieh breed's characteristic of large teats. More recently, Albers has requested that the American Gelbvieh Association calculate carcass EPDs for the breed before the end of the year.

Albers continues to lead by example in his efforts to positively impact the beef industry with quality cattle and leadership. Albers was nominated by the Kansas Livestock Association.

Gregg and Diane Butman
Cottonwood Angus Farms
Pipestone, Minnesota

Cottonwood Angus Farms has been raising cattle in Southwestern Minnesota since 1878 and started raising purebred Angus cattle in 1954. The Cottonwood Angus Farms is a diversified operation which calves 300 purebred Angus brood cows and farms 2,200 acres of corn, soybeans and alfalfa. The cows are run on 1,000 acres of pasture in the Flandreau Creek Valley. The Cottonwood Angus Farms is jointly owned by three families: Gregg and Diane Butman and their son Justin, Lyle and Marjie Oye and Lance and Tammy Oye and their son Dylan. Gregg is the third generation of Butmans to work on the family land located in Northwestern Pipestone County.

At the Cottonwood Angus Farms, practicality and profitability have remained their first priority. They demand cattle to breed quickly, milk well, wean heavy calves and maintain themselves on the forages found in the Flandreau Creek Valley. The Cottonwood Angus Farms began performance testing in 1968 when they enrolled in the American Angus Herd Improvement Records (AHIR). One of their major accomplishments since they started performance testing was to increase weaning weights 237 pounds since 1968 while maintaining calving ease.

In additional to being very successful as an Angus Breeder, Gregg Butman has emerged as a real leader in the Minnesota livestock industry. Gregg has served on the Minnesota Angus Association Board of Directors for 6 years, and Vice President of the County Cattlemen's Association. He has also served on the Agriculture Advisory Board for the Southwestern Technical College. Cottonwood Angus Farms has been nominated by the Minnesota Beef Cattle Improvement Association.

Blaine and Pauline Canning
Prairielane Farms Ltd.
Souris, Manitoba, Canada

Prairielane Farms is located in the Southwest corner of Manitoba and is owned and operated by Clayton and Mona and Blaine and Pauline Canning. Blaine and Pauline have two children, Angela and Michael. The farm consists of approximately 3,500 acres of which 900 acres are used for growing cereal grains and oil seeds. The rest is used to produce forage or is pasture land. The farm was homesteaded in 1889 by James Canning and has been in the Canning family for over 100 years. Prairielane started into R.O.P. in 1968, collecting data for selection purposes. Since the early 1970's Prairielane's breeding program has totally evolved on detailed attention to performance testing on both home tests and the Provincial Test Stations. In recent years, Prairielane has placed more emphasis on a balanced approach in selecting replacements and breeding bulls. The goals of Prairielane have remained constant: 1) To select cattle that will grow rapidly and grade at one year of age, 2) To maintain a herd with high reproductive performance and physical soundness, 3) To have cattle that are quiet and easy to handle, 4) To have cattle that are easy fleshing and that can adapt to environmental change, 5) To have cattle that can produce a positive bottom line. With these goals driving the Prairielane selection criteria, the Prairielane herd has made significant progress in the 1980's and the 1990's. Prairielane Farms are dedicated to performance testing and performance selection. The results are recorded and cattle are culled on the basis of these records. Prairielane's policy is to provide a product measured through a practical program of performance selection and presented with accurate information. Prairielane has the direction, the purpose, the measurements and the cruelty of environment to put each calf against each of the others in the herd -- this is Prairielane's genetic proving ground. Over the years Prairielane seed stock has been well accepted and this is evident in the number of repeat buyers that purchase Prairielane cattle. 1997 will mark the 19th annual production sale at Prairielane Farm. Prairielane Farms Ltd. was nominated by the Canadian Angus Association.

Jim and JoAnn Enos
Lawhorn Valley Salers
Stockton, Illinois

Lawhorn Valley Salers is owned and operated by Jim and JoAnn Enos of Stockton, Illinois. Their cow herd consists of 125 - 150 Salers cows developed from a predominately Hereford-Angus based cowherd purchased in 1969. In 1980 they introduced the first Salers bulls into Illinois.

A combination of Salers bloodlines and performance programs resulted in a 100 pound plus increase in weaning weights during the mid-80's. They have consigned bulls in both the Wisconsin and Western Illinois University Bull Test Stations. They currently have 6 bulls in the Salers Sire Summary. A Lawhorn Valley bred/raised bull (JJE Polled Poundmaker) was ranked first in calves registered in 1995. In addition, they have sold cattle and semen into 23 states and 6 foreign countries.

Other accomplishments include producing the first black and the first red homozygous polled Salers bulls. Jim and JoAnn recently received the 1997 President's Award from the American Salers Association. Their show winnings include Champion female and Reserve Champion Bull at the N.A.I.L.E.

Enos's worked to establish the Eastern States Salers Association and served as president for several years. JoAnn has been Secretary-Treasurer of the Illinois Salers Association since 1991 and Treasure of the Salers Belles. They have always cooperated with the Extension Service, hosting an Area Cow-calf Field Day and numerous livestock judging contests. Jim and JoAnn raised 5 children who combined for 45 years of 4-H projects, which included showing Salers heifers. Enos's goal is to produce seedstock that generate offspring which are profitable for all phases of the beef industry. They also strive to produce a consistently high quality end-product. They believe that their operation and the entire beef industry must strive for self-improvement through education and implementation of new technology. Lawhorn Valley Salers was nominated by the Illinois Beef Association and the University of Illinois Cooperative Extension Service.

Harold Pate
Pate Ranch
Lowndesboro, Alabama

Along with a great deal of help from his wife, Joan, and their five children, Harold Pate has built a reputation for producing some of the country's top Charolais cattle. Harold and Joan established Pate Ranch in 1956. The Pates stress performance records and have had the top gaining bulls in various BCIA-sponsored tests.

Pate Ranch had the first bull to gain four pounds a day on a forage test. In 1992 and 1994 on subsequent grass tests, Pate Charolais Ranch-sired bulls set new records as they gained 4.5 and 4.54 pounds respectively.

Harold has logged many miles on behalf of the cattle industry, serving as president of the Alabama Cattlemen's Association, Alabama BCIA, Alabama Beef Breeds Association and the Southeastern Livestock Exposition. He is a past director of the American-International Charolais Association. He has also served on the Alabama Agricultural Center Board and was chairman of the Lowndes County Soil and Water Conservation.

Pate Charolais Ranch was named Alabama Seedstock Producer of the year in 1987. That same year, Harold was inducted into the Alabama Hall of Fame. Joan has been an active leader in the industry, serving as president of the Alabama Cattlewomen's Association in 1982-84 and as treasure for 13 years. She was inducted into the ACWA hall of Honor in 1994. The following year Joan was appointed to the Alabama Agricultural Center Board by Governor Fob James. The Pate Ranch was nominated by the American International Charolais Association.

E. David Pease
Glen Osprey Farm
Shelburne, Ontario, Canada

Glen Osprey Farm was in the seedstock cattle business for 25 years, since 1972. Glen Osprey Farms' owner, E. David Pease, began with Polled Hereford and Highland Cattle. Currently, the herd includes 68 Salers females. Glen Osprey Farm consists of 550 acres of forage based land. The mature cows are out wintered with no access to barns or woodlot shelter. Bred heifers and younger or thin cows are wintered separately with some shelter. The cows calve from late April through May with the 60 day breeding period extending mid July to mid September. The primary goal of the breeding program is to produce cattle that will function efficiently in a commercial environment. David is an innovator. Innovative concepts which have since been adopted by other cattle producers include out wintering cows for greater commercial application, frost seeding trefoil and red clover, fencing off water courses and employing alternative watering supplies, computer applications for farm record keeping, using on farm ultrasound for measurement of external fat and ribeye area, using high tensile electric fencing, using video tapes to promote cattle sales, designing an Internet web page for farm promotion and gathering carcass data first through agriculture Canada's "Blue Tag" system and most recently with the BIO-Link program. David has held numerous leadership positions on the local, regional, national and international level. David has been an invited speaker on the topic of performance recording for beef cattle within Canada as well as the United States and once in the United Kingdom. In the fall of 1996, he traveled to Vietnam under the sponsorship of the Canadian International Development Agency, CDA, to develop strategies for that country's beef industry.

Glen Osprey Farm has been nominated by Beef Improvement Ontario.

Juan Reyes
MR Angus Ranch
Wheatland, Wyoming

MR Angus Ranch is a seedstock operation consisting of 200 Angus and 200 Amerifax cows. It is located near Wheatland, Wyoming in the Platte River Valley. It is owned and operated by Juan and Joni Reyes and their two children. Juan is a self-made individual. Born in Cuba, he came to this country as a small child. He worked his way to adulthood and eventually bought into a cattle operation. Over the past 20 years his ability as a cattleman and a businessman along with his people skills have allowed him to build a very successful operation. His seedstock operation is based on records that include 20 years of AHIR participation with the Angus Association. MR Angus Ranch has an annual production sale the first Tuesday in March where they sell from 70 - 80 yearling bulls and select group of females. They run from 2000 to 3000 head of yearlings on range grass each summer. Their large irrigated farming operation is used to produce corn, corn silage and alfalfa that is marketed through a 5000 head feedlot where cattle are mainly backgrounded and sold at approximately 900 pounds. They also develop, synchronize and breed approximately 1500 head of replacement females for themselves and customers. Hard work and organizational skills have built MR Angus Ranch into an extremely successful, highly integrated agricultural enterprise. MR Angus Ranch has been nominated by the Wyoming Beef Cattle Improvement Association.

James I. Smith
JANASTCI
Stem, North Carolina

The JANASTCI Angus herd was founded in 1970. The original cattle were purchased from NC State University. With the limited amount of performance data which was available at the time, James quickly realized that it would be necessary to rely on visual appraisal to a large degree in selecting foundation animals. Having grown up with Jersey cows, James learned at a very early age the importance of good udders. After visiting several herds, James was fortunate to visit the Wye Angus herd and to get acquainted with the manager, an ex-dairyman himself, Mr. Jim Lingle. After that visit, James was convinced that the Wye line of cattle would be an integral part of the herd. One of the early goals was to have the cows sired by a Wye bull which had been used as a herd sire at Wye Plantation. This goal was accomplished in 1984.

In 1983, a second breed was added with the first registered Gelbvieh in North Carolina, with an extensive AI and Embryo program with emphasis on performance, black, polled cattle. The Gelbvieh herd really progressed untiltheir dispersal in May, 1996, with a very respectable sale average and cattle selling into 7 states with several of the females going to donor programs.

James has always considered it a privilege to work with cattle people, having served as the president of the North Carolina Cattlemen's Association. The farm is always open to 4H, FFA, NCSU Animal Science, local livestock associations or other interested parties.

With the exception of 4 years in the military service, James' entire life has been devoted to agriculture with emphasis on livestock.

James Smith has been nominated by the North Carolina Beef Cattle Improvement program.

Darrel Spader
Hayland Angus Ranch
Fedora, South Dakota

Hayland Angus Ranch partnership was formed in 1962 with Dr. C.L. Bohan and Darrel and Joan Spader. It started with 18 registered heifers and about 100 commercial cows. In the 70's, the commercial herd was replaced with all registered cows. In 1989, the Spaders became sole owners. The Spaders now breed 105 registered females a year, 25 being heifers, and of these, 80 are calved out and the rest are sold.

The Spaders have been using AHIR since 1968 and rely on it to improve the herd. The market is mostly for light birth bulls. The cow herd averages less than a +3 birth EPD, with good growth at weaning and yearling. The cattle are marketed by Silent Auction on the first Saturday of March.

The Ranch consists of 640 acres and has been on the low input, sustainable farming program since the mid 80's. About 100 acres are farmed with corn, grain rotation. 180 acres are alfalfa/grass which is put up for hay each year, with some of the hay being sold. There are two 4-acre food plots for wildlife. The rest of the farm is pasture and is being developed into smaller units for rotational grazing. In 1996, we started working with the Fish & Wildlife Service and the Conservation District to save the wetlands and improve rotational grazing.

Hayland Angus Ranch was nominated by the South Dakota Beef Breeds Council.

Bob Thomas
Thomas Angus Ranch
Baker, Oregon

Thomas Angus Ranch is a family owned business including Bob and Gloria Thomas; their son and daughter-in-law Rob & Lori Thomas; and daughter and son-in-law Kris and Andy Barr. Located near Baker, Oregon, the Thomas's are celebrating their fiftieth anniversary this year, having gotten their start in the Angus business in 1947 with three head of purebred cattle.

Today, the Thomases run 680 registered Angus cows in a similar fashion to their commercial customers while utilizing the most advanced industry innovations. Some of the innovative aspects of this ranching operation that have given the Thomases their staying power are 1) their focus and never ending commitment to the commercial cattle industry, 2) their use of proven, high accuracy sires in one of the most intensive, largest scale total AI programs in the nation, 3) their dedication to the product they produce, the beef industry and the environment.

Thomas Angus Ranch centers its program around their demand for range bulls which now number around 330 bulls marketed annually. The majority of their genetics are offered at their annual production sale held each fall for the past 24 years. Over 200 bulls, 40 bred heifers and 70 cow/calf pairs are sought after at this sale by customers looking for calving ease, growth, maternal and carcass traits. EPD's and performance information are not only available, but are demanded as customers rely ever increasingly on this data. An additional 130 bulls are sold private treaty in the spring.

The Thomas' unconditional guarantee on the product they sell, their integration between the grassroots producer and feeder, as well as their customers' affiliation with three major branded beef programs will allow this ranching oriented family to enjoy many more years of success. Building on a belief that a superior product will sell itself, the Thomas' will continue to focus their energies on genetic improvements.

Thomas Angus Ranch was nominated by the Oregon Cattlemen's Association.

Nicholas Wehrmann and Richard McClung
Wehrmann Angus
New Market, Virginia

Wehrmann Angus was established in 1975 in Southwest Georgia. The registered Angus herd was started with performance cattle, mostly of Rito breeding from Jorgensen Ranches in Ideal, South Dakota. The herd remained at the same location until July 1, 1986. During those years in Georgia, Wehrmann Angus adhered strictly to performance principles, using the best bulls possible to do the desired job and ambitiously culling the cattle who couldn't measure up. The cow herd was developed to produce strictly on roughage which is the only real feed resource the deep south has to offer. Because of the demands placed on the herd, Richard McClung, who became managing partner in 1978, and Nick Wehrmann, were able to develop a bull that could perform well in the harsh south Florida environment. Thus, a volume bull market in that area was established and is still being enjoyed.

After 11 years in south Georgia, the herd was moved July 1, 1986, to New Market, Virginia to Court Manor Farm which, at the time, consisted of 1,300 acres, but has now grown to 2,250 acres. At that time, an extensive pasture renovation took place. Miles of high tensile fence was built along with barns, corrals and feeding systems. Today, Court Manor is an excellent cow operation.

Since 1985, Wehrmann Angus has put 23 bulls in major bull studs. During the last nine years, ultrasonic measures of loineye and backfat have been taken on all bulls as well as pelvic measurements on all bulls and heifers. Scrotal circumference measurements as well as semen tests are also taken. During the last three years, backfat, loineye and percent intramuscular fat measurements have been taken on all bulls and heifers. Wehrmann Angus has cooperated with Dr. Bill Beal at Virginia Tech in several practical research projects.

Richard McClung has served as a director of the Virginia Angus Association, Virginia Beef Cattle Improvement Association and is also a past president of that organization. He has just completed his third year as a director of the American Angus Association. He is presently a director of the Virginia Cattle Industry Board. McClung has spoken at numerous state field days throughout the U.S. and has also taken part in symposiums and conventions. He has served as a judge from 1991 through 1993 at the National Western Stock Show in Denver.

The Wehrmann Angus herd has definitely reached a level of genetic superiority, recognized across the country and is making a contribution that will make a difference in the beef business.

Wehrmann Angus was nominated by the Virginia Beef Cattle Improvement Association.

COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

Chan Cooper	MT	1972	Gene Gates	KS	1975
Alfred B. Cobb, Jr.	MT	1972	V.A. Hills	KS	1975
Lyle Eivens	IA	1972	Robert D. Keefer	MT	1975
Broadbent Brothers	KY	1972	Kenneth E. Leistritz	NE	1975
Jess Kilgore	MT	1972	Ron Baker	OR	1976
Clifford Ouse	MN	1973	Dick Boyle	ID	1976
Pat Wilson	FL	1973	James D. Hackworth	MO	1976
John Glaus	SD	1973	John Hilgendorf	MN	1976
Sig Peterson	ND	1973	Kahau Ranch	HI	1976
Max Kiner	WA	1973	Milton Mallery	CA	1976
Donald Schott	MT	1973	Robert Rawson	IA	1976
Stephen Garst	IA	1973	William A. Stegner	ND	1976
J.K. Sexton	CA	1973	U.S. Range Exp. Station	MT	1976
Elmer Maddox	OK	1973	John Blankers	MN	1976
Marshall McGregor	MO	1974	Maynard Crees	KS	1977
Lloyd Mygard	MD	1974	Ray Franz	MT	1977
Dave Matti	MT	1974	Forrest H. Ireland	SD	1977
Eldon Wiese	MN	1974	John A. Jameson	IL	1977
Lloyd DeBruycker	MT	1974	Leo Knoblauch	MN	1977
Gene Rambo	CA	1974	Jack Peirce	ID	1977
Jim Wolf	NE	1974	Mary & Stephen Garst	IA	1977
Henry Gardiner	KS	1974	Odd Osteross	ND	1978
Johnson Brothers	SD	1974	Charles M. Jarecki	MT	1978
John Blankers	MN	1975	Jimmy G. McDonnal	NC	1978
Paul Burdett	MT	1975	Victor Arnaud	MO	1978
Oscar Burroughs	CA	1975	Ron & Malcolm McGregor	IA	1978
John R. Dahl	ND	1975	Otto Uhrig	NE	1978
Eugene Duckworth	MO	1975	Arnold Wyffels	MN	1978

COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

Bert Hawkins	OR	1978	Dan L. Weppler	MT	1981
Mose Tucker	AL	1978	Harvey P. Wehri	ND	1981
Dean Haddock	KS	1978	Dannie O'Connell	SD	1981
Myron Hoeckle	ND	1979	Wesley & Harold Arnold	SD	1981
Harold & Wesley Arnold	SD	1979	Jim Russell & Rick Turner	MO	1981
Ralph Neill	IA	1979	Oren & Jerry Raburn	OR	1981
Morris Kuschel	MN	1979	Orin Lamport	SD	1981
Bert Hawkins	OR	1979	Leonard Wulf	MN	1981
Dick Coon	WA	1979	Wm. H. Romersberger	IL	1982
Jerry Northcutt	MO	1979	Milton Krueger	MO	1982
Steve McDonnell	MT	1979	Carl Odegard	MT	1982
Doug Vandermyde	IL	1979	Marvin & Donald Stoker	IA	1982
Norman, Denton & Calvin Thompson	SD	1979	Sam Hands	KS	1982
Jess Kilgore	MT	1980	Larry Campbell	KY	1982
Robert & Lloyd Simon	IL	1980	Lloyd Atchison	CAN	1982
Lee Eaton	MT	1980	Earl Schmidt	MN	1982
Leo & Eddie Grubl	SD	1980	Raymond Josephson	ND	1982
Roger Winn, Jr.	VA	1980	Clarence Reutter	SD	1982
Gordon McLean	ND	1980	Leonard Bergen	CAN	1982
Ed Disterhaupt	MN	1980	Kent Brunner	KS	1983
Thad Snow	CAN	1980	Tom Chrystal	IA	1983
Oren & Jerry Raburn	OR	1980	John Freitag	WI	1983
Bill Lee	KS	1980	Eddie Hamilton	KY	1983
Paul Moyer	MO	1980	Bill Jones	MT	1983
G.W. Campbell	IL	1981	Harry & Rick Kline	IL	1983
J.J. Feldmann	IA	1981	Charlie Kopp	OR	1983
Henry Gardiner	KS	1981	Duwayne Olson	SD	1983

COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

Ralph Pederson	SD	1983
Ernest & Helen Schaller	MO	1983
Al Smith	VA	1983
John Spencer	CA	1983
Bud Wishard	MN	1983
Bob & Sharon Beck	OR	1984
Leonard Fawcett	SD	1984
Fred & Lee Kummerfeld	WY	1984
Norman Coyner & Sons	VA	1984
Franklyn Esser	MO	1984
Edgar Lewis	MT	1984
Boyd Mahrt	CA	1984
Neil Moffat	CAN	1984
William H. Moss, Jr.	GA	1984
Dennis P. Solvie	MN	1984
Robert P. Stewart	KS	1984
Charlie Stokes	NC	1984
Milton Wendland	AL	1985
Bob & Sheri Schmidt	MN	1985
Delmer & Joyce Nelson	IL	1985
Harley Brockel	SD	1985
Kent Brunner	KS	1985
Glenn Harvery	OR	1985
John Maino	CA	1985
Ernie Reeves	VA	1985
John R. Rouse	WY	1985
George & Thelma Boucher	CAN	1985
Kenneth Bentz	OR	1986
Gary Johnson	KS	1986
Ralph G. Lovelady	AL	1986
Ramon H. Oliver	KY	1986
Kay Richardson	FL	1986
Mr. & Mrs. Clyde Watts	NC	1986
David & Bev Lischka	CAN	1986
Dennis & Nancy Daly	WY	1986
Carl & Fran Dobitz	SD	1986
Charles Fariss	VA	1986
David J. Forster	CA	1986
Danny Geersen	SD	1986
Oscar Bradford	AL	1987
R.J. Mawer	CAN	1987
Rodney G. Oliphant	KS	1987
David A. Reed	OR	1987
Jerry Adamson	NE	1987
Gene Adams	GA	1987
Hugh & Pauline Maize	SD	1987
P.T. McIntire & Sons	VA	1987
Frank Disterhaupt	MN	1987
Mac, Don & Joe Griffith	GA	1988
Jerry Adamson	NE	1988
Ken, Wayne & Bruce Gardiner	CAN	1988
C.L. Cook	MO	1988
C.J. & D.A. McGee	IL	1988
William E. White	KY	1988
Federick M. Mallory	CA	1988
Stevenson Family	OR	1988

COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

Gary Johnson	KS	1988	Ken & Wendy Sweetland	CAN	1990
John McDaniel	AL	1988	Swen R. Swenson Cattle	TX	1990
William A. Stegner	ND	1988	Robert A. Nixon & Son	VA	1991
Lee Eaton	MT	1988	Murray A. Greaves	CAN	1991
Larry D. Cundall	WY	1988	James Hauff	ND	1991
Dick & Phyllis Henze	MN	1988	J.R. Anderson	WI	1991
Jerry Adamson	NE	1989	Ed & Rich Blair	SD	1991
J.W. Aylor	VA	1989	Reuben & Connee Quinn	SD	1991
Jerry Bailey	ND	1989	Dave & Sandy Umbarger	OR	1991
James G. Guyton	WY	1989	James A. Theeck	TX	1991
Kent Koostra	KY	1989	Ken Stielow	KS	1991
Ralph G. Lovelady	AL	1989	John E. Hanson, Jr.	CA	1991
Thomas McAvoy, Jr.	GA	1989	Charles & Clyde Henderson	MO	1991
Bill Salton	IA	1989	Russ Green	WY	1991
Lauren & Mel Schuman	CA	1989	Bollman Farms	IL	1991
Jim Tesher	ND	1989	Craig Utesch	IA	1991
Joe Thielen	KS	1989	Mark Barenthsen	ND	1991
Eugene & Ylene Williams	MO	1989	Rary Boyd	AL	1992
Phillip, Patty & Greg Bartz	MO	1990	Charles Daniel	MO	1992
John J. Chrisman	WY	1990	Jed Dillard	FL	1992
Les Herbst	KY	1990	John & Ingrid Fairhead	NE	1992
Jon C. Ferguson	KS	1990	Dale J. Fischer	IA	1992
Mike & Diana Hooper	OR	1990	E. Allen Grimes Family	ND	1992
James & Joan McKinlay	CAN	1990	Kopp Family	OR	1992
Gilbert Meyer	SD	1990	Harold, Barbara & Jeff Marshall	PA	1992
DuWayne Olson	SD	1990	Clinton E. Martin & Sons	VA	1992
Raymond R. Peugh	IL	1990	Lloyd & Pat Mitchell	CAN	1992
Lewis T. Pratt	VA	1990	William VanTassel	CAN	1992

COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

James A. Theeck	TX	1992	Walter Carlee	AL	1995
Aquilla M. Ward	WV	1992	Nicholas Lee Carter	KY	1995
Albert Wiggins	KS	1992	Charles C. Clark, Jr.	VA	1995
Ron Wiltshire	CAN	1992	Greg & Mary Cunningham	WY	1995
Andy Bailey	WY	1993	Robert & Cindy Hine	SD	1995
Leroy Beitelspacher	SD	1993	Walter Jr. & Evidean Major	KY	1995
Glenn Calbaugh	WY	1993	Delhert Ohnemus	IA	1995
Oscho Deal	NC	1993	Olafson Brothers	ND	1995
Jed Dillard	FL	1993	Henry Stone	CA	1995
Art Farley	IL	1993	Joe Thielen	KS	1995
Jon Ferguson	KS	1993	Jack Turnell	WY	1995
Walter Hunsuker	CA	1993	Tom Woodard	TX	1995
Nola & Steve Kleiboeker	MO	1993	Jerry & Linda Bailey	ND	1996
Jim Maier	SD	1993	Kory M. Bierle	SD	1996
Bill & Jim Martin	WV	1993	Mavis Dummermuth	IA	1996
Ian & Alan McKillop	ON	1993	Terry Stuart Forst	OK	1996
George & Robert Pingetzer	WY	1993	Don W. Freeman	AL	1996
Timothy D. Sutphin	VA	1993	Lois & Frank Herbst	WY	1996
James A. Theeck	TX	1993	Mr./Mrs. George A. Horkan, Jr.	VA	1996
Gene Thiry	MB	1993	David Howard	IL	1996
Fran & Beth Dobitz	SD	1994	Virgil & Mary Jo Huseman	KS	1996
Bruce Hall	SD	1994	Q. S. Leonard	NC	1996
Lamar Ivey	AL	1994	Ken & Rosemary Mitchell	CAN	1996
Gordon Mau	IA	1994	James Sr, Jerry & James H. Petik	SD	1996
Randy Mills	KS	1994	Ken Risler	WI	1996
W.W. Oliver, V	VA	1994	Merlin Anderson	KS	1997
Clint Reed	WY	1994	Joe C. Bailey	ND	1997
Stan Sears	CA	1994	William R. "Bill" Brockett	VA	1997

COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

Arnie Hansen	MT	1997	David Petty	IA	1997
Howard McAdams, Sr. & Howard McAdams, Jr.	NC	1997	Rosemary Rounds & Marc & Pam Scarborough	SD	1997
Rob Orchard	WY	1997	Morey & Pat Van Hoecke	MN	1997
Bill Peters	CA	1997			

COMMERCIAL PRODUCER OF THE YEAR

Chan Cooper	MT	1972	Glenn Harvey	OR	1985
Pat Wilson	FL	1973	Charles Fariss	VA	1986
Lloyd Nygard	ND	1974	Rodney G. Oliphant	KS	1987
Gene Gates	KS	1975	Gary Johnson	KS	1988
Ron Blake	OR	1976	Jerry Adamson	NE	1989
Steve & Mary Garst	IA	1977	Mike & Diana Hopper	OR	1990
Mose Tucker	AL	1978	Dave & Sandy Umbarger	OR	1991
Bert Hawkins	OR	1979	Kopp Family	OR	1992
Jess Kilgore	MT	1980	Jon Ferguson	KS	1993
Henry Gardiner	KS	1981	Fran & Beth Dobitz	SD	1994
Sam Hands	KS	1982	Joe & Susan Thielen	KS	1995
Al Smith	VA	1983	Virgil & Mary Jo Huseman	KS	1996
Bob & Sharon Beck	OR	1984	Merlin & Bonnie Anderson	KS	1997

Merlin and Bonnie Anderson
1997 Commercial Producer of the Year
Burke Healey, President; Merlin and
Bonnie Anderson;Ron Bolze, Exec. Director

FOR IMMEDIATE RELEASE

Merlin Anderson receives the "1997 BIF Outstanding Commercial Producer Award"

Dickinson, North Dakota - Merlin Anderson has been selected as the Beef Improvement Federation (BIF) 1997 Outstanding Commercial Producer at the Convention held at the Hospitality Inn in Dickinson, North Dakota.

Many cow-calf producers are gearing up for a marketing environment that rewards a superior product. For Merlin Anderson of Dresden, Kansas, that moment has arrived. He has not only aligned himself with a program that pays a premium for his cattle, but also has produced replacement heifers for which there is a customer waiting list. This success has been the direct result of Anderson's personal commitment to doing his best in all facets of life.

Anderson and his wife, Bonnie, began their career as beef producers in 1956, with 25 Hereford cows. Because his calves weaning weights were poor, Anderson established a performance testing program in 1959. This involved maintaining ownership of his calves from conception to processing as well as meticulous record-keeping of each animal.

The initial data he acquired showed a weaning weight average of 367 lbs. Because this figure was far from the 500 lb. goal Anderson had established, he began purchasing bulls from performance-tested sales. Although it was a bigger investment, he believed it was the best way to improve his herd's productivity.

Continuing in his efforts to improve weaning weights, Anderson introduced Simmental genetics to his herd in 1972 through artificial insemination (AI). Today, Anderson AIs his entire herd for 30 days before placing them on pasture for six weeks with a clean-up bull. He also synchronizes his heifers, so that they will calve within a 30-day period.

By 1987, Anderson's calf weaning weights were averaging about 600 lbs. Although he wanted to keep increasing this figure, he also established carcass quality goals for his herd. His next move was to use Red Angus sires. It was then that he struck gold. The first generation was solid colored calves that had the genetics to produce a superior carcass.

This genetic cross also has provided him the opportunity to feed most of his calves through the Red Angus Supreme Angus Beef Alliance. The program pays Anderson a premium for those calves that meet the required specifications. He also has found a market for some of his replacement heifers. Currently, there are several cattlemen on a waiting list for heifers Anderson doesn't retain in his own herd.

Measuring Anderson's success today, it is difficult to believe that some doubted he would survive as a beef producer. Even a tax consultant advised him to find another job after reviewing his first three-year profits. Nearly four decades later, his cattle are commanding top dollar in the marketplace. Maybe those disbelievers would have changed their minds about Anderson's career choice had they known he was driven by excellence.

BIF is pleased to honor Merlin Anderson for his lifetime of dedication to performance beef cattle principles with their 1997 Outstanding Commercial Producer Award.

1997 BIF
COMMERCIAL NOMINEES

Merlin Anderson
Prairie Dog Creek Cattle Co.
Dresden, Kansas

Determination and a clear set of goals are what have lead to the success of commercial cattleman Merlin Anderson of Dresden. In 1959, Merlin and his wife Bonnie established a performance testing program to improve calf weaning weights. This program involved maintaining ownership of their calves from conception through processing as well as meticulous record keeping on each animal. Their initial goal was to increase weaning weights from 367 lbs. to 500 lbs. This goal was met and exceeded, with their average weaning weight standing at 650 lbs. today. Anderson was able to reach this goal through stringent culling and by incorporating superior genetics through performance tested bulls in the 1960s and eventually by adopting artificial insemination in the 1970s.

Anderson continues to AI his entire herd for 30 days before turning in a clean-up bull for six weeks. He also synchronizes his heifers so that they will calve within a 30-day period. In February, 1997, all 30 of his heifers calved within 30 days, with no death loss.

Today, through the solid base of a once purebred Simmental cowherd, the Anderson's have introduced Red Angus genetics to their program and are reaping the rewards of their primary goal - to receive a premium for the superior quality and consistency they have bred into their herd. Through the Red Angus Supreme Angus Beef Alliance, the Anderson's are receiving a premium over the market for cattle fed through this program. In addition to the rewards gained from his finished cattle, his breeding program has developed replacement heifers that are in high demand.

Anderson has also incorporated equipment and management techniques to make his operation more efficient. Examples of this includes an automatic feeder for those calves in his performance testing program, an electronic scale for weighing individual animals and using existing crop residues to maintain his cowherd.

Driven by excellence, Anderson continually looks for methods that will improve his cowherd and bottom line.

Anderson was nominated by the Kansas Livestock Association.

Joe C. Bailey
Rainbow Ranch
Towner, North Dakota

Joe C. Bailey has been in the commercial cattle business at Towner, North Dakota for 31 years. The Rainbow Ranch consists of 1280 acres of pasture and hayland. The cow herd consists of 85 head of primarily Gelbvieh crossbreds along with a group of registered Red Angus females. Gelbvieh and Red Angus sires are used. Steer calves, along with heifers not meeting replacement requirements, are sold off the cow in late October. The Red Angus bull calves are sold by private treaty. The Rainbow Ranch is entirely a forage production unit. Cattle are the sole converters of this roughage into the salable edible product of beef. Joe has implemented a cell grazing system as a way to increase the efficiency of the pasture land. A cell system occupying a quarter of land will carry 28 cow/calf pairs for the full grazing season as compared to 18 pairs per quarter on the balance of the pasture land. Joe has been using the computerized performance reports from the Cow Herd Appraisal of Performance Software Program (CHAPS) since 1989. The percentage of calves born in the first 21 days has increased 20%. Calving is 98% completed in 63 days. The average weaning age is at 163 days and weight per day of age is over three pounds. A tightly grouped calving season along with weaning. heavy weight calves early is the production model of uniformity and consistency Joe C. Bailey has strived for.

Joe Bailey was nominated by the North Dakota Beef Cattle Improvement Association.

William R. (Bill) Brockett
Virginia Beef Corporation
Haymarket, Virginia

Bill Brockett and family own and operate Virginia Beef Corporation which had its beginning in 1965. Beef cattle are the center piece enterprise on this large diversified leased land in Northern Virginia.

Today, the commercial cow herd numbers 3,500 head of Angus and Angus-Hereford cross cows. In the past few years, Mr. Brockett has developed a very large embryo transfer service utilizing the mature cow herd as recipients for embryos coming from a number of progressive seedstock breeders. Virginia Beef corporation grazes 8,000 stockers and finishes 10,000 to 20,000 cattle in western commercial feedlots annually. In addition, the operation involves the production of 8,000 to 10,000 acres of grain and 3,000 acres of commercial sod for the commercial turf market.

Virginia Beef uses a split calving season. Spring, March 1 to May 1, and fall, September 1 to November 1. For the production of replacement females, the highest ratio cows are bred to Angus bulls. Cows not expected to produce replacement heifers are bred to Charolais bulls as a terminal cross. Artificial insemination is used exclusively on heifers and prior to the current ET project, all of the cow herd was inseminated by AI one time using a synchronized program.

Sire selection receives a great deal of personal care and all bulls, whether used AI or natural service, must meet certain minimum and maximum EPDs, in addition to their own individual performance records. Bulls must first qualify based on numbers and then on other characteristics of phenotype, structural soundness, temperament and so forth.

Bill Brockett's program calls for a mature commercial cow to weigh between 1,050 and 1,200 pounds and be sired by bulls which meet his criteria. Cows are culled based on pregnancy status and production.

Bill Brockett is a very articulate spokesman and has been utilized on a number of in state and out of state beef cattle educational programs. He has served on the Foreign Trade Committee of NCA and presently serves on the Property Rights/Environmental Management Committee of NCBA. In 1995, he received the outstanding Conservation Farmer Award from the Loudoun Soil and Water District.

Indeed, Bill Brockett and Virginia Beef Corporation have been extremely successful and at the same time have provided information and seedstock for many other commercial producers in the region. Virginia Beef Corporation was nominated by the Virginia Beef Cattle Improvement Association.

Arnie Hansen
Hansen Ranch
Sidney, Montana

Arnie Hansen of Hansen Ranches, Sidney, Montana, has been associated with commercial cattle ranching for 50 years. Along with the 350 head cow herd, he is also the proprietor of The South 40 Restaurant, a family owned and operated steakhouse, located in Sidney.

Hansen has adapted to many changes within the beef industry during his lifetime. Industry trends have forced Hansen to use different sire breeds during his ranching career. Currently he uses all Charolais sires on his Charolais-cross cows and Angus replacement heifers. Hansen has developed strong relationships with his bull and heifer suppliers over the years. This allows Hansen to continuously use proven genetics and performance information when selecting replacements for his herd. Hansen DNA tests all calves and finishes them in a custom feedlot. He accumulates carcass data on the calves to determine which sires excel in carcass traits. This carcass information, individual performance, EPDs, and visual appraisal are the determining factors Hansen uses to select prospective herd sires. Selected herd sires are typically one-half or three-quarter brothers to previous sires who have the same high standards of predictable genetic merit. These carefully planned genetics have proven successful in his operation.

The goal of the Hansen Ranch has always been and will continue to be, to keep the ranch a family operation to pass down to future generations. To accomplish this, Arnie Hansen concentrates efforts on improving economically important traits and he explores investment opportunities that will eventually result in net profits for the ranching operation. Hansen Ranch was nominated by the American International Charolais Association.

Howard McAdams, Sr. and Howard McAdams, Jr.
McAdams Farm
Efland, North Carolina

The McAdams Farm is located in Efland, North Carolina in Orange County. The farm has been actively farmed by the McAdams family since 1885. Howard McAdams, Sr. and Howard McAdams, Jr. currently operate the farm which includes 30 acres of tobacco, hay and a 180 cow commercial cow/calf operation.

The cow herd was started in 1967 by Howard, Sr. when 20 commercial Angus cows were purchased along with an Angus bull. In 1984, a crossbreeding program was started using a Hereford bull. In 1986, the McAdams began weighing calves and keeping individual computerized records. Then in 1987, an AI program was started using Simmental bulls working into a three-breed rotation of Angus-Hereford-Simmental. In 1990, Gelbvieh bulls were added to the crossbreeding program.

Cow numbers have gradually increased until there are 180 cows due to calve in the fall of 1997. Cows calve during a short calving season in November and December. Heifers calve at 23 months and begin calving 3 weeks prior to the cows.

The McAdams have utilized performance records to increase their 205 day weaning weights by 125 lbs. in the ten years since they began performance testing. They buy performance tested bulls and use EPDs to select the best bulls for their herd.

The McAdams Farm was nominated by the North Carolina Beef Cattle Improvement program.

Rob Orchard
Orchard Ranch Ltd.
Ten Sleep, Wyoming

The Orchard Ranch Ltd. has operated in the Big Horn Mountains of Wyoming for close to a century. Headquartered south of Ten Sleep, Wyoming on the arid western side of the Big Horns, Rob and Phyllis Orchard operate a low input commercial cow/calf and yearling operation under very harsh environmental conditions. With grazed forage largely satisfying the nutrient requirements throughout the production year, supplemental feed costs have been kept to a minimum. Their break-even prices have been further lowered by infusing first Salers and then Red Angus blood into a base Hereford cow herd. The results from crossbreeding with performance supported Red Angus bulls have been dramatic. They have maintained a moderate sized cow that produces adequate but moderate milk. They have done an excellent job of matching their genetics to their environment and producing a low cost/high return product. The steer calves are roughed through the winter, grazed as yearlings and are transferred off grass in late summer to the feedlot for finishing. Heifers not kept as replacements are spayed and run in a similar manner to the steers. Ownership is retained and carcass data is obtained. The Orchards believe in producing at an optimum level while maintaining or enhancing their forage resource. They are excellent stewards of the land who just happen to produce a very desirable beef product that is very much in demand by the consumer. The Wyoming Beef Cattle Improvement Association is pleased to nominate the Orchards and the Orchard Ranch Ltd. for BIF's Outstanding Commercial Producer Award.

Bill Peters
Peters Ranch
Montague, California

Bill and Lynn Peters operate their commercial cow ranch in the mountainous area of northern California near the Oregon border. Their operation started in 1948 when they finished their own cattle and sold them to the local packing plant. They rely on their own feeds, hay and grain fed through a feed mill with mixer wagons in their feedlot, plus irrigated pasture grazing. Close proximity of a packing plant and retained ownership of their own calves in their feedlot for nearly 25 years provided ample opportunity to learn how their calves performed on their dams, on pasture, in the lot and on the rail. The lesson "quality pays" was learned. Currently, with no local packing plant and long distances to feedlots, their spring-born calves are still bred and raised for quality, but sold in October at about 800 pounds for direct shipment for finishing.

The Peters' use Angus and Charolais crossbred cows mated to either purebred Angus or Charolais bulls. Bull selection follows the genetic trend of progressive performance minded purebred breeders. They avoid the most rapid gaining bull calves, seeking bulls that they can use on both heifers and cows. A 60 day breeding season for heifers and cows results in March and April calves, respectively. Their raised feeds and feedlot are heavily utilized by weaning in September and backgrounding of their calves.

The Peters' credit a short breeding season, genetics for quality beef, improved nutrition and intensive grazing of pasture as key ingredients to their operation. They maintain a policy of some capital improvements every year. The Peters Ranch was nominated by the California Beef Cattle Improvement Association.

David Petty
Iowa River Ranch
Union, Iowa

The Iowa River Ranch runs 260 black and black whiteface cows. Owner David Petty contour farms 1,000 acres of corn and soybeans and cares for 1,500 acres of pasture and CRP land.

David finishes 2,000 head of market hogs a year and retains ownership of his calf crop all the way to slaughter in an attempt to learn more about end product characteristics and consumer acceptance.

David decided at a young age to pursue beef production and being a self-made individual, put his operation together one piece at a time.

David believes production efficiencies of a cow herd are very important to profitability and tries to contain cost of production while also trying to increase whole herd production. David respects the environment and always tries to improve it while making management decisions. Soil conservation is practiced with contour farming and the seeding of grass to a lot of acres. Pasture rotation gives the grass a rest period and improves the stand and quality of forage available for grazing at a later date. Excess early grass is harvested for later use and then the grass is allowed to grow for stock-piled grazing.

By raising his own replacement females, David knows the factors that improve production such as udder quality, disposition, fleshing ability, longevity of the cow family and carcass value of their mates. David's cow herd is also adapted to their environment.

The Iowa River Ranch was nominated by the Iowa Cattlemen's Association.

Rosemary Rounds and Marc & Pam Scarborough
Scarborough Ranch
Hayes, South Dakota

The Scarborough Ranch of Hayes, South Dakota, is a diversified operation, mainly of cattle and winter wheat. Running 400 cows on the rough pastures near the Cheyenne River, they have tried to keep their black and baldy cows moderate sized with good mothering ability. Since 1982, they have bred these cows to high-growth Charolais bulls, believing it to give them the best cross for feedlot performance. Most years, the calves have stayed at the ranch through the backgrounding phase and sold in February. However, marketing is determined by the current situation instead of history, and after studying the markets in the three most recent years, all or some of the calves have been sold at the sale barn in October.

In 1994, Scarborough Ranch retained ownership on 93 of their Charolais-cross heifer calves at a feedlot near Chamberlain, South Dakota. Despite the spring snow and mud, they were very pleased with the cattle's performance and profitability, and are setting as their goal to finish all of their calves in the future. In addition, they signed on with the National Cattleman's Strategic Alliance program where by they received carcass information at slaughter that will be an invaluable selection tool.

Fall calving is also in the Scarborough Ranch future. After two calf crops, they have found that slightly higher feed costs are offset by receiving more dollars per calf, having less bad weather and disease at calving and being able to spread their fixed labor, equipment and bull costs over two cow herds. They are looking to expand their new enterprise and take the fall calves through the feedlot as well.

Rosemary Rounds and her late husband, Marlin Scarborough, brought the first Charolais to the ranch. Since Marlin's death in 1987, Rosemary has continued the tradition in partnership with her son, Marc and his wife Pam. Her younger son, Ryan, is a high school senior who works at the ranch during the summers.

The Scarborough Ranch was nominated by the South Dakota Beef Breeds Council.

Morey and Pat Van Hoecke
Van Hoecke Valley
Pipestone, Minnesota

The Van Hoecke Valley operation is located in Southwestern Minnesota and is operated by Morey and Pat Van Hoecke along with their two children, Bill (18) and Chrissy (15). The Van Hoecke's farm 370 acres of corn and soybeans and 100 acres of alfalfa, but the pride of their farm is the outstanding 140 head commercial cow herd that monopolizes the majority of their time. The entire family takes special pride in their farming operation and are recognized locally for the outstanding contributions they have made in the livestock production area. Their rotational grazing program has increased carrying capacity, while at the same time improving efficiency of the total beef operation. Van Hoecke's feed out their steers on an accelerated finishing program, which takes advantage of the genetic potential of their cattle and the seasonal tendencies of the market.

The entire family is also very active in their 4-H club with both Morey and Pat having served as club leaders. Their leadership abilities don't stop there; however, as Morey also holds a leadership role on the Counties' Beef Advisory Board and the local Cattlemen's Association, with Pat serving an active role in the leadership of their church's Council of Catholic Women's group.

Morey and Pat Van Hoecke were nominated by the Minnesota Beef Cattle Improvement Association.

AMBASSADOR AWARDS

Warren Kester	Beef magazine	MN	1986
Chester Peterson	Simmental Shield	KS	1987
Fred Knop	Drovers Journal	KS	1988
Forrest Bassford	Western Livestock Journal	CO	1989
Robert C. DeBaca	The Ideal Beef Memo	IA	1990
Dick Crow	Western Livestock Journal	CO	1991
J.T. "Johnny" Jenkins	Livestock Breeder Journal	GA	1993
Hayes Walker, III	America's Beef Cattleman	KS	1994
Nita Effertz	Beef Today	ID	1995
Ed Bible	Hereford World	MO	1996
Bill Miller	Beef Today	KS	1997

Bill Miller, Beef Today Magazine
receives the
1997 BIF Ambassador Award
Burke Healey, President; Bill Miller
Ron Bolze, Executive Director

FOR IMMEDIATE RELEASE

Bill Miller receives the "1997 BIF Ambassador Award"

Dickinson, North Dakota - The Beef Improvement Federation (BIF) honored Bill Miller with the Ambassador Award at the Convention held at the Hospitality Inn in Dickinson, North Dakota.

Bill Miller considered being a wildlife biologist, started toward that degree at Kansas State University after graduating from the little Western Kansas town of Collyer High School in 1970. But he took some journalism courses that changed the course of his life, led him to a dual degree in biology and journalism--and introduced him to his future bride, journalist Debbie (Lekron) Miller.

Fortunately for the beef industry, Bill put his journalism degree with his ranching background to specialize in reporting on the beef industry after his K-State graduation in 1974. Where ever he went, his impact was felt. One of the first places he hung his hat was at a magazine that Kansas ag journalist Chet Peterson had created to exemplify the commitment to excellence he saw in the new American Simmental Association. The Simmental Shield stood out among breed magazines for innovative stories that went beyond why breeders chose the cattle they did. Bill Miller built on that tradition, editing a magazine with leadership, stunning visuals and helpful stories that made a difference in readers' lives.

He took that tradition with him when he moved on to become associate beef editor of Successful Farming in the late 1970s. He and Deb moved to Iowa where they bought a farm and raised--surprise--Simmental cattle, while both worked on Merideth Publishing magazines. Bill continued to attract national attention with his reader-friendly stories. No matter how technical the point, he had a writing style that let everyone see that he was one of them, talking and writing their language. In the early 1980s he was noticed by Farm Journal, which hired him away from Successful Farming. He was leery about working for a magazine based in...Philadelphia! But Farm Journal wanted their editors in the field--why, he and Deb could even move back to Kansas if they wanted.

After just a year as a staff editor, Bill was tapped to become editor of what was then Beef Extra. Perhaps it is significant that his first decision on what to put on the cover was an historic one: The beef product was not often seen on the covers of what may have been called beef magazines then, but were really cattle magazines. His cover story was on the new, controversial Maverick Beef, featuring a photo of Roy Moore with a caseful of his product.

Bill has been, arguably, the most beef product-oriented editor in the agricultural press ever since. He never let readers forget that they were producing food, and led this awareness campaign before the days of Beef Quality programs. In his 12 years of editorial leadership at Beef Today, he has always been a champion for fairness, even if that meant suggesting that a packer had a good idea. Yet no one has ridden packers harder than Bill to ensure they keep producers' interests in the forefront, or call them on something he saw as more one-sided than farsighted.

Bill did get to move back to Kansas. He and Debbie and their daughters Anna and Christine bought a ranch south of Council Grove around 1990 and sold their Iowa farm. He continued in his role of producer-editor, knowing full well the practical implications of every story he wrote or edited. Most of those stories were directly involved, or tied to issues with which the Beef Improvement Federation addresses continually. His background and continually building experience in production helped Bill maintain a role as one of the most effective communicators the beef industry has known. You may not always agree with Bill over the years, but you could always see where he was coming from. And if you got the chance to talk to him, you knew you were talking to someone who cared.

Bill was an American Ag Editors Association Writer of the Year, in 1996, for his editorial, "Where have all the ethics gone?" But this piece, which was also named story of the year from AAEA, is not so much a standout as an example of Bill's take on the beef industry and life. This is all about people, producing beef for other people, learning our lessons and playing fair along the way.

Those who have had the privilege of working with Bill, know that he leads by example, in a brotherly style that has always made Beef Today a truly people-oriented business magazine for the people who produce beef. Though he turned over the editorship of Beef Today last year to Steve Suther, a writer and editor whose talent he helped develop over the previous 10 years, Bill remains as involved as possible in his new position as editor at large. He's still part of the family at Beef Today, though he has lately pursued new "Horizons" as Chief Marketing Officer for U.S. Premium Beef. You'll still see HORIZONS in every issue, as Bill continues to lead and explore new options for the beef industry while taking a little more time to live it.

Each year, BIF recognizes the Ambassador Award recipient as an individual from the livestock media who has promoted BIF principles and the performance beef cattle movement.

BIF is pleased and honored to recognize the many contributions of Bill Miller by presenting him with the BIF Ambassador Award.

PIONEER AWARDS

Jay L. Lush	IA	1973	Clyde Reed	OK	1981
John H. Knox	NM	1974	Milton England	TX	1981
Ray Woodward	ABS	1974	L.A. Moddox	TX	1981
Fred Wilson	MT	1974	Charles Pratt	OK	1981
Charles E. Bell, Jr.	USDA	1974	Otha Grimes	OK	1981
Reuben Albaugh	CA	1974	Mr. & Mrs. Percy Powers	TX	1982
Paul Pattengale	CO	1974	Gordon Dickerson	NE	1982
Glenn Butts	PRT	1975	Jim Elings	CA	1983
Keith Gregory	MARC	1975	Jim Sanders	NV	1983
Braford Knapp, Jr.	USDA	1975	Ben Kettle	CO	1983
Forrest Bassford	WLJ	1976	Carroll O. Schoonover	WY	1983
Doyle Chambers	LA	1976	W. Dean Frischknecht	OR	1983
Mrs. Waldo Emerson Forbes	WY	1976	Bill Graham	GA	1984
C. Curtis Mast	VA	1976	Max Hammond	FL	1984
Dr. H.H.Stonaker	CO	1977	Thomas J. Marlowe	VA	1984
Ralph Bogart	OR	1977	Mick Crandell	SD	1985
Henry Holsman	SD	1977	Mel Kirkiede	ND	1985
Marvin Koger	FL	1977	Charles R. Henderson	NY	1986
John Lasley	FL	1977	Everett J. Warwick	USDA	1986
W.L. McCormick	GA	1977	Glenn Burrows	NM	1987
Paul Orcutt	MT	1977	Carlton Corbin	OK	1987
J.P. Smith	PRT	1977	Murray Corbin	OK	1987
James B. Lingle	WYE	1978	Max Deets	KS	1987
R. Henry Mathiessen	VA	1978	George F. & Mattie Ellis	NM	1988
Bob Priode	VA	1978	A.F. "Frankie" Flint	NM	1988
Robert Koch	MARC	1979	Christian A. Dinkel	SD	1988
Mr. & Mrs. Carl Roubicek	AZ	1979	Roy Beeby	OK	1989
Joseph J. Urick	USDA	1979	Will Butts	TN	1989
Bryon L. Southwell	GA	1980	John W. Massey	MO	1989
Richard T. "Scotty" Clark	USDA	1980	Donn & Sylvia Mitchell	CAN	1990
F.R. "Ferry" Carpenter	CO	1981	Hoon Song	CAN	1990

Jim Wilton	CAN	1990	Dixon Hubbard	USDA	1993
Bill Long	TX	1991	Richard Willham	IA	1993
Bill Turner	TX	1991	Dr. Robert C. DeBaca	IA	1994
Frank Baker	AR	1992	Tom Chrystal	IA	1994
Ron Baker	OR	1992	Roy A. Wallace	OH	1994
Bill Borror	CA	1992	James S. Brinks	CO	1995
Walter Rowden	AR	1992	Robert E. Taylor	CO	1995
James W. "Pete" Patterson	NC	1993	A.L. "Ike" Eller	VA	1996
Hayes Gregory	NC	1993	Glynn Debter	AL	1996
James D. Bennett	VA	1993	Larry V. Cundiff	NE	1997
O'Dell G. Daniel	GA	1993	Henry Gardiner	KS	1997
M.K. "Curly" Cook	GA	1993	Jim Leachman	MT	1997

1997 BIF Pioneer Award Winners

Larry Cundiff
Burke Healey, President, Larry Cundiff;
Ron Bolze, Executive Director

1997 BIF Pioneer Award Winners

Henry Gardiner
Burke Healey, President; Henry Gardiner;
Ron Bolze, Executive Director

Jim Leachman
Burke Healey, President; Jim Leachman;
Ron Bolze, Executive Director

FOR IMMEDIATE RELEASE

Larry V. Cundiff receives a "1997 BIF Pioneer Award"

Dickinson, North Dakota - The Beef Improvement Federation (BIF) honored Larry V. Cundiff with a Pioneer Award at the Convention held at the Hospitality Inn in Dickinson, North Dakota.

Larry Cundiff was born in Kansas in 1939, received his B.S. from Kansas State University in 1961, his M.S. and Ph.D. from Oklahoma State in 1964 and 1966. He married his wife, Laura, in 1960. They have three children. He was on the faculty at the University of Kentucky from 1965 to 1967, before working as a research geneticist in the USDA.

Cundiff has not only designed, conducted and published some of the most important beef breeding research of the 20th century, but also has lead in the transfer of new technology to the beef industry through his continued work in BIF and his presentations made across the nation and around the world.

Many of Cundiff's M.S and Ph.D. research results are incorporated into the BIF Guidelines for Uniform Beef Improvement Programs. His work from 1967 to 1977 on a comprehensive crossbreeding study has resulted in a crossbred commercial beef industry. His contributions and leadership since 1975 in the conduct and reporting of results from the Germ Plasm Evaluation Project at U.S. MARC to characterize diverse breeds recently imported to the U.S. has influenced the opportunities of the commercial producer. From 1967 to 1988, he served as regional coordinator of the North Central Regional Beef Breeding Project (NC-1). In 1975, he became research leader for the Genetics and Breeding Research Unit at U.S. MARC. Cundiff has played a key role in the recruitment of a scientific team and in the planning, conduct and reporting of research in beef, sheep and swine at U.S. MARC. This front line research has and will impact the entire livestock industry. Cundiff, in his easy way, will continue to share new technology with the beef industry he serves.

BIF is pleased and honored to recognize the many contributions of Larry Cundiff by presenting him with the BIF Pioneer Award.

FOR IMMEDIATE RELEASE

Henry Gardiner receives a "1997 BIF Pioneer Award"

Dickinson, North Dakota - The Beef Improvement Federation (BIF) honored Henry Gardiner with a Pioneer Award at the Convention held at the Hospitality Inn in Dickinson, North Dakota.

Henry Gardiner laid the foundation for Gardiner Angus Ranch, a 21,000 acre ranch located in Southwest Kansas, 50 miles south of Dodge City. It is owned and operated by Henry, Greg, Mark and Garth Gardiner and their wives. The cowherd consists of over 1000 head of registered and commercial Angus cows.

Henry Gardiner has been a long time advocate of breeding more profitable cattle utilizing many of the new technologies that have become available in cattle breeding. His involvement with evaluating beef cattle started in the 1960's when he became aware of differences in cattle by evaluating his purebred and commercial herd, utilizing performance records on birth weight and growth.

As time progressed and Henry was searching for superior genetics, he progeny tested many bulls from breeders across the United States for growth and carcass traits. Because of his involvement with progeny testing, he realized that bull selection methods based strictly on performance index were flawed and, as he observed, most of the bulls he had progeny tested were average or below average when later compared based on more current genetic information.

As EPD's became available in the Angus breed, he utilized them in his cattle breeding program both in the purebred and commercial program. He soon realized the EPD system was able to do a much better job of ranking bulls for the traits he had been interested in than the other methods of sire selection.

Today, performance data is taken on all calves born on the ranch whether from registered cows or commercial cows. This would include conception date, birth date, birth weight, calving ease, 205 day weight and yearling weight. Feedlot gain is taken on all male calves, both steers and bulls. Gardiner has collected carcass data since 1970 on all A.I. sires using steers out of commercial cows. A.I. sires are selected from sires that have high accuracy EPDs with light birth weight, acceptable milk and as much yearling weight as possible with moderate mature size (frame score 5 and 6 at maturity).

Henry long ago realized that to maximize the full potential of the highly proven superior bulls, all matings in the purebred and commercial program needed to be to high accuracy A.I. bulls. For over 10 years, Gardiner Angus Ranch has not used natural service sires.

The next step in the progression of their program was to utilize the top cows in their program to produce many calves through embryo transplant. Today Gardiner Angus Ranch produces more ET calves than any other purebred Angus operation in the United States. Because of Henry's early acceptance of EPD's, A.I. and embryo transfer, Gardiner Angus Ranch has contributed greatly to the Angus gene pool in the U.S. and world beef cattle business.

Henry has served the industry over time as president of the Kansas Angus Association, Performance Registry International, Livestock and Meat Industry Council and the Beef Improvement Federation. Gardiner Angus Ranch was honored with the BIF Commercial Producer of the Year in 1981 and the BIF Seedstock Producer of the Year in 1987.

BIF is honored to recognize the pioneering spirit of Henry Gardiner by presenting him the BIF Pioneer Award.

FOR IMMEDIATE RELEASE

Jim Leachman receives the "1997 BIF Pioneer Award"

Dickinson, North Dakota - The Beef Improvement Federation (BIF) honored Jim Leachman with the Pioneer Award at the Convention held at the Hospitality Inn in Dickinson, North Dakota.

Jim Leachman is founder of Leachman Cattle Company in Billings, Montana, and of the Optimum Mainstream Crossbreeding System. Ranked by the National Cattlemen's Beef Association as the second largest registrar of seedstock in the United States, Leachman Cattle Company features five purebred lines and three composites. Each of these lines is represented in the 2,000 head cow herd which Leachman maintains on 110,000 acres of native range in southwestern Montana.

Leachman holds an Annual Cattleman's Congress the third week of April which features seminars, banquets and the World's Largest One Brand Bull Sale. The sale features include enormous sight unseen buyer participation, the Bull Roll, and across breed comparisons. Visitors from Australia, New Zealand, Argentina, Brazil, Paraguay, Mexico, Canada and Europe come to the ranch each year. Leachman's program is expanding with branches in Argentina and Brazil where new composite breeds are being developed. Leachman has exported live cattle embryos to Canada, Mexico, Brazil, Argentina, New Zealand, Australia and Japan. Demand for Leachman genetics can also be seen in their growing market for semen, both domestically and abroad.

Leachman's influence is obvious in the sire summaries of many breeds where Leachman bulls excel for antagonistic performance traits. Leachman leads the industry in the practical application of performance testing and genetic selection. He has exhibited national champions in eight breeds along with winning many pen and carload competitions. Leachman has judged over 15 breeds worldwide including English, Continental and Zebu.

Beef Magazine selected Leachman as one of the "25 Who Made the Difference" in the beef cattle industry over the past 25 years. He is a past president of the Red Angus Association of America, and of the Beef Improvement Federation. He is the only recipient of all three of the Red Angus Association's prestigious awards: Personality of the Year; Breeder of the Year; and Pioneer Breeder.

Leachman is an outspoken and popular speaker on such subjects as balanced and objective breeding, management and marketing programs. He is also quoted in many trade publications.

Leachman Cattle Company is a family owned and operated business. Leachman's wife, Corinne serves as computer programer. Jim's sons include Leland, the company's general manager, Seth, the company's breeding specialist and Justus, who works for Price Waterhouse in San Francisco.

Leachman has dedicated his life to improving cattle and the cattle industry. He has great determination, drive, honest and integrity.

BIF is pleased and honored to recognize the many contributions of Jim Leachman by presenting him with the BIF Pioneer Award.

CONTINUING SERVICE AWARD RECIPIENTS

Clarence Burch	OK	1972
F.R. Carpenter	CO	1973
E.J.Warwick	DC	1973
Robert DeBaca	IA	1973
Frank H. Baker	OK	1974
D.D. Bennett	OR	1974
Richard Willham	IA	1974
Larry V. Cundiff	NE	1975
Dixon D. Hubbard	DC	1975
J. David Nichols	IA	1975
A.L. Eller, Jr.	VA	1976
Ray Meyer	SD	1976
Don Vaniman	MT	1977
Lloyd Schmitt	MT	1977
Martin Jorgensen	SD	1978
James S. Brinks	CO	1978
Paul D. Miller	WI	1978
C.K. Allen	MO	1979
William Durfey	NAAB	1979
Glenn Butts	PRI	1980
Jim Gosey	NE	1980
Mark Keffeler	SD	1981
J.D. Mankin	ID	1982
Art Linton	MT	1983
James Bennett	VA	1984
M.K. Cook	GA	1984
Craig Ludwig	MO	1984
Jim Glenn	IBIA	1985
Dick Spader	MO	1985
Roy Wallace	OH	1985
Larry Benyshek	GA	1986
Ken W. Ellis	CA	1986
Earl Peterson	MT	1986
Bill Borror	CA	1987
Daryl Strohbehn	IA	1987
Jim Gibb	MO	1987
Bruce Howard	CAN	1988
Roger McCraw	NC	1989
Robert Dickinson	KS	1990
John Crouch	MO	1991
Jack Chase	WY	1992
Leonard Wulf	MN	1992
Henry W. Webster	SC	1993
Robert McGuire	AL	1993
Charles McPeake	GA	1993
Bruce E. Cunningham	MT	1994
Loren Jackson	TX	1994
Marvin D. Nichols	IA	1994
Steve Radakovich	IA	1994
Dr. Doyle Wilson	IA	1994
Paul Bennett	VA	1995
Pat Goggins	MT	1995
Brian Pogue	CAN	1995
Harlan D. Ritchie	MI	1996
Doug L. Hixon	WY	1996
Glenn Brinkman	TX	1997
Russell Danielson	ND	1997
Gene Rouse	IA	1997

1997 BIF Continuing Service Award Recipients

Glenn Brinkman
BIF Past President
(Not Pictured)

Russell Danielson
Burke Healey, President; Russell Danielson;
Ron Bolze, Executive Director

Gene Rouse
Burke Healey, President; Gene Rouse;
Ron Bolze, Executive Director

FOR IMMEDIATE RELEASE

Glenn Brinkman receives a "1997 BIF Continuing Service Award"

Dickinson, North Dakota - The Beef Improvement Federation (BIF) honored Glenn Brinkman with a Continuing Service Award at the Convention held at the Hospitality Inn in Dickinson, North Dakota.

Glenn Brinkman was born in Minnesota, raised in Mississippi and is a graduate of Louisiana State University with a degree in forestry. He has chaired several International Brangus Breeders Association (IBBA) and Texas Brangus Breeders Association committees, serving as president of each organization. He was the first recipient of IBBA's Brangus Breeder of the Year Award in 1982.

Mr. Brinkman was general manager and later co-owner and general manager of Brinks Brangus from its inception in November, 1968, until the sale of the herd in July of 1993. During that time Brinks Brangus became firmly established as a leader in the Brangus breed and in the beef cattle industry. Brinks Brangus was a breed pioneer in the use of embryo transfer and was the first to sell shares in a female for that purpose. Brinks Brangus was also the first to syndicate a Brangus bull. Brinks Brangus bred numerous national and international grand champions. Under Glenn's direction, the comprehensive breeding, performance and marketing programs of Brinks Brangus led to many record-breaking achievements.

Glenn Brinkman was elected president of the Beef Improvement Federation for the 1995-1996 term. He was nominated for the BIF Seedstock Producer of the Year in 1985 and 1986. In May 25, 1993, the 73rd legislature of Texas passed a resolution honoring Glenn Brinkman for his many contributions to the cattle industry in Texas.

Glenn has always been willing to use whatever resources he has had at his disposal to promote educational and performance programs. As the president of IBBA, he used his BRANGUS JOURNAL space to stress the value of performance records and to admonish breeders to contribute data to the National Sire Evaluation project through their participation in the Brangus Herd Improvement Records (BHIR) program. The impeccable integrity of Glenn Brinkman and the Brinks program was a main force behind a tremendous surge of interest in, and subsequent growth of, the association's performance programs in 1984. His common sense approach to performance was an asset and, as the person who had probably kept more complete records on more cattle than anyone else in the breed, the IBBA performance program often drew on his experience and expertise to help plan a meaningful, workable program. Glenn insists that performance is more than just weighing cattle; it is a complete, well-laid plan to accomplish a set of objectives.

Summing up Glenn and his program is no easy task because his is not a simplistic approach. Glenn does not make snap judgments; every side of an issue is weighed before he makes a decision. He takes care that his thoughts and comments are well-placed, and he always takes a positive approach. His positive attitude toward the cattle business is infectious; one conversation with Glenn and you have no doubt that there is a future in cattle breeding. Glenn has commanded respect, not only as a successful cattle breeder, but as a deep-thinking, solid businessman. His forthcoming contributions will reach beyond Brangus circles. Glenn's philosophies and strategies embody the purpose of BIF and have much to offer the entire beef cattle community. Glenn Brinkman has succeeded because he has utilized every tool available in the industry. He has incorporated the accomplishments of others into this program and has never become infatuated with the non-productive.

Glenn is proudest of his work in research. His early work with Kansas State University measuring ribeye area ultrasonically, laid the groundwork for ribeye area EPD as found in the Brangus Sire Summary today.

In summary, he has the uniqueness and the foresight of one who will forever leave his imprint on the beef cattle industry. He is a quiet man, and is happiest when out with his cows deciding on the best direction for next years calf crop. Glenn is inordinately proud of his three grown children, their spouses and the most astounding group of grandchildren.

BIF is pleased and honored to recognize the many contributions of Glenn Brinkman by presenting him with the BIF Continuing Service Award.

FOR IMMEDIATE RELEASE

Russell Danielson receives the "1997 BIF Continuing Service Award"

Dickinson, North Dakota - The Beef Improvement Federation (BIF) honored Russ Danielson with the Continuing Service Award at the Convention held at the Hospitality Inn in Dickinson, North Dakota.

Russ Danielson grew up near Cuba, North Dakota, attended a country school and Valley City High School. He was active in 4-H, won national recognition in 4-H for "Gardening" and showed Shorthorn cattle. He played football for Valley City State College for 1 year and graduated from North Dakota State University (NDSU) in 1964. Russ was quite active in campus activities including the Livestock Judging Team, Little International where he achieved Champion Showman honors and he worked at several of the NDSU Livestock Production Barns. Russ assumed duties as the Beef Herdsman in 1965, and, at one time calved 400 cows. He exhibited cattle locally, at the Red River Valley Fair, Valley City Winter Show and ND State Fair with numerous champions in all 3 British Breeds. Russ always said "The college has to set an example. Our exhibit always has to look good and most of all, we HAVE to be the FIRST people in the barn from tie out in the morning." You could count on it. They always were.

Russ joined the research and teaching faculty after approximately 10 years as Beef Herdsman and completion of his Master's degree. As faculty supervisor of the NDSU beef herd, Russ taught courses in Beef Production, Livestock Selection and Evaluating, Livestock Management and Introductory Animal Science, routinely promoting performance beef cattle concepts and BIF principles in the classroom. He coached the Junior Judging and Meat Animal evaluating teams. Russ currently advises as many students as anyone in the entire College of Agriculture including more than half of all undergraduate Animal Science students. Russ has been a longtime advisor to the Saddle and Sirloin Club and has been recognized with college and campus awards for outstanding student advising, outstanding club advisor, outstanding teacher and as a Preferred Professor.

Russ has an outstanding reputation as a beef cattle judge and evaluator, having judged at practically every major state and national level show and having the reputation of never straying very far from the basics.

The smartest thing Russ ever did was marry Helen in 1966 and they raised two daughters, Karen and Beth, both of which graduated from the University of North Dakota where they were outstanding all conference and all American volleyball players and academic all Americans.

In summary, Russ has an uncanny ability to bring seemingly complex things into focus and actually simplify them. There are certain things which are right and appropriate and certain things which are not. The right and appropriate way is usually the simplest and best. His values are in the right place and center around helping people. He is respected as an evaluator, motivator and most of all, as one to be counted on in all circumstances.

The Beef Improvement Federation is proud and honored to recognize the tireless commitment of Russ Danielson to the beef cattle industry by presenting him with the BIF Continuing Service Award.

FOR IMMEDIATE RELEASE

Gene Rouse receives a "1997 BIF Continuing Service Award"

Dickinson, North Dakota - The Beef Improvement Federation (BIF) honored Gene Rouse with a Continuing Service Award at the Convention held at the Hospitality Inn in Dickinson, North Dakota.

Gene Rouse is a beef researcher, a teacher and a livestock extension specialist. His research on the development of ultrasound for determining body composition in the live animal and also in carcasses has led to many contributions to the Live Animal and Carcass Evaluation Committee of BIF. He, along with Doyle Wilson and John Crouch, are responsible for the creation and conduct of the symposia, workshops and certification for ultrasound technicians through BIF.

Rouse is a creative researcher and his ultrasound research is cooperative involving the incorporation of new ultrasound technology and the application to the evaluations. His beef research has centered on the growth and development of the market animal. Rouse's ability to work with industry in the development of programs that put research results to work is his real asset. He has helped form alliances of beef producers and organized the sale of beef as a branded product. Gene's quiet leadership and extensive knowledge of the beef industry gets things done from the design and conduct of the research to the transfer of applicable technology.

Rouse received his B.S. from the University of Minnesota in 1967, his M.S. and Ph.D. from Iowa State in 1969 and 1971. He was Extension Area Livestock Specialist at Spencer, Iowa from 1971-1976. He became a State Extension Livestock Specialist in 1982, when he became a researcher and teacher on the faculty of Animal Science at Iowa State University. Gene taught beef production, manages the beef teaching herd and has proceeded to conduct research projects on beef production and the development of ultrasound to evaluate body composition in the live animal. His management, meats and breeding expertise has made him a leader in technology transfer to the beef industry.

BIF is pleased and honored to recognize the many contributions of Gene Rouse by presenting him with the BIF Continuing Service Award.

1997 Beef Improvement Federation Board of Directors

(Left to Right) Front Row: John Hough, Gary Johnson, Jed Dillard, Burke Healey, James Smith
Second Row: Kent Anderson, Dick Gilbert, Ronnie Silcox, Ron Bolze
Third Row: John Crouch, S.R. Evans, Larry Cundiff
Fourth Row: Willie Altenburg, Herb McLane, Roger Hunsley, Jim Doubet, Norm Vincel
Not Pictured: Don Boggs, Larry Corah, Galen Fink, Ronnie Green, Roy McPhee, Connee Quinn, Richard Willham

Burke Healey
BIF President 1996/97

Gary Johnson
BIF President 1997/98

Ron Bowman, North Dakota Beef Cattle Improvement Associations President extends welcome to Convention Attendees

Kris Ringwall,Co-Host 1997 BIF Convention

Keith Helmuth, Co-Host 1997 BIF Convention

Nancy Jo Bateman
Coordinator of the
New Beef Products
Luncheon

Herb McLane
Canadian Beef Breeds
Council, Executive Secretary
Host for 1998
BIF Convention
Calgary, Alberta, Canada

Alan Albers
Albers AK Gelbvieh & KLA
7651 SW 160 Ave.
Nashville KS 67112
316-246-5318

Curtis Alderson
University of Nebraska
Norfolk NE 68701
402-329-4821

Ben Alderton
PO Box 341
Goodwell OK 73939
405-349-5254

William Alkinson
Michigan State University
Angell Building 133 Service Road
East Lansing MI 48824-1234

Hugh Allen
Liahn Farms
736 Springbank Drive
London Ontario N6K 1A3
Canada

Mark Allen
Graduate Studies - UNL
7120 Adams #78
Lincoln NE 68507
402-467-4193

Beecher Allison
North Carolina State University
516 Test Farm Road
Waynesville NC 28786
704-456-7520

William Altenburg
ABS Global Inc.
9100 N Co. Rd 15
Ft. Collins CO 80524
970-568-7881

Brian Amundson
Bar V Ranch LTD
2652 Hwy 281 E.
Jamestown ND 58401

John R. Andersen
GT Angus
3428 Valley Woods Dr.
Verona WI 53593
608-833-5960

Don Anderson
MSU-Northern Ag Research Center
Star Rt 36 Box 43
Havre MT 59501
406-265-6115

Kent Anderson
North American Limousin Foundation
P.O. Box 4467
Englewood CO 80155
303-220-1693

Merlin & Bonnie Anderson
KLA
Rt 1 Box 156
Dresden KS 67635
913-475-3737

Sharon Anderson
North Dakota State University
Box 5437
Fargo ND 58105
701-231-8944

Sue Armstrong
Beef Improvement Ontario
6986 Hwy 24 S.
Guelph Ontario N1H 6J4
Canada 519-767-2665

Jerry Arnold
Coffee Creek Ranch
425 N Cherry
Valentine NE 69201
402-376-3872

Jeff Arseneau
Minnesota Ext. Service
PO Box 307
Carlton MN 55718
218-384-3511

Mike Baker
Cornell Coop Extension Service
480 N. Main St.
Canandaigua NY 14424
716-394-4171

Mark Barenthson
8815 81 St NW
Powers Lake ND 58773

Brett Barham
Texas Tech. University
5830 2nd St.
Lubbock TX 79416
806-799-4327

Geoff Barker
Canadian Limousin Association
5663 Burleigh Crescent
SE Calgary Alberta T2H 1Z9
Canada 403-253-7309

Mel Barnett
11950 93rd St NE
Bismarck ND 58501

Leland Barth
North Dakota Ag Dept.
600 E. Blvd.
Bismarck ND 58505

Nancy Jo Bateman
North Dakota Beef Commission
4023 N. State St
Bismarck ND 58501
701-328-5120

Kindra Beitelspacher
NRCS
220 E. Rosser
Bismarck ND 58501

Gary L. Bennett
USDA ARS
PO Box 166
Clay Center NE 68933-0166
402-762-4254

James D. Bennett
Knoll Crest Farm
HCR 1 Box 39
Red House VA 23963
804-376-3567

Paul Berg
North Dakota State University
166 Hultz Hall
Fargo ND 58105

Philip Berg
University of Minnesota
119 2nd Ave SW Suite 2
Pipestone MN 56164
507-825-5416

Charles Berger
2877 83rd Ave SW
Richardton ND 58652

J. Keith Bertrand
University of Georgia
206 Livestock Poultry Bldg.
Athens GA 30602-2771
706-542-1852

Loren & Carole Berwald
North Dakota BCIA
HC 3 Box 53
Keene ND 58847
701-675-2418

James F. Bessler
American Livestock Insurance Co.
PO Box 520
Geneva IL 60134-0520
630-232-2100

Vawnita Best
NDSU Animal & Range Science
1231 10 St N
Fargo ND 58105
701-241-4454

Ron Bieber
Bieber Red Angus
11450 353rd Ave
Leola SD 57456

Ralph Blalock. Jr.
Cooperative Extension Service
PO Box 129
Tarbor NC 27886
919-641-7815

John & Lucy Bobb
PO Box 406
Center ND 58530
701-794-3148

Ronald C. Bock
Bock Charolais
13748 40th St SW
Belfield ND 58622
701-575-4658

John Boddicker
American Maine-Anjou Association
760 Livestock Exchange Rd
Kansas City MO 64102
816-474-9555

John Boehms
Swan Creek Ranch
774 Yellow Hammer Rd
Troy TN 38260
901-538-9779

Don Boggs
South Dakota State University
Box 2170
Brookings SD 57007
605-688-5448

Wayne Bollum
BEEF Magazine
7900 Int'l Dr. Suite 300
Minneapolis MN 55425
612-851-4671

Ron Bolze
Kansas State University
105 Exp Farm Rd
Colby KS 67701
913-462-7575

Jerry Bornemann
5415 S. State Rd
Durand MI 48429
517-743-4509

Andrew (Andy) C. Boston
Purdue University Extension
205 East Main Street
Paoli IN 47454
812-723-7107

Rick Bourdon
Colorado State University
Ft. Collins CO 88523
303-491-6150

Richard Bowman
Rt 3 Box 24
Rhame ND 58651

Ron & Orpha Bowman
North Dakota BCIA
HCR 4 Box 2
Bowman ND 58623
701-523-5426

Mike Boyd
Mississippi State University
Box 9815
Mississippi State MS 39762
601-325-2802

Paul Brackelsberg
Iowa State University
119 Kildee Hall
Ames IA 50011
515-294-7235

Minnie Lou Bradley
Bradley Ranch
Rt 1 Box 152
Memphis TX 79245
806-888-1062

Randy Brandt
8890 County Rd 17C
Maxbass ND 58760

John Brethour
Kansas State University
1232 240th Ave
Hays KS 67601

Tom Brink
American Gelbvieh Association
10900 Dover St.
Westminster CO 80021
303-465-2333

Bill & Barbara Brocket
VA Beef Corp.
1215 James Madison Hwy.
Haymarket VA 20169
703-754-8873

Steve Brooks
Brooks Angus Ranch
Rt 1 Box 25
Bowman ND 58623
701-523-5391

Tom Brooks
Pfizer Animal Health
PO Box 93
Ft. Shaw MT 59443

Donald Brown
RA Brown Ranch
Box 789
Throckmorton TX 76483
817-849-0611

Rob Brown
CCBIA
Box 789
Throckmorton TX 76483
817-849-0611

Sylvia Brown
North Dakota Beef Commission
4023 N. State Street
Bismarck ND 58501

Kelly Bruns
South Dakota State University
Box 2170
Brookings SD 57007

Dean Bryant
Roseda Farm
15317 Carroll Road
Monkton MD 21111
410-472-2697

Craig (Zeb) Bryantt
Critical Vision Inc.
430 10th St. NW Suite n-110
Atlanta GA 30318
404-817-9655

Jackie Buckley
NDSU - Morton County Extension
210 2nd Ave NW
Mandan ND 59554
701-667-3340

John Butler
NCBA
5420 S. Quebec
Englewood CO 80155

Sarah Buxkemper
American Simmental Association
2617 CR 400
Ballinger TX 76821
915-442-4501

Jack Byrd
Knibbs Creek Farm
PO Box 313
Amelia VA 23002
804-561-2421

Blaine & Pauline Canning
Rairielane Farms
Box 4221
Souis Manitoba R0K 2C0
Canada 204-858-2475

Jodi Carlson
North Dakota District 4 Cattle Women
HC 1 Box 62
Dunn Center ND 58626

Kenton Carlson
Merck Agvet
2161 Victoria Rose Dr.
Fargo ND 58104
701-239-1774

Jeff & Rachael Carpenter
NCCES
3541 Hog Hill Rd
Vale NC 28168
704-276-3393

Wanda Cerkaney
South Dakota State University
521 12th S. #102
Brookings SD 57006
605-697-6324

Jeff H. Chandler
Extension Service
PO Box 68
Goldsboro NC 27533-0068
919-931-1525

Herve Chapelle
Herd Book Limousin
Lanaud 87220
Boisseuil
France 05-55-06-46-47

Jack & Gini Chase
Buffalo Creek Red Angus
Box 186
Leiter WY 82837
307-736-2422

Chris Christensen
Christensen Bros. Simmentals
37548 221st
Wessington Springs SD 57382

Tom Chrystal
1887 H Ave
Scranton IA 51462

Don Clanton
914 Grande
North Platte NE 69101
308-532-1971

Sidney R. Clarke III
Lutine Farms Inc.
PO Box 1117
Shawnee OK 74802-1117
405-275-1045

James Clement
Mandan Vet Clinic
2248 Sunny Rd. South
Mandan ND 58554

Stan Clements. Jr.
Clemson University
PO Box 246
Greenwood SC 29648
864-229-6681

John Comerford
Penn State University
324 Henning
University Park PA 16802
814-863-3661

Sam Comstock
CSU Animal Science
Colorado State University
Ft. Collins CO 80523

M.K. (Curly) & Sandra Cook
Cloud Creek Cattle Co.
Rt 1 Box 365
Crawford GA 30630-9739
706-743-8373

Mamadou Coulibaly
WSU Dept. of Animal Science
Pullman WA 99164-6310
509-335-1802

Glenn Coulter
Ag & Ag Food Canada
PO Box 3000
Lethbridge Alberta P1J 81
Canada 403-327-4561

Denny Crews
Ag & Ag Food Canada
PO Box 3000
Lethbridge Alberta T1J 4B1
Canada 403-327-4591

John Crouch
American Angus Association
3201 Frederick Blvd.
St. Joseph MS 64506
816-233-3101

Judy Crouch
2100 Lovers Lane
St. Joseph MO 64506

Larry V. Cundiff
USDA ARS MARC
PO Box 166
Clay Center NE 68933
402-762-4171

Bruce Cunningham
American Simmental Association
2200 W. Dickerson #80
Bozeman MT 59715
406-587-4531

David Danciger
Tybar Angus Ranch
1644 Prince Creek Rd.
Carbondale CO 81623
970-963-1391

Russ Danielson
North Dakota State University
ARS Dept. Hultz Hall
Fargo ND 58105
701-231-7648

Orville Deckert
37600 253 Ave NE
Arena ND 58412
701-943-2643

Max Deets
NCBA
PO Box 3469
Englewood CO 80155
303-694-0305

Dan Dhuyvetter
Farmland Industry
12418 Southridge Dr.
Kansas City MO 64116-0005

John Dhuyvetter
2120 Academy Rd
Minot ND 58701

H.H. Dickensen
American Hereford Association
PO Box 4059
Kansas City MO 64101
816-842-3757

Bob Dickinson
2831 Severin Road
Gorham KS 67640
913-998-4357

Jed & Joan Hare Dillard
Basic Beefmasters
Rt 2 Box 92
Greenville FL 32331
904-997-6223

Fran Dobitz
HC 81 Box 62
Morristown SD 57645
701-522-3480

David Dockter
MN Select Sires
HC 5 Box 45
Mandan ND 58554
701-663-4175

Greg Docter
Cargill BeefWorks
716 W. 3rd
Mitchell SD 57301

Troy Dodd
Integrated Genetic Management Inc.
PO Box 1464
Canyon TX 79015

Joerg Dodenhoff
Iowa State University
109 Kildee Hall
Ames IA 50011
515-294-5049

Josh Dohrman
111 7th St. S.
Hettinger ND 58639

L. J. Dohrmann
9721 31 R St SW
Taylor ND 58656

Dan Dorn
Decatur County Feed Yard Inc.
RR 3 Box 9
Oberlin KS 67749-9405
913-475-2212

Jim & Sherry Doubet
American Salers Association
5600 S. Quebec St. Suite 220A
Englewood CO 80111
303-770-9292

Patrick Doyle
Colorado State University
Colorado State University
Ft. Collins CO 80523
970-491-5414

John Edwards
North American Limousin Foundation
P.O. Box 4467
Englewood CO 80155

Gerald Effertz
Effertz Key Ranch
1985 49th St N
Velva ND 58790
701-624-5104

Jerry S. Effertz
Effertz Black Butte Acres
1975 48 St. N.
Velva ND 58790-9107
701-624-5136

Kaye Effertz
North Dakota Ag Dept.
600 E. Blvd
Bismarck ND 58505

Neil Effertz
American Loala Management
17350 N Hwy 1804
Bismarck ND 58501

Roger Effertz
Effertz Key Ranch
1985 49th St N
Velva ND 58790
701-624-5104

Bill Ekstrom
CSU Cooperative Extension
Box 270
Meeker CO 81641
970-878-4093

Antonio Elias-Calles
Washington State University
710 SE Chinook S 85
Pullman WA 99163-4824
509-333-6099

A.L. (Ike) Eller Jr.
Virginia Tech.
500 Patrick Henry Drive
Blacksburg VA 24060
540-231-9163

Chad Ellingson
21st Century Genetics
2100 County Road 135
St. Anthony ND 58566

Mauricio A. Elzo
University of Florida
PO Box 110910
Gainesville FL 32611-0910
352-392-7564

Clair Engle
Penn State University
324 Henning Bldg.
University Park PA 16802
814-863-3669

Mark Enns
University of Arizona
7300 N. Mona Lisa Apt. #8352
Tuscon AZ 85741
520-626-7266

Jim & JoAnn Enos
Lawhorn Valley Salers
9416 E. Center Rd
Stockton IL 61085

Tim Erickson
University of Wisconsin
2805 Maple View Drive
Madison WI 53719
608-263-4320

S.R. Evans. Jr.. MD
Mississippi BCIA
1604 Leflore Ave.
Greenwood MS 38930
601-453-5317

Doug Fee
Canadian Angus Association
214 6715 8th St NE
Calgary Alberta T2E 7H7
Canada 403-571-3580

Rod Fee
Successful Farming
1716 Locust
Des Moines IA 50309

Donnie Feiring
Feiring Angus Ranch
HC 2 Box 26
Powers Lake ND 58773
701-755-3324

Robert J. Felsman
University of Arizona
PO Box 4966
Pine Bluff AZ 71611
870-543-8530

Tom Field
Colorado State University
CSU
Ft. Collins CO 80523
970-491-6642

Lori Fink
Fink Genetics
7101 Anderson
Manhattan KS 66503

Fred Fleener
285 10th St E
Dickinson ND 58601

Waldo & Sali Forbes
37 Breckton Drive
Sheridan WY 82801

Doug Frank
ABS Global Inc.
6908 River Road
DeForest WI 53532
608-846-6252

Judy A. Frank
Noller & Frank Charolais
18278 Highway 92
Sigouney IA 52591
515-622-2388

Bob Freer
Taurus International
PO Box 1160
Armidale NSW 2350
Australia 61-67-728831

Basil Fritz
Saskatchewan Extension - Yorkton
3085 Albert St.
Regina Saskatchewan S4S 0B1
Canada 306-787-4692

Warren Froelich
NDSU Extension Service
PO Box 1109
Williston ND 58801

Ron Frye
American Angus Association
Box 395
Huntley MT 59103

Randy Gaebe
NDSU Extension Service
301 Bdwy
Napoleon ND 58561
701-754-2504

Lee M. Garbel
Western Vet Clinic
Box 699
Williston ND 58801

Henry & Nan Gardiner
Gardiner Angus Ranch
Rt 1 Box 290
Ashland KS 67831
316-635-2932

Mark Gardiner
Gardiner Angus Ranch
Rt 1 Box 290
Ashland KS 67831
316-635-2932

Jim Gardner
Rex Ranch
HC 89 Box 25
Ashby NE 69333
308-577-6705

Charles T. Gaskins
Washington State University
135 Clark Hall
Pullman WA 99164-6310
509-335-6310

Mark Gerlach
Braunvieh Marketing Conection Inc.
Rt 2 Box 53
Wilber NE 68465

Jim Gibb
NCBA
5420 S. Quebec
Englewood CO 80111
303-850-3370

Richard Gilbert
Red Angus Assoc.
4201 I 35 N
Denton TX 76207
817-387-3502

Colette (Koko) Gjermundson
Tri-State Livestock News
HCR 1 Box 49
Richardton ND 58652
701-938-4697

Mark G. Goforth
603 Prince Avenuw
Goldsboro NC 27530
919-735-0970

Bruce Golden
CSU Animal Science
Colorado State University
Ft. Collins CO 80523
303-491-7128

Bob Gordon
Alta Genetics Inc.
Box 399
Souris Manitoba R0K 2C0
Canada 204-483-3064

Bruce Gordon
Alta Genetics Inc.
Apt 307 1510 Wayridge Drive
Madison WI 53704
608-241-7991

Joyce Gordon
Alta Genetics Inc.
Box 399
Souris Manitoba R0K 2C0
Canada 204-483-3064

Lynn Gordon
Red Angus Association
4201 N I 35
Denton TX 76207
817-387-3502

Elaine Graham
Beef Improvement Ontario
RR 3
Hastings Ontario K0L 1Y0
Canada

Jim Graham
Saskatchewan Extension - Swift Current
3085 Albert St.
Regina Saskaschewana S4S 0B1
Canada

Terry Grajczyk
Saskatchewan Sustainable Production
3085 Alberta St.
Regina Saskatchewan S4S 0B1
Canada 306-787-4692

Ronnie D. & Jane Green
Colorado State University
An. Sci. Dept. CSU
Ft. Collins CO 80523
970-491-2722

Dale Greenwood
North Dakota Stockmen's Association
HC 2 Box 11
Cartwright ND 58838

Scott Greenwood
HC 2 Box A-11
Cartwright ND 58838

Jeff & Diana Grill
Grill Cattle Co.
HCR 2 Box 32
Isabel SD 57633

Randy Guthrie
North Carolina State University
8800 Cassam Rd
Bahama NC 27503-8566
919-471-6872

John B. Hall
1861 Hwy 169E.
Grand Rapids MN 55744
218-327-4345

Arnie Hansen
820 9 Ave SW
Sidney MT 59270
406-482-2789

Bob & Mary Lu Harriman
Professional Beef Genetics
5785 Robertsville Rd
Villa Ridge MO 63089
314-742-3215

Gene & Gynell Harris
HC 01 Box 46
Killdeer ND 58640
701-863-6695

Ken Hartzell
21st Century Genetics
N 5573 Poplar Rd.
Shawano WI 54166
715-526-5484

Craig Hays
Animal Insights
Rt 1 Box 31
Prairie MS 39756

Burke & Tina Healey
Southern Cross Ranch
PO Box 444
Davis OK 73030-0444
405-369-2711

Bob Hearnen
Cargill. Inc.
515 E. 6th Ave
Mitchell SD 57301

Keith Helmuth
North Dakota State University
4065 Hwy 22 South
Dickinson ND 58601
701-227-2079

Norm & Trudy Hemstad
Manitoba Dept. of Ag
GR 350 Box 4 RR 1
Brandon Manitoba R7A 5Y3
Canada 204-726-0590

Greg Henderson
Drovers Journal
10901 W. 84th Terr.
Lenexa KS 66241
913-438-8700

Lois G. Herbst
Herbst Lazy TY Cattle Co.
91 Herbst Road
Shoshoni WY 82649
307-856-2027

Shauna Hermel
BEEF Magazine
7900 Int'l Dr. Suite 300
Minneapolis MN 55425
612-851-4671

Andy D. Herring
Texas Tech. University
5830 2nd St.
Lubbock TX 79416
806-742-1475

William Herring
University of Missouri
S-132 Animal Science Center
Columbia MO 65211
573-884-6860

Joe Hillers
Washington State University
Dept. of Animal Science
Pullman WA 99164
509-335-4022

Rodney Hilley
Georgia Cattlemen
344 HWy 109 West
Molena GA 30258
770-567-3909

Doug L. Hixon
University of Wyoming
PO Box 3684
Laramie WY 82071
307-766-3100

Doug Hoff
Scotch Cap Angus
HCR 66 Box 25A
Bison SD 57620

Jimmy & (son) Bret Holliman
Auburn University
105 County Road 944
Marion Junction AL 36759
334-872-7878

Tom Holm
Linkage Genetics
2411 S. 1070 W. #B
Salt Lake City UT 84119
801-975-1188

Joan Hoovestol
North Dakota Beef Commission
4023 N. State Street
Bismarck ND 58501

Karl Hoppe
North Dakota State University
Box 219
Carrington ND 58421
701-652-2951

Herb Horptnier
Horptner Herefords
2367 Brownsboro Meridian
Eagle Point OR 97524
541-826-6796

Stacy Horrocks
WTAMU
PO Box 1166
Canyon TX 79015

John Hough
American Hereford Association
PO Box 014059
Kansas City MO 64101
816-842-3757

Robert Hough
Red Angus Association
4201 N I 35
Denton TX 76207
817-387-3502

Patsy Houghton
Heartland Cattle Company
Rt 3 Box 134
McCook NE 69001

Brian House
Select Sires Inc.
11740 US 42 N
Plain City OH 43064
614-873-4683

Frank Howeth
Brock III Farms / Intl Brangus Breeders
507 Grindstone Rd.
Weatherford TX 76087
817-596-5100

Harlan Hughes
NDSU Extension Service
PO Box 5437
Fargo ND 58105
701-231-7380

Roger E. Hunsley
American Shorthorn Association
8288 Hascall Street
Omaha NE 68124
402-393-7200

Richard Huntrods
Feldun Purdue Ag Center
RR 10 Box 122
Bedford IN 47421
812-279-8554

Doug Husfeld
BBU
6800 Tark Ten Blvd. Suite 290 W
San Antonio TX 78213
210-732-3132

Don Hutzel
NOBA Inc.
Box 607
Tiffin OH 44883
419-447-6262

Lauren Hyde
CSU Animal Science
Colorado State Universit
Ft. Collins CO 80523

John Jackson
ABS Global Inc.
15 Grassland Street
Billings MT 59106
406-656-2251

Loren Jackson
International Brangus
PO Box 69620
San Antonio TX 78269-6020
210-696-4343

Robert Jameson
Stockmen's Supply Inc.
3905 9th Ave W
West Fargo ND 58078

Tom Jenkins
PO Box 166
Clay Center NE 68933
402-762-4247

Delyn Jensen
Alberta Agriculture
Box 347
Hanna Alberta TOJ 1PO
Canada 403-854-5500

Kevin D. Jensen
Jensen Brothers
PO Box 197
Courtland KS 66939-0197
913-374-4372

Gary & Jody Johnson
Johnson Farms
1654 C. Ave.
Dwight KS 66849
913-482-3362

Larry Johnson
College Station TX 77843
409-845-3517

Scott Johnson
American Angus Association
7201 Frederick Blvd.
St. Joseph MO 64506
816-233-3101

Todd Johnson
Kansas Livestock Association
6031 SW 37th St.
Topeka KS 66614
913-273-5115

Ian Johnsson
Meat Research Corp.
8140 E. Phillips Ave.
Englewood CO 80112
303-804-5244

Steven M. Kappes
USDA ARS MARC
PO Box 166
Clay Center NE 68933
402-762-4363

Susan Keller
Broken Heart Ranch
1573 55th St.
Mandan ND 58554

Dale Kelly
Canadian Charolais Association
2320 41st Ave NE
Calgary Alberta T2E 6W8
Canada 403-250-9242

Linda M. Kelly
University of Arizona
PO Box 182
Ft. Thomas AZ 85536
520-475-2359

Bob Kemp
Ag & Ag Food Canada
Lethbridge Research Center
Lethbridge Alberta T1J 4B1
Canada 403-317-2243

Shelly & Keith Kendrick
Murphy Ranch
HC 1 Box 16A
Killdeer ND 58640

Linda Kesler
American Simmental Association
1 Simmental Way
Bozeman MT 59715
406-587-4531

Doug W. King
Dickinson State University - Ag Dept
470 State Ave.
Dickinson ND 58601

David Kirkpatrick
University of Tennesee
PO Bjox 1071
Knoxville TN 37901
423-974-7294

Terry E. Kiser
Mississippi State University
Box 9815
Miss. State MI 39762
601-325-2935

Bill Klein
NDSU Extension Service
PO Box 200
Ashley ND 58413
701-288-3465

Bob Klemmer
Saskatchewan Extension - Weyburn
3085 Albert St.
Regina Saskatchewan S4S 0B1
Canada 306-787-4692

Kathy Kolb
Badlands Ultra-Scan
HCR 66 Box 20A
Meadow SD 57644

Merle Koon
Flying K Cattle Co.
2619 Hunters Point Drive
Wexford PA 15090

Mick Kreidler
Farm Progress Co.
6200 Aurora. #609 E
Des Moines IA 50322-2838
515-278-7784

Frank Kubik
538 1st St W.
Dickinson ND 58601

Al Kuck
21st Century Genetics
PO Box 469
Shawano WI 54165
715-526-7553

John & Jeanne Lambert
Box 450
Ogallala NE 69153
308-284-6051

Tim Lambert
Beef Improvement Ontario
6986 Hwy 24 S.
Guelph Ontario N1H 6J4
Canada 519-767-2665

Bart Larremore
Texas Tech. University
5202 B 96th St.
Lubbock TX 79421
806-742-2496

Theodora Larson
Badlands Ultra-Scan
HCR 66 Box 19C
Meadow SD 57644

GustAvo Ma Laureano
Conselo Federal de Medicina Vet.
Estancia Amarica
Sao Gabriel 97300-000
Brazil

Jim & Corrine Leachman
Leachman Cattle Co.
Box 2505
Billings MT 59108
406-254-2666

Leland Leachman
Leachman Cattle Co.
Box 2505
Billings MT 59108
406-254-2666

Melvin & Luella Leland
Leland Red Angus
HC 57 Box 4089
Sidney MT 59270

Todd Leland
Leland Red Angus
HC 57 Box 4089
Sidney MT 59270

Willard Lemaster
University of Florida
PO Box 110910
Gainesville FL 32611-0910
352-392-2390

Wayne Lenfesty
Agriculture - Canada PFRA
Box 1000B RR 3
Brandon Manitoba R7A 5Y3
Canada 204-726-7591

Richard Lichtenwalner
North Carolina State University
207 Research Station Rd
Plymoth NC 27962
919-793-4428

Jerry Lipsey
American Simmental Association
1 Simmental Way
Bozeman MT 59715
406-587-4531

Ian & Diana Locke
Wirruna Poll Hereford Stvd Spring Valley
Holbrook NSW 2644
Australia 060-86277

Trent Loos
Loos Cattle Co.
16251 Anchorom Rd.
Hallsville MO 65255

David Lust
West Texas A & M University
WT 333 Box 998
Canyon TX 79015

Will MacDonald
7640 Hwy 1804 S.
Bismarck ND 58504

Trisha Madison
NDSU Animal & Range Science
RR 1 Box 21
Alexander ND 58831
701-828-3507

Walter W. & Evidean Major Jr.
Major Farms
812 North Main Street
Lawrenceburg KY 40342
502-839-6231

Lowell Malard
Pfizer Animal Health
10900 62nd Ave SE
Bismarck ND 58504
701-255-1993

Lee Manske
North Dakota State University
1089 State Avenue
Dickinson ND 58601

Lorna Marshall
ABS Global Inc.
9550 E. Iowa
Denver CO 80231
303-368-0151

Troy Marshall
North American Limousin Foundation
9550 E. Iowa Ave.
Denver CO 80231
303-220-1693

Twig Marston
Kansas State University
4025 E. Seven Mile Road
Garden City KS 67846
316-275-8018

Richard & Susan McClung
Wehrmann Angus
RR 1 Box 390
New Market VA 22844
540-896-5232

Roger McCraw
North Carolina State University
Box 7621
Raleigh NC 27695
919-515-7722

Steve McGuire
American Simmental Association
1 Simmental Way
Bozeman MT 59715
406-587-4531

Earl McKarns
Shamrock Vale Farms
8002 Merlin Rd NE
Kensington OH 44427
330-223-1050

Herb McLane
Canadian Beef Breeds Council
230 6715 8th St NE
Calgary Alberta T2E 7H7
Canada

Jason McLennan
A & M Enterprises
6844 Sunnyside Drive
Fargo ND 58104

Michael McNeil
USDA-ARS
Rt 1 Box 2021
Miles City MT 59301

Charles A. McPeake
University of Georgia
L-P Building UGA
Athens GA 30602
706-542-0974

Stanley R. McPeake
Arkansas University Extension Service
PO Box 391
Little Rock AR 72203
501-671-2162

Andy & Katherine Meadows
Mandan Vet Clinic
605 16th Ave NW
Mandan ND 58554

Frank & Jane Melchoir
4109 86th Ave SW
Richardton ND 58652

Tony & Karen Messmer
Messmer Red Angus
8860 39 St. SW
Richardton ND 58652
701-974-3966

Ray & Val Meyer
Sodak Angus Ranch
HC 66 Box 237
Reva SD 57651
605-866-4424

Bill Miller
US Premium Beef - Beef Today
1193 Four Mile Rd.
Council Grove KS 66846
316-767-7041

Dale Miller
North Carolina State University
Box 7621
Raleigh NC 27965
919-515-7772

Mark Miller
North Dakota State University
Box 430
Rolla ND 58367

Stephen Miller
Centre for Genetic Imprvmnt of Livestock
University of Guelph
Guelph Ontario N1R 5S7
Canada 519-824-4120

Martha Mobley
571 Leonard Farm Road
Louisburg NC 27549

Bert Moore
North Dakota State University
ARS Dept.. NDSU
Fargo ND 58105
701-231-7651

Melissa Moore
New England Farmer
845 Loudon Ridge Road
Loudon NH 03301
603-267-7103

Cody Moreshead
Washington State University
PO Box 191
Albion WA 99102
509-334-5442

Dan W. Moser
University of Georgia
L-P Building UGA
Athens GA 30602-2771
706-542-1852

Ron Moss
PFRA
Box 24
Dauphin Manitoba R7N 2T9
Canada 204-638-6108

Naomi & Tom Murphy
Murphy Ranch
HC 1 Box 16A
Killdeer ND 58640
701-764-5408

Cindy Nagel
Midwest Sonatech
RR 1 Box 9
Springfield SD 57062
605-369-2628

Mark & Kelly Namminga
Rt 1 Box 107
Avon SD 57315
605-369-2598

Nimi Natan
ABS Global/Ardshiel
6361 Meetinghouse Road
New Hope PA 18938

Dale W. Naze
NDSU Extension Service - McKenzie County
Box 525
Watford City ND 58854
701-842-3451

Van H. Neidig
APEIS Corporation
1109 S 13 St Suite 303
Norfolk NE 68701
402-379-9487

Larry A. Nelson
Purdue University
1151 Lily. ANsc
West Lafayette IN 47907-1151

Tom Nelson
Nelson Livestock Co.
HC 71 Box 7437
Wibaux MT 59353

Dave Nichols
Nichols Farms
Rt 1 Box 98
Bridgewater IA 50837
515-369-2829

Marv Nichols
Nichols Cryo-Genetics
8827 NE 29th St.
Ankeny IA 50021
515--964-3497

Mark Nieslanik
Tybar Angus Ranc
1644 Prince Creek Rd.
Carbondale CO 81623
970-963-1391

Colin Nilsson
Agri Tech International
Box 171A
Lethbridge Alberta T1J 4K4
Canada 403-381-3814

David E. Noller
Noller & Frank Charolais
18278 Highway 92
Sigourney IA 52591
515-622-2388

Becky Norris
Leachman Cattle Co.
Box 2505
Billings MT 59108
406-254-2666

Sally Northcutt
Oklahoma State University
204 Animal Science Bldg.
Stillwater OK 74078
405-744-6060

Kenneth (Ken) G. Odde
Pfizer Animal Health
PO Box 128
Polluck SD 57648
605-889-2827

James Odermann
Odermann Communications
HC 1 Box 52
Belfield ND 58622
701-575-4767

Steve Olson
Iowa Cattlemen's Association
2176 210 St.
Grand Mound IA 52751

James W. Oltjen
University of California Animal Science
U of California - Davis
Davis CA 95616
916-752-5650

Rob & Pyllis Orchard
HC 30 Lonetree
Tensleep WY 82442
307-366-2450

Neil Orth
International Brangus
PO Box 69620
San Antonio TX 78269-6020
210-696-4343

Jim & Sonja Ozbun
RR 3 Box 92
Dickinson ND 58601
701-264-7113

Peter Parnell
Angus Soceity of Australia
Locked Bag II
Armidale NSW 2350
Australia

Joe C. Paschal
Texas Ag. Ext. Service
Rt 2 box 589
Corpus Christi TX 78406

Bill Patrie
PO Box 727
Mandan ND 58554
701-663-6501

David & Nancy Pease
Beef Improvement Ontario
6986 Hwy 24 S.
Guelph Ontario N1H 6J4
Canada 519-767-2665

Lorna Pelton
9687 Kemp Rd.
College Station TX 77845
409-846-9499

Lynn & Sue Pelton
Pelton Simmental/Angus Ranch
HC 2 Box 41
Burdett KS 67523
316-525-6632

Tommy Perkins
Southwest Missouri State Univ.
901 S. National Ave.
Springfield MO 65804
417-836-5020

Lyle Perman
Rock Hills Ranch
30872 143rd St
Lowry SD 57472

Ken Persyn
Medina Valley Genetics
PO Box 535
Casteoville TX 78008

Bill & Lynn Peters
Peters Ranch
8520 5th Ave
Montague CA 96064
916-459-3425

Brandon R. Pileik
University of Nebraska
2909 Q Street #3
Lincoln NE 68503
402-435-1777

Brian Pogue
Gencor
RR 5
Guelph Ontario N1H 6J2
Canada 519-821-2150

Chip Poland
North Dakota State University
1089 State Avenue
Dickinson ND 58601

David Polser
Elanco Animal Health
1516 S. Park Ave.
Sioux Falls SD 57105
605-336-7824

Duncan J. Porteous
Canadian Hereford Association
5160 Skyline Way NE
Calgary Alberta T2E 6W8
Canada 403-275-2662

Dick Pruitt
South Dakota State University
Box 2170
Brookings SD 57007

Connee R. Quinn
Elanco Animal Health
HC 66 Box 16
Chadron NE 69337
605-867-1071

Dean Raasch
RR 2 Box 358
Massena IA 50853

Steve & Penny Radakovich
Radakovich Cattle Co.
1725 120th St.
Earlham IA 50072
515-834-2359

Howard Rambur
Rambur Charolais
Rt 1 Box 3418
Sidney MT 59270
406-482-3255

Susan Ramsey
Oregon Cattlemen's Assoc.
38211 Sledge Road
Scio OR 97374
503-394-3312

Jeanette J. Rankin
PO Box 24
Ferdig MT 59466
406-937-3728

J.Kevin Rayburn
Alcoa Land
2431 SE Browning Rd
Evansville IN 47711
812-853-4208

Ole Redland
Redland Red Angus
HC 73 Box 640
Hysham MT 59038

David E. Redman
Purdue Extension Service
1410 I Street
Bedford IN 47421
812-275-4623

Kenneth J. & Holly Redman
HC 56 Box 6012
Sidney MT 59270
406-482-7233

Michael Reese
South Dakota State University
RR 1 Box 61
Hancock MN 56244
320-392-5853

Dennis & Donna Reich
4181 82nd Ave SW
Richardton ND 58652
701-878-4397

Reese & Darlene Richman
Richman Cattle
921 West Vine St.
Tooele UT 84074
801-882-2976

Kris Ringwall
North Dakota State University
1089 States Avenue
Dickinson ND 58601
701-227-2348

Harlan Ritchie
Michigan State University
Michigan State Univ.
East Lansing MI 48824
517-355-8409

Kenneth B. Roberts
Swan Creek Ranch
383 Cedar Park
Centerville TN 37033
615-729-4496

Gerald Roise
HC 2 Box 19
Powers Lake ND 58773

Lora Rose
Big Sircle - Little Ranch
564 Geesaman Rd
Colvilli WA 99114
509-684-5690

John E. & Elizabeth (Bettie) Rotert
Rotert Angus
577 SW Hwy K
Montrose MO 64770
816-693-4844

Gene Rouse
Iowa State University
215 Meat Lab
Ames IA 50011

Larry Rowden
ABS Global Inc.
408 N 5th Ave.
Broken Bow NE 68822
308-872-2598

Ivan & Doris Rush
University of Nebraska
4502 Ave I
Scottsbluff NE 69361
308-632-1245

Cheryl Russwurm
Ontario Ministry of AFRA
220 Trillium Court RR #3
Walkerton Ontario N0G 2V0
Canada

Richard Saacke
Dairy Science Dept.
Virginia Tech. University
Blacksburg VA 24061
504-231-4755

Troy Salzer
University of Minnesota
606 5th Ave SW #130
Roseau MN 56751
218-463-1052

Bob Sand
University of Florida
PO Box 110910
Gainesville FL 32611-0910
352-392-7529

Michael Santerre
Semex Alliance
3450 Sicotte C.P. 518
Saint Hyacinthe Quebec J2S 7B8
Canada 514-774-1141

Ned Sayre
Waffle Hill Farm
3332 Cool Branch Rd
Churchville MD 21028
410-734-7136

David W. Schafer
Colorado State University
18683 Hwy 140
Hesperus CO 81326
970-385-4574

Ruth Scheresky
NDSU - Ward County Extension
Courthouse Room 101 Box 5005
Minot ND 58702
701-857-6444

Michael L. Schlegel
Delaware Valley College
700 E. Butler Ave.
Doylestown PA 18901-2697
215-489-2420

Rick Schmidt
NDSU Extension Service
Box 166
Center ND 58530
701-794-8748

Chuck Schorsch
Box 334
Richardton ND 58652

Bryce Schumann
367 Hwy 40
Lecompton KS 66050
913-887-6754

Todd Sears
ABS Global Inc.
404 W. Apollo Ave #204
Bismarck ND 58501
701-250-0057

George & Sarah Seidel
Colorado State University
CSU
Ft. Collins CO 80523
970-491-5287

Tim Semler
NDSU Extension Service
314 W 5th
Bottineau ND 58318
701-228-2253

Frank Seymour
Goldsboro Hog Farms
105 NW 4th St.
Snow Hill NC 28580
919-747-5764

Norm Shannon
Ag & Ag Food Canada
PO Box 3000
Lethbridge Alberta T1J 4B1
Canada 403-317-2243

Martin Sieber
NAAB
401 Bernadette
Columbia MO 65203
573-445-9541

Mike Siemen
University of Wisconsin
1675 Observatory
Madison WI 53706-1284
608-263-4304

Ronnie Silcox
University of Georgia
Coliseum
Athens GA 30602
706-542-7023

Darrel Smith
HCR 30 Box 1
Mobridge SD 57601

James E. & Nancy Smith
3064 Old 75
Stem NC 27581
919-528-2403

Kris Smith
Merck AgVet
4620 Roundup Road
Bismarck ND 58501

Troy Smith
Angus Journal
HC 72 Box 19
Sargent NE 68874
308-527-3483

Warren Snelling
BeefBooster Management LTD.
226 1935 32nd Ave NE
Calagary Alberta T2E 7H7
Canada 403-291-9771

Charlie Soiseth
NDSU Extension Service
PO Box 462
Ft. Yates ND 58538

Darrel & Joan Spader
Hayland Angus Ranch
RR 2 Box 22
Fedora SD 57337
605-527-2575

Dick Spader
American Angus Association
3201 Frederick
St. Joseph MO 64506

Jim Spawn
American Tarentaise Association
1912 Clay St.
N. Kansas City MO 64116

Scott Spickard
Hawkeye West
3642 S. 56th W.
Billings MT 59101
406-656-9034

Rebecca K. Splan
University of Nebraska
A218C Animal Sciences
Lincoln NE 68583-0908
402-472-6409

Wade Staigle
HC 2 Box 208
Center ND 58530

Doug Stanton
Farmland Supreme Beef Alliance
2220 Drum
Hays KS 67601
913-625-9557

John Stewart-Smith
BeefBooster Management LTD.
226 1935 32nd Ave NE
Calagary Alberta T2E 7H7
Canada 403-291-9771

Andy Stiefel
ABS Global Inc.
2846 Hilton Lane
Sun Prairie WI 53590
608-825-6771

Chad Stine
AICA
PO Box 20247
Kansas City MO 64195
816-464-5977

Julie Stitt
Canadian Charolais Association
2320 41st Ave NE
Calgary Alberta T2E 6W8
Canada 403-250-9242

Dr. Charlie Stoltenow
North Dakota State University
PO Box 5161
Fargo ND 58105
701-231-7522

Mike Stratton
Cornell Coop Extension Service
158 S. Main St.
Mt. Morris NY 14510
716-658-3250

Dr. Daryl Strohbenn
Iowa State University
109 Kildee Hall
Ames IA 50011
515-294-2240

Brian Sundstrom
NSW Agriculture
C|- ABRI University of New England
Armidale NSW 2350
Australia 61-67-733555

Harris Swain
Delaware State University
138 Beech Drive
Dover DE 19904
302-739-5151

Steve Swigert
Noble Foundation
PO Box 2180
Ardmore OK 73402
405-223-5810

Bob Taylor
Colorado State University
Ft. Collins CO 80523
303-491-1101

Ryan Taylor
Northern Plains Premium Beef
1363 54th St NE
Towner ND 58788

Todd Taylor
Mandan Vet Clinic
2248 Sunny Rd. South
Mandan ND 58554

Mary Tessmann
ABS Global Inc.
6908 River Road
DeForest WI 53532
608-846-6219

R. Mark Thallman
USDA ARS MARC
PO Box 166
Clay Center NE 68933
402-762-4261

Joe Thielen
University of Wyoming
343 Hwy 230
Laramie WY 82071
307-742-0732

Bob & Gloria Thomas
Thomas Angus Ranch
Rt 1 Box 34
Baker OR 97814

Frank H. & Judy Thomas
Georgia Cattlemen
Rt 1 Box 40
Alamo GA 30411
912-568-7743

Mark Thomas
NCBA
444 North Michigan
Chicago IL 60611
312-670-9212

Rob & Lori Thomas
Thomas Angus Ranch
Rt 2 Box 57
Baker OR 97814

Cleo Thompson
North Dakota Beef Commission
14174 20 St SE
Page ND 58064
701-

Craig Thompson
Critical Vision Inc.
430 10th St. NW Suite N-110
Atlanta GA 30318
404-817-9655

Cy Thuene
Great Plains Agri Business
PO Box 965
Burwell NE 68823
308-346-4221

Jerry Tuhy
Dickinson Public Schools
Box 1057
Dickinson ND 58601

David Van Heuvelen
Wolf Creek Software
200 Terrace Road
Chamberlain SD 57325
605-734-5820

Dale Veseth
HC 84 Box 8195
Malta MT 59538

Wayne Wagner
West Virginia University
PO Box 6108
Morgantown WV 26506
304-253-3392

Roy Wallace
Select Sires Inc.
11740 US 42 N
Plain City OH 43064
614-873-4683

Bob Weaber
American Gelbvieh Association
10900 Dover Street
Westminster CO 80021
303-465-2333

Milt Weiss
Canadian Charolais Association
2320 41st Ave NE
Calgary Alberta T2E 6W8
Canada 403-250-9242

Jack Whittier
Colorado State University
105 B Animal Science
Ft. Collins CO 80549
970-491-6233

Robert Williams
University of Georgia
302 Livestock Poultry Bldg.
Athens GA 30602
706-542-0989

Jon Tomsen
2820 Jameson N. Apt #16
Lincoln NE 68516
402-423-0455

Larry Ulsaker
HCO-1 Box 10
Medora ND 58645
701-565-2292

Dale Van Vleck
ARS
A218 An Sci. UNL
Lincoln NE 68585-0908
402-472-6010

Norm Vincel
Select Sires
PO Box 370
Rocky Mount VA 24151
540-483-5123

Hayes Walker III
American Beef Cattlemen
10012 Buudella Drive
Las Vegas NV 89134
702-255-5641

Bob Walton
Western Vet Clinic
Box 699
Williston ND 58801

Marilou Wegner
Charolais Association
PO Box 20247
Kansas City MO 64195
816-464-5977

Steve & Debb Weninger
HCR 3 Box 35A
Rhame ND 58651
701-279-5766

George J. Wiegand
Box 88
Mott ND 58646

Cliffton Willms
Moorman's Inc.
3115 Hall Street
Hays KS 67601
913-628-6704

Don Trimmer. Jr.
Accelerated Genetics
E 10890 Penny Lane
Baraboo WI 53913
608-356-8357

Dave Van Dyben
American Simmental Association
1 Simmental Way
Bozeman MT 59715
406-587-4531

Kevin VanderWal
South Dakota State University
619 N. Samera Ave.
Volga SD 57071
605-627-9409

Doug Voll
PO Box 785
Watford City ND 58854

Bill Wallace
Arkansas University Extension Service
2301 S. University Ave.
Little Rock AR 72203
501-671-2235

Duane Warden
20054 Perry Rd
Council Bluffs IA 51503
712-323-2389

Nick & Virginia Wehrmann
Wehrmann Angus
824 C Street
North Wilkesboro NC 28659
910-838-0664

G Presley White
Ag MIT
P.O. Box 1193
Emporia KS 66801
316-343-3669

Richard Willham
Iowa State University
239 Kilder Hall. ISU
Ames IA 50011
515-294-3533

Doyle E. Wilson
Iowa State University
109 Kildee Hall
Ames IA 50011
515-294-2240

M.G. Wismans
ICAR
PO Box 454
6800 Al Arnhem
Netherlands 31-26-3861226

Jerry Wulf
Leonard Wulf & Sons Inc.
Rt 3
Morris MN 56267

Bruce Young
Koch Industries Inc.
4111 East 37th North
Wichita KS 67220
316-828-4766

Doug Zalesky
South Dakota State University
1905 Plaza Blvd.
Rapid City SD 57702

Neil Zimmerman
RR 4 Box 118
Minot ND 58701
701-624-5682

Brent Woodward
University of Minnesota
101 Hecker Hall
St. Paul MN 55108
612-624-3667

Leonard Wulf
Leonard Wulf & Sons Inc.
RR 3 Box 235
Morris MN 56267
320-392-5802

John Young
Rex Ranch
HC 96 Box 4
Whitman NE 69366
308-544-6539

Grant Zalinko
Saskatchewan Institute Applied Sci & Tec
P.O. Box 216
Rouleau Saskatchewan SOG 4HO
Canada 306-776-2425

Bill Zollinger
Oregon State University
112 Withycombe
Corvallis OR 97331-6702
541-737-1906

Florian Woroniecki
7190 28 St
Hebron ND 58638

Lowell & Lori Yould
Leachman Cattle Co.
Box 2505
Billings MT 59108
406-254-2666

Peter Zahakos
8975 33rd St SW
Richardton ND 58652-9707

Bill Zimmerman
Univ. of Minn. Ext. Serv.
208 Atlantic Ave.
Morris MN 56267
320-589-7423

SPONSORS FOR THE 29TH BIF CONVENTION

PRIME

Pfizer, Inc. Animal Health Division

CHOICE

Farm Credit Services of North Dakota
Four Bears Casino and Lodge
North Dakota Beef Commission
National Association of Animal Breeders
National Cattlemen's Beef Association

SELECT

American Dairy Assn. of the Upper Midwest
Bowman Charolais Ranch
Brooks Angus Ranch
Harvest States Cooperatives
North Dakota Charolais Association
North Dakota District 4 Cattlewomen
Norwest Bank of Dickinson
Merck & Co., Inc. Merck Ag Division
1st International Bank & Trust of Warford City
Stuber Hereford Ranch

SPONSORS FOR COFFEE BREAKS

ABS Global, Inc.
Accelerated Genetics
Alta Genetics
Cooperative Resources International
21st Century, NOBA, Genex
Select Sires

HOSTS

North Dakota Beef Cattle Improvement Association
North Dakota State University
Dickinson State University
North Dakota Stockmen's Assn.

SUPPORT SERVICES

Dickinson Convention & Visitors Bureau
North Dakota Cattlewomen
Chamber of Commerce, AG Committee
North Dakota Purebred Council

Editor: Ron Bolze
Production Assistant: Sally Patten

Additional copies of these proceedings are available for $10.00 per copy plus postage from:

Ron Bolze, Executive Director
Beef Improvement Federation
Department of Animal Sciences - Kansas State University
105 Experiment Farm Road
P.O. Box 786
Colby, Kansas 67701
Phone: 785/462-6281
Fax: 785/462-2315
E-Mail: RBolze@OzNet.KSU.Edu