PROCEEDINGS

BEEF IMPROVEMENT FEDERATION

RESEARCH SYMPOSIUM & ANNUAL MEETING

BEEF IMPROVEMENT FEDERATION

23RD MEETING

MAY 15 - 18, 1991

B I F

SAN ANTONIO, TEXAS

1991 BEEF IMPROVEMENT FEDERATION BOARD OF DIRECTORS

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1991 BEEF IMPROVEMENT FEDERATION CONFERENCE
Wyndham San Antonio, San Antonio, Texas
May 15 - 18, 1991

Wednesday, May 15th

1:00-6:30 PM	Registration
3:00 PM	Board of Directors' Meeting
6:00 - 10:00 PM	"Welcome to Texas" - (Ticket Required) (Lone Star Brewing Company)

Thursday, May 16th

7:00 AM - 6:00 PM	Registration

SYMPOSIUM: THE ROLE OF BIOTECHNOLOGY IN BEEF CATTLE PRODUCTION

8:00 AM	WELCOME Russell Cross, Head of Dept. of Animal Science, Texas A&M University
8:15 AM	BIOTECHNOLOGY AND BEEF PRODUCTION James E. Kinder and LaRee Werth, Department of Animal Science, University of Nebraska
9:00 AM	THE CURRENT SITUATION IN GENE MAPPING RESEARCH Jerry Taylor, Texas A&M University
9:40 AM	BREAK
10:00 AM	THE IDENTIFICATION OF GENETIC MARKERS FOR PROLACTIN Roy Ax, Department of Animal Science, University of Arizona
10:45 AM	THE IDENTIFICATION OF GENETIC MARKERS FOR DISEASE RESISTANCE Noelle Muggli-Crockett, Utah State University
11:30 AM	NCA POSITION ON BIOTECHNOLOGY Burke Healey, Southern Cross Ranch
12:30 PM	LUNCH (Ticket Required)
1:30-2:00 PM	CAUCUS AND ELECTION OF BOARD OF DIRECTORS
2:00-5:00 PM	SYSTEMS COMMITTEE Jim Gibb, Chairman 1. NCA/IRM Project: A Banker's Perspective 2. Review of Different Methods For Calculating Calf Crop Percent, Calving Distribution and Herd Inventory 3. Sub-committee Recommendations CENTRAL BULL TEST COMMITTEE Ron Bolze, Chairman Bull Performance Testing Texas Style A. Heifer Development Program B. CHAPS Production Testing Program C. Steer Futurity LIVE ANIMAL AND CARCASS EVALUATION COMMITTEE John Crouch, Chairman Present the Recommended Guidelines for Ultrasonic Proficiency Evaluation

6:00 PM	Social Hour (Cash Bar)
7:00 PM	Awards Banquet (Ticket Required)

Friday, May 17th

7:30-9:00 AM	Breakfast (Ticket Required)
8:00 AM-5:00PM	Registration

SYMPOSIUM: GENETIC PREDICTION AND LIVE ANIMAL EVALUATION OF CARCASS TRAITS

9:30-10:30 AM — Current Compared to 1982 Fixed Base

John Crouch	H. H. Dickenson
Bruce Robbins	Wayne Vanderwert
R. Forgason	Brett Middleton
Loren Jackson	John Dhuyvetter
Joe Garrett	Bruce Cunningham
Jim Gibb	Steve McGill

10:30 AM — BREAK

11:00 AM — Genetic Prediction Programs in Australia
Keith Hammond, Animal Genetics and Breeding Unit, NWS Agricultural and Fisheries, Armidale

11:30 AM — Genetic Prediction of Ultrasound Evaluations in Australia
Alex McDonald, Animal Genetics and Breeding Unit, University of New England, Armidale

12:00 Noon — Ultrasound Estimation of Carcass EPDs
Larry Cundiff, USDA, ARS

12:30 PM — LUNCH (On your own)

2:00-5:00 PM — Committee Meetings

REPRODUCTION AND GROWTH COMMITTEE
Keith Vander Velde, Chairman

Male Reproduction and Its Relationship To Fertility
A. Scrotal Circumference
B. Proper Adjustment to Yearling Age

Female Reproduction - Gestation Length EPDs

GENETIC PREDICTION COMMITTEE
Larry Cundiff, Chairman

Fixed vs. Floating Base
Electronic Identification of Cattle
Across Breed EPDs
Genetic Prediction of Mature Weight
Other Genetic Prediction Items

Saturday, May 18th

7:00 AM-7:00 PM	King Ranch Tour - Ticket Guaranteed with Pre-Registered Participants
8:00 AM-5:00 PM	Hill Country Tour - Ticket Guaranteed with Pre-Registered Participants

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BIOTECHNOLOGY AND BEEF PRODUCTION

James E. Kinder and LaRee Werth
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Summary

The term "Biotechnology" has been used more prevalently over the past decade but it is comprehended differently by different segments of our society. Biotechnology can be defined as a set of tools to influence genetic change. Biotechnology represents a process for influencing the rate at which change occurs rather than change per se. The tools of biotechnology will speed the processes used to improve efficiency of beef production.

Biotechnology gives us the ability to gain a greater understanding of the blueprints of heredity of **microbes**, **plants** and **animals**. Because these entities - microbes, plants and animals - are the cornerstones of the beef cattle industry the impact of biotechnology will be considerable. The ability to gain a greater understanding of genes and particularly gene regulation of **microbes** that benefit or have a detrimental effect on beef cattle will be of great importance. A greater understanding of microbes that populate the rumen or cause diseases will occur. In addition, microbes will be used to produce pharmaceutical products that impact the beef industry. The digestibility of existing **plants** and the seeds they produce will be influenced. Proteins - particularly those that by-pass the rumen - will be introduced into plants where they do not exist at present. In **animals** the new tools of biotechnology will be used to improve efficiency of genetic selection procedures. Gene marker assisted selection will be a powerful tool. The techniques to clone beef cattle are available and patents for these techniques have been approved. The quality of these techniques will improve in the future. The ability to make transgenic animals is available but many improvements are needed before commercial application to the industry will occur. The use of transgenic animals in research will enhance the understanding of how specific genes are regulated.

Some of the tools of biotechnology are viewed by the public sector as being relatively benign and little resistance to incorporation of these tools into the beef industry will occur. Examples are marker assisted selection of plants or animals. The tools to clone plants or animals are viewed to be of relatively low risk but are still looked upon with disfavor by specific segments of our society. Production of transgenic microbes, plants or animals is looked upon with skepticism by larger segments of our society. The release of genetically altered microbes or plants into the field is viewed by some to be of high enough risk to our environment that it should not occur. In some cases the knowledge base is not available to make good decisions about what should and should not occur in the use of the tools of biotechnology.

The rate at which biotechnology has an ever-increasing impact on the beef industry is difficult to evaluate. However, there is no question but what the impact will be considerable. There is also no question but what society as a whole, wants to have a greater

say in how the tools of biotechnology are used. The days of developing products and letting the marketplace decide if they are of value will continue to some extent but society is demanding greater inputs in deciding whether products should or should not be used. It is important for each of us in the beef cattle industry to be knowledgable about the tools of biotechnology and their impact on our industry. These tools will be used by our industry and other segments of the animal industry. We in the beef industry must make sure these tools are used for the betterment of ourselves and our society as a whole.

What is Biotechnology?

Biotechnology is a set of tools that has rapidly developed during the past decade to assist in understanding genes and gene regulation. The use of the tools of biotechnology to map the bovine genome is getting a great deal of emphasis. The subsequent use of knowledge gained from the mapping of the genome in traditional selection procedures will be considerable. The use of recombinant DNA and bioprocess engineering tools to produce pharmaceuticals of improved quality and in high quantities will occur. Monoclonal antibodies will be used to improve the ability to diagnose diseases. Embryo manipulation and transfer will be used to produce cloned lines of cattle. The transfer of genes from other species into cattle is in preliminary stages of development. Gene transfer is presently being used with mice to gain a greater understanding of gene regulation. Many genes and their regulation are similar between mice and cattle; therefore, research with mice will provide valuable clues to regulation of similar genes in cattle.

Similar tools to those described for use in cattle can be used more precisely in studying plants and microbes and in production of genetically altered plants and microbes. Tissue culture and plant regeneration techniques could prove to be particularly beneficial in the plant world.

Without question, the greatest impact biotechnology will have on all of agriculture is an improved understanding of gene function. Our knowledge on how genes are involved in production of messenger ribonucleic acids which in turn produce proteins in cells of the body is expanding at a rapid rate. Beef producers do not normally think of themselves as manipulators of gene function. By applying many of the management practices of beef production the function of various genes is modified. Much emphasis is being placed on understanding the regulatory portion of various genes. Many factors impact the regulatory segments of genes which enhance or inhibit gene expression and thus production of proteins. Nearly all of the tools of biotechnology have been used to enhance our ability to understand gene function. Tremendous strides are occurring in this area but we are just beginning to scratch the surface to broaden our understanding of gene regulation. A much greater understanding of how genes are regulated will occur during the next decade. Knowledge gained from this area is and will have an ever-increasing impact on all segments of animal production.

Uses of Biotechnology in Beef Production

The tools of biotechnology will be used in the microbial, plant and animal world. For obvious reasons the beef industry will be impacted by all these segments.

A. Microbes

Recombinant DNA technology will help us to understand the pathogenicity of microbes and to combat disease transmission by microbes. Improved vaccines will result from use of this technology. New knowledge of inhibition of pathogenic bacteria and spoilage organisms will impact how processing and storage of beef occurs.

Knowledge gained on rumen anaerobes could tremendously impact the beef industry. Our understanding of how anaerobes degrade cellulose and starch will improve. The ability to alter anaerobes so they can produce specific vitamins or amino acids could have a positive impact on the beef industry. Manipulating the genetics of rumen anaerobes to control fermentation - increase proprionate and decrease acetate production would be an obvious benefit. Likewise, genetic alteration of anaerobes to redirect carbon dioxide and methane production into acetate could improve efficiency of production. Many scientists feel that changing the genetics of rumen anaerobes will often result in an energetic disadvantage to the altered microbe and the ability of this altered microbe to compete in the environment of the rumen will be compromised. If this is the case, genetic alteration of rumen anaerobes and their use in beef production is not likely to occur in the next decade. However, use of biotechnology will improve understanding of how anaerobes digest starch and cellulose and will greatly benefit the field of rumen microbiology.

B. Plants

The tools of biotechnology will be used to improve selection of plants that are resistant to diseases and pests. These new tools enhance our ability to select and alter plants for adaptation to different environments. Plants are selected for herbicide resistance so chemicals that are relatively benign to the surrounding environment can be used to control unwanted plants. More emphasis is placed on selection of plant species for use in mixed populations (i.e. alfalfa with grasses) that more efficiently fix nitrogen and reduce the dependance on nitrogen fertilizer. This reduces the contamination of water supplies and reduces the energy consumed in production and use of these fertilizers. Optimists feel the potential exists to transfer the ability to fix nitrogen to plants that previously do not have that ability. However, the ability to transfer genes that are involved in nitrogen fixation into plants will not occur in the near future. Emphasis will be placed on selection or transferring genes into legumes to alter the profiles of proteins in these plants to reduce, if not eliminate, the occurrance of bloat.

Tools of biotechnology will be used to develop plants or their seeds for improved digestibility. This has long been a goal in plant production and the tools of biotechnology will speed improvements in this process. There is emphasis on developing plant varieties that have improved content of protein that will by-pass the rumen and enhance efficiency of feed utilization. The tools of biotechnology should also yield products and or processes which improve the quality of plants or seeds while they are in storage.

C. Animals

The tools of biotechnology will be used in animal health, reproduction, lactation, partitioning of protein and fat stores and improvements in the nutritional value of the meat produced by the beef industry.

Monoclonal antibodies are being developed that are very specific in diagnosing diseases. These antibodies can also be produced in large quantities with virtually unlimited supplies as compared to antibodies used for diagnostic procedures in the past. New improved vaccines are being developed with recombinant DNA technology. The ability to select animals that are resistant to specific diseases will improve as more markers of genes are developed. With this improved knowledge more emphasis will be placed on selection for disease resistance in the future.

In reproduction, embryo transfer procedures have been developed and are presently being used in the industry. The procedures for cloning of embryos has been patented and is expected to have a significant impact on selection procedures which are utilized by seedstock producers. The ability to sex semen is improved, however, ways to commercialize this process have not been developed. The development of this procedure could be a real boon for a well established biotechnology - artificial insemination.

The use of biotechnology to enhance lactation is not likely to have a large impact on the beef industry. The ability to produce milk more efficiently in the dairy cow results from use of recombinant bovine somatotropin. Some people have advocated the use of the cow as a bioreactor to produce specific pharmaceuticals for use in human medicine. Recombinant porcine somatotropin has been used experimentally in swine to increase gain by 10-45%, increase feed efficiency 15-35%, decrease backfat by 15-70% and increase loineye size 15-50%.

The new tools of biotechnology will enhance the ability to detect tissue residues, feed contaminants, water contaminants and pathogens. All of these improved abilities will have an impact on beef production. Procedures for detection of residues, etc. continue to become more and more sensitive and the tools of biotechnology will only speed this process.

There is a strong effort being put forth by scientists to obtain the funds to map the bovine genome. Much progress has already been made in this area but with improved funding the rate of progress will increase. This process will require a concentrated effort on the part of federal and state funded scientists from around the world if mapping the genome is to occur in an efficient manner. The use of gene markers to improve traditional selection procedures will occur. As mapping of the genome occurs more and more knowledge about gene regulation will develop and this information will also be used to enhance the efficiency of beef production.

Gene insertion to make transgenic animals has been done. There are some major limitations to this technology because the efficiency of producing these animals is very low. Improved procedures to increase the efficiency of production of transgenics are being pursued. Additional information is needed to target foreign genes to specific sites in the host genome. An improved understanding of the control or expression of most genes that might be transferred is also necessary. Another limitation is that most genetic engineering techniques are limited to one gene.

Transfer of Biotechnologies to the Beef Industry

More research utilizing the tools of biotechnology is being performed in the private sector. Companies are performing more basic research and there is an increased emphasis in universities to develop cooperative research endeavors with companies. Universities will continue to perform much of the basic research. Companies will still depend on scientists from universities to perform much of the basic research - particularly that research which is not applicable to current lines of products being developed. Much of the research to improve our basic understanding of gene function will be done in the public sector.

The United States federal government emphasized research in biotechnology earlier than other countries. In 1984 the federal government of the United States provided funding at a level that was more than double the amount spent by West Germany, France, Great Britain and Japan combined.

As always a concern is how to get the knowledge gained from research transferred to producers. The United States has not done well in technology transfer and it is widely felt that this has allowed countries such as Japan to become very competitive with many U.S. industries. Technology transfer in agriculture has been more efficient than in some of the other U.S. industries. With development of new biotechnology, competition will be keen with other countries to efficiently incorporate the new techniques into production agriculture. For example, Japan has had a long history of close cooperation between the government, universities and industry in applied research that relates to agriculture. There is no question but what Japan will try to be at the forefront of marketing biotechnology. Commercial development of biotechnology is predicted to account for over 10% of Japan's Gross National Product by the year 2000. It will require a coordinated effort by all segments of our society in the United States to have a competitive edge in using these technologies to the advantage of our society as a whole.

Society and Agricultural Biotechnology

The impact of biotechnology on public health, the environment and on specific segments of our society that will be affected by the new technologies is closely scrutinized by the public sector. A recent example of this is the relatively intense evaluation by the public sector of what the use of recombinant bovine somatotropin (bST) will do to the health of those that drink the milk of cows treated with this hormone. More focus has been placed on the impact of bST on the smaller, family owned farms in the dairy industry. Fears have been raised that the use of bST will increase the rate of exodus of the family owned dairy farm from the dairy industry. Differing biotechnologies are being questioned to differing degrees. Some of the technologies are viewed as being relatively benign, others are viewed to be of high risk. The success or failure of specific technologies will hinge on consumer acceptance of the products derived from the use of the technology.

To evaluate what ought to or ought not occur, we must evaluate the advantages and disadvantages of the tools of biotechnology. Opponents of biotechnology want to ensure against unwanted outcomes by eliminating or slowing the progress to the point it is not profitable to pursue developments in biotechnology. Proponents favor ignoring unwanted outcomes because they insist the new tools of biotechnology are already as safe as other technologies accepted by society. It is obvious incorrect decisions on the uses of these technologies could lead to disasters on one hand or result in overly cautious restrictions on the other hand. Social and economic change associated with scientific advance has and will continue to be an integral part of the success of the United States. The emerging biotechnologies are the next major stage of technical change in agriculture. We will have to carefully evaluate the safety of the technologies and the progress that will occur through their use.

Several surveys indicate that the majority of the people in our society favor the use of biotechnology in food production. A large majority of the public believes the benefits of biotechnology to society outweigh the risks. However, the percentage of the public favoring expanding control over innovation in biotechnology is increasing. In many cases, it is difficult to assess biosafety issues that relate to biotechnology because of lack of knowledge. Knowledge about these issues will increase and if the public sector is going to understand science and how it can impact the way we live, science education must improve at all levels of our educational system. Improved education will help but it will be difficult to keep the public informed of the ever increasing amount of information that is produced in our society. The amount of information one needs to synthesize to be an informed decision maker will only increase. If the public demands greater inputs into these decisions, then they will not only need to understand the issues but they will also need to know how to weigh the issues. We will be challenged with many of these issues in agriculture. It is the responsibility of each individual to ensure that biotechnology has an impact on our industry without undue risk to human health and our environment. The viability of our industry in the future and our ability to sustain the important role the beef industry has in our society will depend on our decisions.

Acknowledgements

We appreciate the valuable thoughts that were detailed in the publication Agricultural Biotechnology Issues and Choices (1991). Many of the thoughts we have outlined herein were gleaned from reading this publication. We thank Dr. Randy Prather of the University of Missouri-Columbia for providing valuable information on the impact the biotechnologies will have on the area of reproduction in cattle. We also thank Dr. Prather and Dr. Mike Wilson of Granada Biosciences, Inc. for providing slides to utilize in the oral presentation given on the subject outlined in our publication at the 1991 Beef Improvement Federation Meetings. We are deeply indebted to Ms. Laura Rife for her assistance in preparation of this publication. Most importantly, we thank the citizens of Nebraska for supporting our research and allowing us to work in such a stimulating, agriculturally oriented, environment.

The Current Situation in Gene Mapping Research: Carcass Traits in Cattle

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Molecular genetics is the study of individual gene structure and function. The study of gene action at the molecular level has demonstrated that the bovine genome is comprised of a finite number of genes and that conceivably, relatively few loci influence many quantitative traits. If we consider 5 gene loci each with 3 different allelic forms of the gene, there are (ignoring linkage) a total of 7,776 possible genotypes. The number of different possible genotypes increases very rapidly as either the number of loci or alleles at each locus increases. Clearly, it is possible that very few genes may be responsible for the genetic differences observed among animals for some quantitative traits. Such loci are referred to as quantitative trait loci (QTL). Variation in individual genes may be responsible for a relatively large fraction of the total genetic variance (additive and nonadditive genetic variance combined). Such genes are termed major genes. The existence of major genes influencing quantitative traits has been documented. Examples include the Booroola fecundity gene in Merino sheep, the recessive dwarf gene in cattle and muscle hypertrophy (double muscling) in cattle and pigs.

One of the best examples of the existence of major genes that impact a quantitative trait is given by human serum cholesterol. Everyone is now aware that a great deal of variation exists for serum cholesterol and that this variation may affect an individual's risk for coronary heart disease. This phenotypic variation has a significant genetic basis; 58% of the variation for serum cholesterol levels can be explained by genetic variation in the population (V_g), and 42% can be explained by environmental variation (V_e; Boerwinkle and Sing, 1987). Of the variation due to genes, 59% can be explained by a person's genotype at three loci which encode apolipoproteins A IV, B and E (Talmud and Humphries, 1986; Boerwinkle and Sing, 1987). Over one-third of the phenotypic variation in human serum cholesterol is determined by only three genes. Furthermore, by knowing an individual's genotype for these loci, it is possible to determine the individual's genetic propensity for high serum cholesterol and also the expected liability of their children. This is directly analogous to our use of EPDs to predict progeny performance.

Detectable differences at the DNA level are called marker loci. The term marker is used to infer that these genes or DNA sequences may be sufficiently closely linked (by proximity) to certain major genes, that the marker and major genes are inherited together. Historically, marker loci used by breeders and geneticists as selection aids were physiological and included coat color and polledness genes. These ideas are not new, and the use of visible markers to detect QTLs began in the 1920's (Sax, 1923) A major limitation of these early studies was the lack of sufficient numbers of variable markers to saturate the genomes of the target species. The detection of markers using Restriction Fragment Length Polymorphism (RFLP), Randomly Amplified DNA Polymorphism (RAPD) and DNA fingerprinting techniques, provides an additional suite of biochemically identifiable markers to allow detection of major genes.

Polymorphic genetic markers have been identified that explain significant amounts of phenotypic variation for quantitative characters in plants and animals. The most exhaustive studies reported are those by Paterson et al. (1990, 1991) who used a restriction fragment length polymorphism (RFLP) map and data from interspecific crosses of tomato. Animal research has found significant marker genotype effects for serum cholesterol in humans (Boerwinkle and Sing, 1987; Boerwinkle et al., 1989), and for milk production (Cowan et al., 1990), postweaning growth and carcass lean content (Beever et al., 1990) in cattle.

The major determinant of success in analyses of quantitative characters using marker genotypes, is the number of detected genetic polymorphisms and their physical map location. As of April 1990, the bovine genetic map comprised 160 identified genes and was the 3rd most complete map in existence (Womack, 1990; and Table 1). These genes have been assigned to syntenic groups (genes that reside on the same chromosome) representing all of the bovine chromosomes and 12 of these syntenic groups have been specifically identified by chromosome (X and Y sex chromosomes identified separately). Of these genes, 44 are known to have RFLP markers. The 44 RFLPs known in cattle mark 16 of the 29 bovine autosomes and the sex chromosomes. Ten chromosomes are marked by at least two RFLPs and one chromosome by 11 RFLPs.

Table 1. Number of chromosomes and mapped loci for a sample of species[a].

Species (Common name)	2N	Mapped loci
Homo sapiens (Human)[b]	46	4,831
Mus musculus (Mouse)	40	2,502
Bos taurus (cow)	60	140
Sus scrofa domestica L. (Pig)	38	42
Ovis aries (Sheep)	54	41
Equus cabullus (Horse)	64	25

[a] O'Brien (1990)

[b] 2,235 loci had not been fully characterized at the time of publication

Once DNA markers have been detected and their synteny and linkage relationships established, reverse genetics studies can be designed involving families of animals segregating for the trait of interest to identify economically important QTLs for marker assisted selection schemes. The potential for success of such studies depends on:

1) The degree of saturation of the marker map, which determines the likelihood of detecting a QTL through a) having a marker in the region where the gene resides, and b) the ability to detect the QTL depending on its magnitude of observable effect,
2) The ability to use the marker to identify animals possessing the desirable QTL allele so that selection errors are avoided, and
3) The cost effectiveness of the technology over more conventional (and potentially lower cost) breeding technologies.

As you should have realized by now, gene mapping is a somewhat nebulous term that is often used to encapsulate all areas of research focussed on determining the relationship between differences at the genomic DNA level with differences at the observed or phenotypic level. In the remainder of this paper, we will focus on three components of gene mapping, namely detection of DNA polymorphisms, construction of linkage maps and reverse genetics, that define a research program at Texas A&M designed to identify genes associated with carcass quality traits in beef cattle. Our rationale for a molecular approach to this problem, is based on the current inability of ultrasound technology to reliably identify differences in marbling and tenderness traits in cattle. This necessitates a progeny test as the only alternative for calculation of EPDs for these traits. The limitations in obtaining sufficient sires and progeny for high selection differentials and accuracies, coupled with the increase in generation interval and high recurrent program maintenance cost, justifies the high initial cost of identifying gene markers for these traits given the relatively low cost of subsequent animal genotyping in a marker assisted selection scheme.

Detection of DNA Polymorphisms

RFLPs are commonly used genetic markers, that require cloned segments of DNA as probes to identify markers in the region of the genome containing the clone. Williams et al. (1990) described a new technique to produce polymorphic genetic markers called randomly amplified polymorphic DNA markers that augments the RFLP approach. RAPDs define a new tool with enormous potential for rapidly screening genomes for DNA polymorphisms. The RAPD technique randomly amplifies DNA fragments using the polymerase chain reaction and short (8-12 bases) oligonucleotide primers. When short primers are used, they are expected to have many homologous sequences throughout the genome. For example, assuming a random distribution of bases, a 10 base primer is expected to have a homologous sequence every $4^{10} = 1,048,576$ base pairs. Since the average mammalian genome contains 3 billion base pairs per haploid genome, the 10 base primer is expected to have $(3 \times 10^9)/4^{10} = 2,861$ homologous sequences per haploid genome. Segments of DNA which are flanked by a sequence homologous to the primer will begin to amplify at a rate of 2^N, where N is the number of amplification cycles. Fragments in the size range of 100-2,500 base pairs are expected to be preferentially amplified, and an RAPD reaction will usually generate several fragments within this size range. Williams et al. (1990) have shown that altering any base in a primer will change the resultant banding pattern of an individual. Because the fragments of interest are observed as amplified products on an agarose gel, they can be excised from the gel and used for other molecular analyses, including cloning, sequencing and hybridizations to determine syntenic assignment or search for RFLPs.

The first published application of the technique to the genome of agriculturally important animals was from our laboratory, by Rohrer et al. (1991). In this study, 40 commercially available 10-base primers were screened against an F1 population of 4-way cross goats. The number of bands per screened primer ranged from 0 to 16, with 12.5% resulting in no bands and an average of 6.38 bands/primer. A range of 0 to 4 polymorphisms/primer were detected, with 42.5% of all primers revealing no polymorphisms and an average of 1.05 polymorphisms/primer screened. The number of polymorphisms within the fragment range yielding the strongest amplification (500 - 1,800 bases) ranged from 0 to 3, with 50% of primers yielding no polymorphisms and an average of .7 polymorphisms/primer.

Assignment of synteny and linkage

The localization of genes of large effect influencing economically important production traits for use in marker assisted selection requires the development of highly saturated linkage maps. First, assignment of synteny is done by constructing a radioactively labeled probe from a DNA marker and hybridizing the probe to a panel of rodent-bovine hybrid cell lines. Syntenic markers are assigned by the method of concordance. Markers that hybridize to replicate lines within each somatic cell hybrid panel are denoted concordant, and assigned to a homologous syntenic group. Experience with bovine gene mapping indicates that correctly assigned syntenic genes are concordant at least 90% of the time, and nonsyntenic genes are concordant less than 30% of the time. In this manner, all detected markers may be assigned to syntenic groups, where a syntenic group defines an individual bovine chromosome.

Due to the high degree of homology between mammalian species, markers mapped in one species are very likely to map to others. Recent research has documented extensive conservation of synteny between humans and cattle (Womack and Moll, 1986). For example, the majority of the genes found on human chromosome twelve are found on bovine chromosome U3 (Figure 1). In addition, the majority of the genes found on human chromosome nine are found on bovine chromosome U18 (Figure 2). Hence

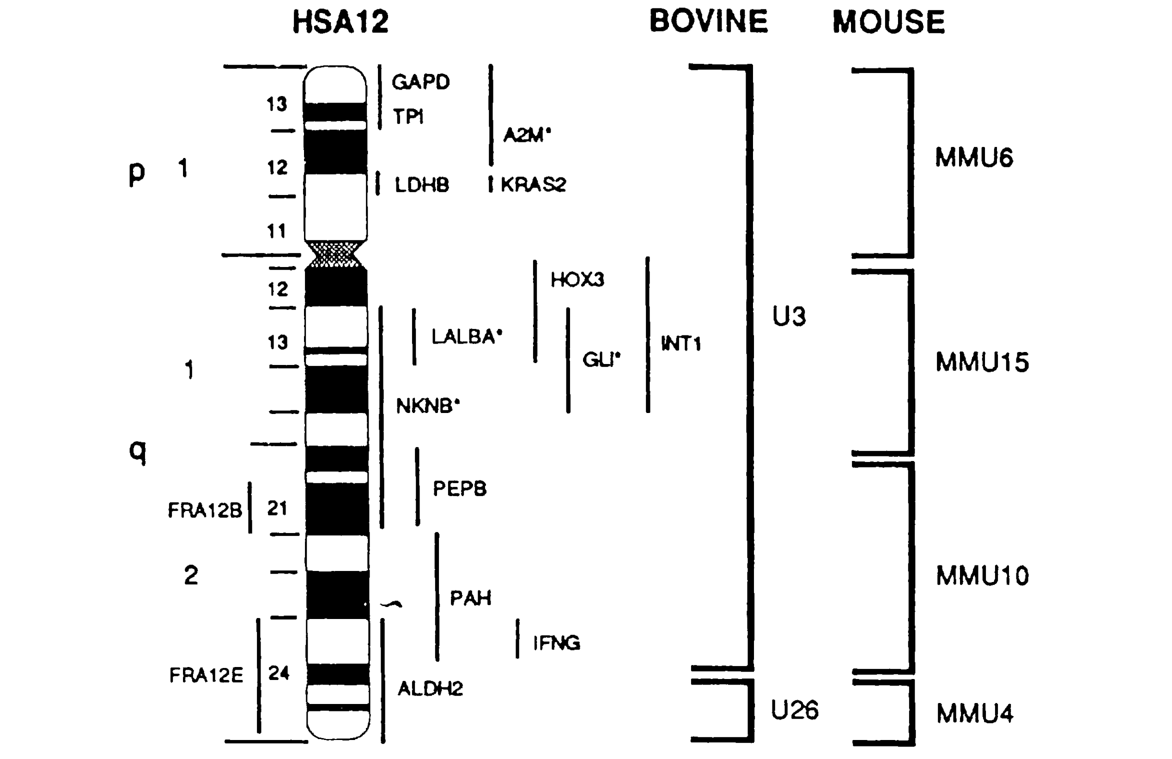

Figure 1. Comparison of Human Chromosome 12 with bovine and mouse chromosomes

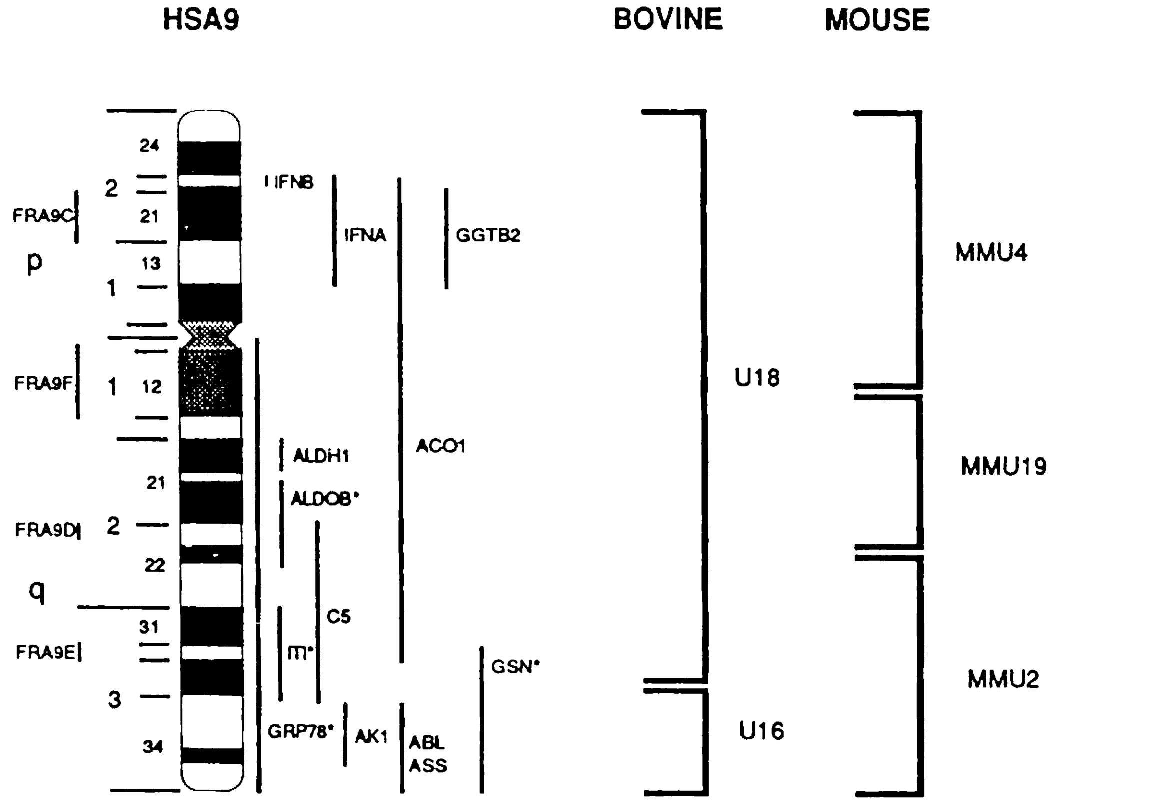

Figure 2. Comparison of human chromosome 9 with bovine and mouse chromosomes

markers detected in human genetic research will probably also map to a bovine chromosome. All markers that lie on the same chromosome are called linked markers because they tend to be inherited together. The degree to which they are inherited together is determined by their physical separation , called the map distance and measured in centimorgans (cM). Linkage analysis is used to determine map distances among syntenic markers from recombination events among families of cattle segregating for both markers. The construction of a saturated linkage map of markers is critical to the use of gene mapping technology for identifying genes of effect large enough to be of use in marker assisted selection for the improvement of economic importance in cattle. By the term saturated, we mean that we have a sufficient number of evenly spaced markers distributed throughout the genome to allow the detection of economically important QTLs in planned breeding experiments. A commonly used term is a 20 cM (centimorgan) map, which would require about 180 markers. Such a map allows the design of breeding programs with sufficient animals in a reverse genetics study to allow a high likelihood of detect QTLs when marker genotypes are compared statistically against trait observations.

The development of a bovine syntenic map using RFLPs has progressed slowly due to the need for mapped genes for use as RFLP probes (Womack, 1990). The status of the bovine gene map is in Table 2 and known RFLPs in Table 3. We have selected RAPDs to assist in the rapid construction of a saturated genome map in cattle. Based on the results of Rohrer et al. (1991) we estimate that the 600 commercially available 10-base oligonucleotide primers should yield 600 x .7 = 420 RAPD markers. The bovine genome consists of approximately 30 Morgans, or 150 regions of 20 cM each. Under the assumption that detected RAPD markers are randomly distributed within the genome, the probability of any one of the 150 x 20 cM regions containing at least one RAPD marker is $1 - \left(\frac{149}{150}\right)^{600} = .98$ and the probability of the region containing no markers is .02. Hence we would expect approximately 98% of the genome to be saturated to 20 cM if RAPD markers were randomly distributed. This assumption is probably not valid, but the markers detected should cover at least two-thirds of the genome and allow the detection of QTLs. The number of commercially available RAPD primers has increased from 100 in September, 1990 to 600 currently. If primers continue to be added at this rate, it should be possible to greatly increase the saturation of the bovine genome. The greater the degree of saturation, the greater the power of reverse genetics to detect QTLs.

Reverse genetics

The reverse genetics approach is used to identify chromosomal segments associated with specific phenotypic differences in segregating families. The practicality of this approach has been demonstrated repeatedly. Edwards et al. (1987) used 25 variable genetic markers to search for QTLs affecting 82 traits of commercial importance in corn. They were able to locate QTLs for every trait of interest. In a subset of 25 traits examined in detail, 8% to 40% of the phenotypic variation could be explained by the markers, with individual markers explaining up to 16% of the phenotypic variation. In combination, the markers explained 30% of the variation in the trait of greatest economic importance; grain yield. Although the small percentage of variance accounted for by a single marker may seem minor, each may actually be of great importance. For example, the ADH 1 locus explained only 3.5% of the variation in grain yield, yet the alternate homozygote classes differed, on average, by 20 gm per plant, roughly 16% of the average grain yield. This reveals that genetic variation is a function of both gene effect and gene frequency. Desirable alleles, such as at the ADH 1 locus, may themselves be of large effect but contribute relatively little to total variation due to their low frequency. Such loci can contribute greatly to genetic improvement, since there is a large effect of a change in gene frequency on the genotypic mean when the desirable allele is at low frequency.

Table 2. Bovine gene map

Syntenic Group	Chromosome	Gene Locus
U1		PGD, ENO1, AT3, ABLL, REN
U2		SOD2, ME1, PGM3
U3	5	GAPD, LDHB, TPI1, PEPB, IFNG, A2M, INT1, HOX3, LALBA, KRAS2, GLI, PAH, NKNB, KRTB, GDH, LYS, PFKM, IGF1
U4	21	MPI, CYP11A, FES, IGH, D21S16
U5	10	PKM2, NP, HEXA, FOS, KRT8L1, B2M
U6		PGM1, AMY1
U7		LDHA, TYR
U8		MDH2, ASL, PRM, GUSB, HBA1
U9	18	GPI, DIA4
U10		SOD1, IFREC, PRGS, PAIS, CRYA1, SST, APP, ETS2, S100B, COL6A1, COL6.'.2, CBS, GAP43, PFKL, CD18, TF CP, SI
U11		ITPA, ADA, VIM, IL2R, SRC, HCK
U12		ACY1, RHO, GPX1
U13		HOX1, MET, COL1A2, ESD, IL6
U14		GSR, PLAT
U15	6	PGM2, PEPS, CASAS1, CASAS2, CASB, CASK, ADH2, IGJ, IF
U16		ABL, ASS, AK1, GRP78, LGB, J, IGHML1
U17	8	IDH1, FN1, CRYG, VIL1
U18		ACO1, IFNA1, IFNA2, IFNB, GSN, GGTB2, ALDOB, ALDH1, C5, ITIL, NEFM, NEFL, CLTLA2
U19	15	CAT, A, PTH, HBB, CRYA2, FSHB
U20	23	GLO1, CYP21, BOLAA, BOLAB, BOLAD, PRL, TCP1, M, HSPA1, MUT
U21	19	GH, HOX2, KRTA
U22		AMH, SPARC, CLTLB
U23		ALDH2, IL2, IGL, FGB, FGG
U24	14	TG, MOS, CA2, MYC, CYP11B
U25		CLTLA1
U26		GOT1, CYP17A, ADRA2R
U27		POLR2
U28		MBP, YES1
U29		
X	X	G6PD, HPRT, PGK1, GLA, F9, DMD
Y	Y	DYZB, DYZ1

Table 3. Known bovine RFLPs

Syntenic Group	Gene Locus	Enzyme
U3	LALBA	Eco RI, Hind III, Msp I, Taq I
U3	LYS(3)	Eco RI
U4	IGHM	Bam HI, Bgl II, Eco RI, Hind III
U4	IGHG4	Bam HI, Bgl II, Eco RI, Hind III
U4	CYP11A	Hind III, Msp I, Pvu II
U5	B2M	Eco RI
U10	APP	Eco RI, Hind III, Msp I, Pst I, Taq I
U10	S1OOB	Bgl II, Hind III, Msp I, Taq I
U10	ETS2	Msp I, Taq I
U10	GAP43	Hind III, Msp I, Taq I
U10	COL6A1	Bam HI
U10	COL6A2	Pst I
U10	SOD1	Eco RI, Hind III, Msp I, Pst I, Taq I
U10	CD18	Taq I
U10	CBS	Eco RI, Taq I
U10	TF	Hind III, Msp I, Pst I, Taq I
U10	CP	Eco RI, Hind III, Taq I
U13	ESD(M)	Bgl II
U15	CASAS1	Eco RI, Hind III, Msp I, Taq I
U15	CASAS2	Eco RI, Hind III
U15	CASB	Hind III, Msp I, Taq I
U15	CASK	Hind III, Msp I, Taq I
U16	LGB	Eco RI, Hind III, Msp I, Taq I
U17	FN	Msp I, Taq I
U17	CRYG	Eco RI
U18	IFNA1(3)	Eco RI, Hind III
U18	IFNA2(M)	Eco RI, Hind III
U18	IFNB(2)	Eco RI, Hind III
U18	GGBT2	Bgl II, Taq I
U18	ALDH1	Hind III, Msp I
U19	CRY A2	Bam HI, Eco RI
U19	HBB	Hind III
U19	PTH	Msp I
U20	HSPA1(M)	Eco RI, Pst I, Pvu II, Taq I
U20	BOLAD(M)	Bam HI, Eco RI, Pvu II, Taq I
U20	CYP21	Pst I
U20	PRL	Bam HI, Eco RI, Msp I
U21	GH	Bam HI, Bgl II, Eco RI, Hind III, Msp I, Taq I
U22	SPARC	Bgl II, Eco RI, Hind III
U22	PDEA	Eco RI, Hind III
U23	IGL	Bam HI, Bgl II, Eco RI, Hind III
U24	TG	Bgl II, Eco RI, Pvu II
U24	CYP11B	Bgl I, Bst E II, Eco RI, Hind III, Msp I, Pst I, Pvu II
U26	CYP17A	Bam HI, Bcl II, Bgl I, Bst E II, Hind III, Msp I, Pst I, Pvu II, Taq I

Successful searches for QTLs with major effects are not limited to plants. Beever et al. (1990) used six polymorphic marker loci to look for genes of major effect in a large (n=146) half-sib family of Angus cattle. They detected markers that had a significant effect on preweaning growth and lean muscle content. This study examined only a very small fraction of the bovine genome and suggests that an exhaustive survey should reveal numerous QTLs of economic importance. From our laboratory, Rohrer et al. (1991) screened DNA for RAPD markers from a sample of 50 4-way cross goats that were screened biweekly for fecal *Haemonchus contortus* eggs (EPG), Coccidia oocysts (COC) per gram of feces and blood packed cell volume (PCV). Of the five different primers initially tested, one (AP9, sequence 5'-ACGGTACACT-3') produced easily repeatable polymorphic bands differing in length by approximately 10 base pairs. Animals were scored for their genotype at the AP9:905/AP9:915 locus, yielding 20 AP9:915 homozygotes, 24 heterozygotes and 6 AP9:905 homozygotes, with corresponding allele frequencies of $p = .64$ for AP9:915 and $q = .36$ for AP9:905. Also, animals were scored for either the presence or absence of a band at a second polymorphic locus revealed by the same primer with an approximate length of 500 base pairs (AP9:500). Fourteen individuals displayed the band and 36 did not. Marker loci were not linked ($P < .05$). Marker genotypes were included in mixed linear model analyses under an animal model (Henderson, 1984) to detect associations with phenotype for resistance. Estimates of variance components were computed using restricted maximum likelihood procedures (REML) as described by Patterson and Thompson (1971). Genotype at the AP9:500 locus was associated with PCV ($P < .01$), with goats possessing the AP9:500 allele having a PCV 1.73% higher than homozygous individuals without this allele. Assuming no dominance at this locus, the distance between alternate homozygotes was .903 phenotypic SD for PCV, suggesting the presence of a quantitative trait locus (loci) of large effect segregating with this marker.

The Angleton Project

Texas A&M University and the Texas Agricultural Experiment Station have dedicated the Angleton Research Station and all of its cattle and technical resources to the development of a resource herd segregating for carcass merit traits. The Angleton Research Station has 218 Brahman x Hereford cows of breeding age that serve as recipients for a MOET program. This program is currently producing backcross embryos from F_1 cattle with Brahman and Angus parents. The mating scheme includes two replicates of all possible reciprocal crosses as follows:

A♂ X A•B♀	A•B♂ X A♀
A♂ X B•A♀	A•B♂ X B♀
B♂ X A•B♀	B•A♂ X A♀
B♂ X B•A♀	B•A♂ X B♀

where A•B♀ denotes an F_1 female, derived from mating an Angus sire to a Brahman cow.

This design requires a minimum of 16 bulls and 16 donor cows. To maximize the potential genetic information derived from the cross, we must also have access to tissue samples for DNA extraction and analysis from the purebred sires and dams of the F_1 parents used in the MOET project. To date, we have obtained 31 of the required 32 foundation animals for which we have access to tissue samples from purebred parents, with the collaboration of Texas breeders and the USDA MARC, Clay Center, Nebraska. MOET procedures this spring should result in at least 100 progeny. Cows are implanted up to three times per breeding season to maximize the conception rate. Facilities available at Angleton allow for approximately 150 calves per year. Assuming an average of 40% conception per transfer, the annual conception rate should be 78.4%, requiring the maintenance of approximately 190 recipient cows for an annual yield of 150 calves of 16 full-sib families of size n=9. We realized an conception rate of 50% per transfer this spring, for which the annual conception rate should be 87.5%. Open cows will be carried over to the next breeding season, or culled as necessary. The MOET program is currently designed to run for three years. This will result in the production of approximately 450 calves, with between 50 and 60 calves of each mating type and with 16 families of approximately 28 full-sibs per family. If the number of families or sibling numbers need to be increased, up to two additional years of matings can be performed, bringing the total number of progeny to approximately 750. The result of the Angleton program will be a set of at least 16 large full-sib families from a carefully designed breeding program with genetic material available on all parents and grandparents. While all progeny will be slaughtered, a DNA library will be maintained representing every animal involved in the breeding program, to allow for future analysis as new gene probes become available. Surplus embryos of each family will be stored to provide a resource for future studies.

The Angleton progeny will be recorded for structural, health, weight for age and growth characteristics. All progeny will be carried through feedlot and carcass evaluation stages. Animals will be individually fed, with slaughter after a 120-day feeding period. Rate of gain on test and feed conversion rates will be gathered on individual animals. Carcass evaluation data will be obtained at slaughter describing maturity, marbling, quality grade, yield grade, fat thickness, ribeye area, percentage kidney-pelvic-heart fat and carcass weight. Tissue samples will be brought to the Meats and Muscle Biology Laboratory at Texas A&M University for determination of extractable lipids, moisture content, protein content, collagen analysis, 9-10-11th rib dissection, Warner-Bratzler shear force, descriptive sensory analysis (taste panel), fragmentation index, calcium dependent protease analysis and sarcomere length.

Technology Transfer

The molecular markers for specific genes of major effect will be made available to industry through the development of a series of tests which will determine individual animal genotypes from blood samples. These tests will determine which allelic form of the critical region that each animal possesses. Since the magnitude of effect and mode of gene action will be determined by this study, evaluation of each genotype's predicted carcass merit and those of progeny produced by each genotype will be possible.

These tests will have numerous applications. AI sires can be genotyped and their EPDs (due to identified QTLs) for economically important traits determined. This will allow wide dissemination of high-quality germplasm in a short time frame. Most desirably, both sires and cows will be genotyped. This will allow each producer to select the matings to optimize production characters in the progeny and will be particularly useful for bull producers who combine superior genetic attributes into each animal. Animals can be evaluated as soon after birth as is practical, thus a producer could test calves before they were weaned to determine which individuals to keep and which individuals to cull or castrate.

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DESIGNER GENES FOR THE BEEF INDUSTRY[1]

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INTRODUCTION

Through the years we have relied on the measurement of phenotypes to predict genetic potential. Phenotypes can vary depending upon the environment and management in which cattle are maintained. Performance testing enables us to put genetically diverse animals into the same environment to determine how the animals respond to identical management conditions. Some perform superior, some are inferior, and others end up average when the data are tabulated at the end of the performance trial. Animals judged to be superior under one set of performance testing may have produced different results if the test had looked at performance under a whole different management scheme. Nevertheless, performance testing gives us data with a level of statistical confidence that serve as the basis for ranking performance of animals.

To overcome still more of the environmental effects, information from performance of sibs, progeny and other relatives has been used to estimate expected progeny differences (EPDs) so we can rank relative merit of animals to arrive at some estimate of genetic worth. Unfortunately, we still do not have the programs in place to compare bulls across breeds or to directly assess traits expressed in only one sex.

GENES WITH MAJOR EFFECTS

Using modern molecular biology tools, we can now determine the genotype of an animal. For example, in dairy cattle we know that there are two types of proteins found in milk, caseins and whey. They are produced by specific genes and there are a number of different forms found in milk. Two loci have been identified as affecting cheesemaking qualities of milk: kappa-casein and beta-lactoglobulin (whey protein). These two loci each have two alleles, A and B. The BB genotypes of kappa-casein improves renneting properties of cheese and BB genotypes of beta-lactoglobulin improve cheese yield (Schaar, 1985). Graham et al. (1984) suggests that selection for these genes would increase cheese yield by 5 % per year in Australia if milk yield was held constant. These genes may also account for some of the variation in milk yields. The dairy industry is actively genotyping their active bulls to provide producers with more information to assist in selection.

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MARKER ASSISTED SELECTION

Geneticists have tried for years to identify a trait that is simply inherited yet would directly correlate to production characteristics. Then one could select for a "marker" gene and the production trait would improve. This method of selection has been termed "marker assisted selection." Beever et al. (1990) found that progeny from an Angus bull, heterozygous for 6 marker loci, that inherited one of the red blood cell B system alleles had heavier weaning weights, greater daily gains and less fat thickness than progeny inheriting the other allele. Also, half-sibs that inherited a specific allele from the bovine major histocompatibility complex (BoLA-A system) had larger rib-eye areas than sibs inheriting the other allele.

RESTRICTION FRAGMENT LENGTH POLYMORPHISMS

Another approach using biotechnology tools does not rely on knowing the exact location of a gene or its allelic forms. In human medicine, approximately 3,500 genetic probes have been developed for diagnosis of human disease. Typically, white blood cells are harvested, DNA is extracted from the cells, and then genetic fingerprinting can be performed after that DNA is digested into smaller pieces with different enzymes. Certain patterns of DNA pieces, known as restriction fragment length polymorphisms (RFLP), react with a specific gene probe and serve as the basis for diagnosing the probability of a genetic predisposition for a particular ailment.

That same type of technology can be used in the beef cattle industry. Using restriction fragment length polymorphisms (RFLP), we don't have to even know where genes that are affecting traits are located on a chromosome or what they really do. Because genes come in pairs, one gene contributed from the sire and one from the dam, we can "mark" the desirable gene by finding a unique DNA pattern close to it. Progeny from a sire heterozygous for a marker locus could be identified by the gene they received by which marker they have. We can then follow which of a sire's two genes at a given location he passes on, and perhaps we can get a better estimate of the breeding value of progeny. You may be able to select replacement heifers based on whether they received desirable genes from a heterozygous sire, or decide at weaning which bulls should go into a testing program.

A recent study in dairy cattle (Cowan et al., 1990) looked for DNA sequence differences in the prolactin gene, an important hormone for milk production. One important sire in Holsteins was found to be heterozygous for the RFLP "marker" in prolactin. Sons that were homozygous (AA) for the marker had 737 lbs more predicted difference (PD) for milk and $63.00 more PD dollars than sons that were homozygous for the other gene (BB).

CURRENT RESEARCH QUESTIONS

Lots of questions arise immediately. Are there patterns of the gene for growth hormone that relate to differences in growth or birthweight of a newborn calf? Since growth hormone stimulates the liver to produce insulin-like growth factor-1 (IGF-1), and IGF-1 directly modulates cellular and tissue growth, perhaps IGF-1 gene patterns will shed light on breed differences, as well as individual differences, of growth responses in cattle. Can we identify a gene (or genes) that contribute to variation in marbling? Genetic markers for double muscling in rats and high growth rate in mice have been identified. Can these gene markers provide diagnostic utility to breeders of beef cattle? Connective tissue in meat contributes to gristle and lack of tenderness. Connective tissue has been well-characterized chemically and is composed of various proteins. Can gene probes for those connective tissue proteins prevent us from making a bad mating or direct us to a more suitable cross before we breed the animals and find out later on that the carcasses we produced from that cross were far from what we intended?

CHALLENGES TO CONSIDER

The Value-Based Marketing Task Force report, "The War on Fat", states the primary objective of the industry should be "to improve production efficiency by reducing excess trimmable fat by 20% and increasing lean production by 6%, both by 1995, while maintaining the eating qualities of beef." This can be accomplished in two ways: either change the genetic makeup of the animal to produce a leaner product or trim it off the carcass. In the short term, trimming has become the industry's answer; but the long term answer is to change the genetic makeup of our feeder cattle. Chuck Lambert, NCA economist, predicts that if all ground beef is sold as a 90% lean product each carcass would need to increase lean yield by 56 lbs to meet demand. A primary objective is to develop techniques to identify superior sires for carcass characteristics. EPDs are currently being developed to identify sires superior for carcass traits. Finding genetic markers or major genes for carcass composition will improve accuracy of our estimates and provide unique selection criteria for producers.

CONCLUSION

Biotechnology tools give us precise genetic data immediately. Probes for specific genes, based ultimately on performance data, will most certainly revolutionize the beef industry. We will eventually be predicting, with accuracy, performance of animals based on a genetic fingerprint obtained at a day of age. That fingerprint may dictate whether the animal is used for breeding or moves into a feedlot. We may be able to even predict what type of diet it will best respond to, or what climate it should be put into to optimize production. If this sounds unbelievable, imagine making those same predictions using one cell from an embryo to genetically fingerprint prior to the embryo transfer. In addition, the sex of the embryo will be established as part of the battery of fingerprinting tests.

Figure 1 highlights how patterns of genetic markers might be used today to increase milk production in dairy cattle. Based on results from Cowan et al. (1990) and Lin et al. (1986) the right combination of a genetic marker for prolactin, kappa-casein and beta-lactoglobulin should theoretically lead to an increase of milk in certain families of cattle. Within a short period of time we will be able to construct similar tables reflecting gene patterns and performance responses in beef cattle.

The future of the beef industry holds enormous potential using these tools of modern science. Hopefully, as an industry, we will embrace that technology and work diligently to keep the U.S. beef industry competitive in the world marketplace.

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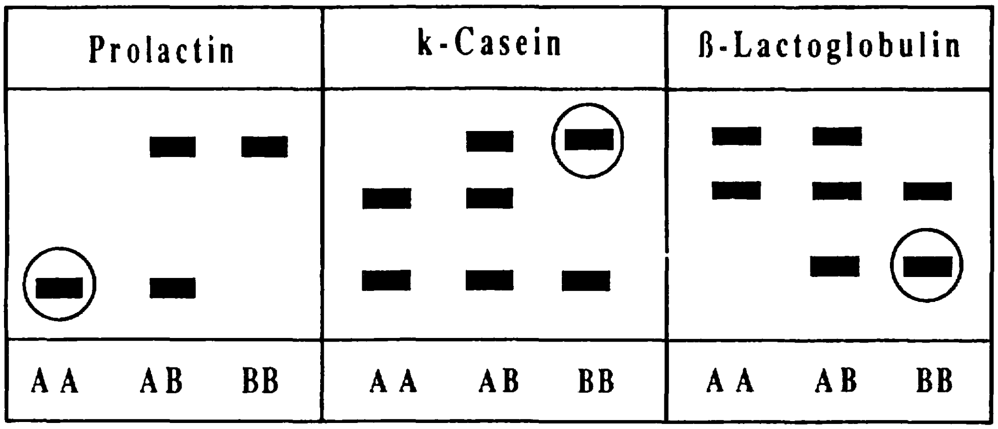
FIGURE 1: GENOTYPES FOR THREE DIFFERENT LOCI THAT AFFECT MILK PRODUCTION IN DAIRY CATTLE. THE IDEAL ALLELE IS CIRCLED.



IDENTIFICATION OF GENETIC MARKERS FOR DISEASE RESISTANCE. **Noelle Muggli-Cockett, Utah State University, Logan, UT, Roger Stone, USDA, ARS U.S. Meat Animal Research Center, Clay Center, NE and Clayton Kelling, University of Nebraska, Lincoln.**

Introduction. Efficiency of animal production could be increased by reducing losses due to diseases. Therefore, disease resistance is an obvious trait to include in a selection program. However, how to incorporate this trait into the program is a difficult question. While it has been experimentally shown that selection for resistance against specific disease is effective, it would be impossible to select for resistance to all potential diseases. Also, selection studies in mice show that increasing resistance to one disease can result in increased susceptibility to other diseases. This may be because antagonistic relationships exist among the mechanisms of the immune system. Thus, it would be preferable to use general resistance to disease as the selected trait in cattle.

For a selection program to be successful, the criterion for selection must be accurate in estimating the breeding potential of the animals. While an accurate method of assessment would be to infect all animals with a disease-causing agent and select those that survive, it would be very costly. A preferred, indirect method of selection would include the use of genetic markers that are associated with, or closely linked to, the genes influencing disease resistance. Potentially, a newborn animal could be tested for these markers and evaluated for lifetime resistance, since an animal's genetic potential is not altered throughout life. Animals with resistant markers could be selected for breeding stock and those with susceptible markers could be removed from the herd.

Major Histocompatibility Complex. One possible set of genetic markers for disease resistance are genes belonging to the major histocompatibility complex (MHC). These genes code for proteins involved in the recognition of self versus nonself and therefore, are critical in the regulation of the immune response. The MHC in cattle spans a short segment of bovine Chromosome 23 and contains genes that code for class I and class II proteins. Class I proteins, found on almost all nucleated cells, are involved in rejection or acceptance of tissue and organ grafts as well as tumor rejection and elimination of virus-infected cells. Class II proteins, found predominantly on cells of the immune system, are involved in regulation of antibody production. In 1963, it was demonstrated that genes of the MHC determine the degree of response made by the immune system against foreign molecules or pathogens. Since then, this chromosomal region has been associated with over 30 diseases in humans including insulin-dependent diabetes mellitus and rheumatoid arthritis.

RFLP analyses. To date, six MHC class II genes in cattle have been isolated and characterized in this laboratory. Regions of these genes have been used in RFLP (restriction fragment length polymorphism) analyses in order to examine genetic variation and identify possible genetic markers for disease resistance. The RFLP technique involves first the isolation of total DNA from blood samples taken from each animal. The DNA is cut with a restriction enzyme resulting in various sized DNA fragments and the fragments are separated by size on gel electrophoresis. These fragments are transferred to a filter paper, creating an exact replica of their arrangement in the gel. In the meantime, a piece of the gene of interest is radioactively label with ^{32}P. This radioactive probe is then mixed with the filter and will bind to any fragments of DNA on the filter that contain that gene. Fragments that bind the radioactive probe are visible as black bands on an X-Ray film. The inheritance of the bands can be easily followed through a family with all animals receiving one band from the sire and another band from the dam. The bands are codominantly expressed, with a homozygous animal having one band size (receiving the same sized band from both parents) and a heterozygous animal having two different band sizes (a different sized band received from each parent). The restriction enzyme that is used to cut the DNA recognizes a very specific DNA sequence and if even one nucleotide varies, it cannot cut. Therefore, fragment size, dependent on whether or not a restriction enzyme can cut the DNA, is actually a tag or marker for differences in the gene and therefore, a marker for differences in the MHC protein.

Of all possible combinations of bands that exist for the different MHC genes, there have only been a few combinations identified in cattle. This is because the genes of the MHC are tightly linked along the chromosome. Those combinations that are inherited from each of the animal's parents are called haplotypes. The haplotypes are used in statistical analyses to detect association between the MHC and a trait of interest. To detect an association, animals with different MHC haplotypes should have significantly different values of the trait. For example, an indication that the MHC is associated with infection of bovine respiratory syncytial virus (BRSV) would be that there is a lower occurrence of respiratory disease caused by BRSV in animals with one haplotype than in animals with another. This analysis approach has been used to investigate the association of the MHC genes with growth traits, as well as the levels of antibodies against two viruses causing respiratory disease in cattle, bovine viral diarrhea virus (BVDV) and bovine respiratory syncytial virus (BRSV).

Associations with the MHC. Major histocompatibility complex haplotypes were determined for 145 Angus and 64 Hereford calves from ten sires that were born in 1988 and 1989 at the USDA, ARS Research Center in Clay Center, Nebraska. Weights were taken on all calves at birth, weaning and 11 months of age. In addition, blood samples were collected from the calves every 30 days and assayed for antibody levels to BVDV and BRSV. There was no association between the MHC haplotypes present in these calves and birth weight, weaning weight, adjusted 205-day weight, preweaning average daily gain and postweaning average daily gain. The haplotypes did differ for levels of antibodies measured 30 d after birth and after a BRSV outbreak that occurred in 1989. Also, there were differences among haplotypes for BVDV antibody levels in response to a BVDV vaccination. However, a single haplotype did not always have the same effect in calves of different sires. While calves of one sire with a particular haplotype had higher than average antibody levels, calves with the same haplotype sired by a different bull had lower than average antibody levels. This indicates that selection for increased antibody levels using MHC haplotypes as the selection criterion may not be straight forward. However, there certainly is potential for using MHC genetic markers in combination with other genes in the immune system for improvement of disease resistance.

The NCA Position on Biotechnology

Burke Healey

Head of the Task Force on Animal Patent Legislation, and
Vice Chairman, Research & Education Committee
National Cattlemen's Association, Denver, Colo.

As the title to my talk suggests, my job here at the conclusion of this segment of our program is to attempt to set forth the position of the National Cattlemen's Association as it regards this whole area of biotechnology.

I'd be less than honest if I didn't say at the outset, that you can't be as involved in these issues as I have been the last four and a half years for our industry without developing some personal biases. At the same time I want to be as objective as I can. Really that part is easy when I'm setting forth NCA policies and resolutions. Our policies in the NCA are set out by resolutions and directives, and they are a matter of written, public record.

Our NCA position is presently set out in a current resolution or priority issue for each of these subjects that fall in this area of biotechnology. That is the official NCA position--no more or less. None of us in leadership roles in the NCA or any large umbrella type of organization have the right to imply that anything else is official policy. You all know full well when you get organizations as large and as diversified as the NCA or our own Beef Improvement Federation that it sometimes becomes very difficult to hammer out formal positions on which majority endorsement can be obtained.

I feel like I'd be less than candid or honest, however, if I didn't also try to convey to you here today some of the background that's caused the NCA to take the positions it has taken or currently holds in these matters. I have to admit this whole area is a very exciting and challenging one. It affords all of us as animal breeders unbelievable opportunities that we couldn't even dream of twenty years ago. By the same token these great technological advances also present some very big challenges and some dangers for each of us. It's in these areas where my personal biases may creep into the discussion.

With that said, let me turn to the three broad areas of biotechnology on which the NCA currently has taken an official position. We have addressed:

I Animal Patents for Transgenic Beef Cattle
II Mapping the Bovine Genome
III Marker Assisted Selection

Let's begin in chronological order as these issues arose starting with Transgenics and Animal Patents. So far, this is without a doubt the most controversial area of the three--both within and without our industry.

First, let me define a transgenic. In this case it's a domestic beef animal whose DNA has been genetically engineered or altered from that which it could have received by natural selection from its parents. In other words, a new gene has been added or substituted to what could have been this animals's natural occurring DNA makeup. Similarly, a gene may have been removed or deleted. At present, under U. S. law any such process to so engineer such an animal is patentable under the current law of the land. Perhaps more importantly to all of us, any such animal so engineered is patentable. The offspring of any transgenic animal containing the specifically engineered gene might very well also be patentable under our present law.

Once the possibility of transgenic mammals was a reality, and in April 1988 when the U. S. Patent Office began issuing patents on such genetically engineered animals, the NCA stepped to the forefront to try and develop practical federal legislation in this area of animal patents. Our goal was to try to draft an exemption for farmers and ranchers from current patent law that would be both fair to the inventors and also to the industry if it tried to implement and utilize these transgenics in our food chain.

We currently have a resolution in our NCA Policy that states:

* * * * *

ANIMAL PATENTS

WHEREAS, the National Cattlemen's Association support biotechnology and genetic engineering research that can improve beef production efficiency, develop disease resistant and product enhancement traits, and provide humanitarian benefits; and

WHEREAS, the beef industry support the principle of patenting the techniques and the processes of genetic engineering and accepts the Supreme Court ruling allowing the patenting of transgenic animals; and

WHEREAS, beef producers recognize the impracticalities of maintaining traceable records of offspring derived from patented transgenic animals, and they are unwilling to participate in potential trade resulting in monopolistic, legalistic, federal regulation and greatly increased personal liabilities.

THEREFORE BE IT RESOLVED, that the National Cattlemen's Association does not support the application of current patenting laws and royalty payments to the future offspring of patented transgenic animals.

* * * * *

At first NCA and Farmers Union were the only two major farm organizations taking this position. I'm proud to report that now every major farm organization is on our side. They began to realize the potential liabilities out there for every segment of our industry under current patent law.

Just some of the questions that arise under our present law are:

1 - How or who keeps track of what genes are in what animals?

2 - Is any animal found to be harboring such a gene subject to royalties and infringement penalties for a 17 year patent life?

3 - How could herds using multiple sires operate under such a threat?

4 - In view of the accidental matings that can take place, how would a registered or commercial breeder protect himself from the liabilities he'd incur if a key sire in his herd turned up with a genetically engineered gene no one even knew he carried?

The potential exposure to lawsuits and economic ruin for producers found to have unauthorized transgenic material in their animals, should such a discovery of "tagged" DNA material occur, simply boggles the mind. Keep in mind these genetic alterations which could be traced generation after generation are additive. In 50 years we could have cattle with dozens if not hundreds of different altered germ cells in their DNA.

The NCA feels it is imperative to develop federal legislation allowing for full patent protection on the processes and techniques used in developing transgenic farm animals. Patent protection for the original transgenic animal that is so engineered is also acceptable to the association. NCA is adamant, however, that the offspring of a transgenic farm animal as well as the semen or eggs it produces must be exempt from patent infringement liabilities and not be subject to royalty fees.

Last year we got such legislation passed in the House of Representatives. It died at the end of the session, however, without having ever been taken up in the Senate. Since all the major farm groups now endorse the exemption, I think it's only a matter of time until we secure this much needed protection from Congress. Farmers were granted more or less the same type of protection or exemption by Congress for seed plants under the 1970 Plant Variety Protection Act.

The last two areas of biotechnology I want to address involve Gene Mapping and Marker Assisted Selection. They are really two different subjects as you've seen here today. They are, however, very related and the work done in one of the projects will no doubt generate a beneficial "spin off" for the other.

The NCA resolutions and policy for Gene Mapping and Marker Assisted Selection are tied together because of the similarity of subject matter. The present NCA policy for both subjects is summed up in the following resolution:

* * * * *

GENOME MAPPING

WHEREAS, research on DNA, the very genetic basis of life itself, and on many of the production traits of economic importance such as rate of growth, feed efficiency, fat deposition, marbling, and resistance to disease is progressing; and

WHEREAS, in order to fully understand and utilize this technology, a genome map of cattle is essential; and

WHEREAS, this technology once developed can provide broad applications of genetic engineering by America's cattle producers using natural methods of selection within the nation's present cattle population; and

WHEREAS, the accompanying technology of Marker Assisted Selection can result in greatly increasing the accuracy of selection for critically important economic traits without any of the disadvantages of genetically engineering changes in the basic nature of the bovine genome itself; and

WHEREAS, the availability of unique facilities and beef cattle populations essential for the basic research to construct a comprehensive bovine genome map are available at the Roman L. Hruska U. S. Meat Animal Research Center as well as at many of the nation's land grant and other agriculturally oriented universities.

THEREFORE BE IT RESOLVED, that the National Cattlemen's Association encourages USDA and Congress to provide the necessary financial support for the basic research required to map the genome of beef cattle at the U. S. Meat Animal Research Center as well as at those land grant and other agriculturally oriented universities with the facilities and personnel capable of conducting this research.

* * * * *

As you can see, the NCA is strongly in favor of securing the necessary funding from whatever sources are available to generate the bovine genome map. That map is the key to opening up new eras of genetic breeding the likes of which no breeder could ever before have even dreamed.

If you want to hear a success story in cooperation and fund raising this is certainly one of them. As the cattle industry's representative for the NCA on the Forum For Animal Agriculture we were able this past year to make securing this genome map one of the three top priorities the Forum would seek in the President's Initiative For Agriculture Research. As a result, we were able for the first time to get 5 million dollars for Animal Genome research in the Agricultural Research Service 1991 budget with $1.1 million of that going to bovine genome research projects at Beltsville, Md. and Clay Center, Neb.

Keep in mind the first conference ever held in this country to even address the topic of putting together a map of the bovine genome was just 15 months ago in late February 1990 at Banbury Center at Cold Spring Harbor Laboratory on Long Island, New York. Two months later the University of Illinois hosted a second seminar in April 1990 to address the need for such a genome map for all the Domestic Farm species. Participants from over a half dozen foreign nations along with 100 of America's best scientists in this field were there at the Allerton Conference Center to spell out the needs and the benefits. I was fortunate enough to represent the cattle industry as the NCA delegate at the conference. I left that meeting convinced one of the greatest breeding tools any animal breeder could ever have was at hand, but first we've got to have the map.

At the summer conference and board meeting of the NCA in August of last year an interim resolution like the current one above on gene mapping was adopted along with a resolution to endorse the President's Initiative for Agricultural Research. With their passage NCA staffers in Washington went to work with other major farm organizations to secure passage of the Initiative.

In the meantime, we started to convey the importance of the map and the tremendous economic benefits it would have for our beef industry to anyone we could find on the Beef Industry Council or the National Livestock & Meat Board who would listen. Proposals were sought by the NCA staff from universities around the country for research projects involving the major carcass gene effects. A prestigious peer review group poured over six outstanding proposals. They unanimously chose a five year proposal submitted by Texas A & M.

This leads us to the third and last area of biotechnology in which the NCA is working so hard and exerting so much effort--Marker Assisted Selection.

The bovine map is the basic research we need to develop this principle of Marker Assisted Selection. Dr. Morris Soller from the Hebrew University of Jerusalem set out his theories for MAS as a breeder tool during the Allerton Conference at the University of Illinois last spring so simply and so eloquently that even a novice like myself could see the light. What a revelation this great elder scholar gave us. For those of us there who were looking for practical applications and real economic benefits this kindly gentleman stole the show.

Once we can find the markers for specific genes controlling economically important traits, we can breed genotype to genotype. But first, we've got to have the map. There is little doubt in the meantime while this basic mapping research is going on we will find some of these markers. The human mapping and research is going to find a great number of these markers for us.

Your NCA leadership and staff have been helping to generate funding in the area of identifying and locating genetic markers equally as hard. Two months ago in March we took the Texas A & M proposal to find the genes controlling major carcass effects to the Beef Industry Council and their agent the Product Technology Subcommittee of the National Livestock & Meat Board. They underwrote the first year's funding of this project for $150,000. This is a five year project and will require $250,000 in each of the ensuing years to be completed. Hopefully, the Meat Board will see fit to continue to completely fund both this and the Three State Carcass EPD research project that it also underwrote in March for $150,000.

NCA staffers have also made requests to Congress for partial funding of these projects in the Fiscal Year 1992 Budget. Both items are currently in the pot for consideration by the Agriculture Committees in both bodies of Congress.

The cooperation and enthusiasm of both the Meat Board staff and leadership for these two projects when they became aware of the need and the potential benefits has been tremendous. We have to be very careful, however, in any project involving these major gene effects that involve Beef Checkoff dollars. The law only allows us to spend Checkoff dollars for product research and not production research. These funds have to be used for basic bovine mapping research or for the identification of genes effecting carcass traits such as marbling, fat deposition, leanness, rib-eye area, etc. They cannot be used for projects specifically designed to find genes effecting production traits such as birth weights, yearling weights, milk, etc.

In addition, significant research for gene markers at individual universities such as Texas A & M, Illinois, Wisconsin and at Oklahoma State are underway. Partial funding for several of these have been advanced by the efforts of our NCA staff and leadership.

In summary let me make a few personal observations as to where we are and where we are going. These views do not in any way reflect official NCA positions. I've outlined those already. They do reflect some of my personal biases. These biases are based on my involvement in these aspects of bovine technology for the cattle industry for the last four and a half years. They also reflect observations at several conferences and seminars as well as conversations with countless academics and producers on these subjects.

Transgenics as such are still a long way off (perhaps ten to fifteen years) in terms of viable and useful transgenic sires. They'll have tremendous costs. The first bulls could run as high as ten million dollars and have only one or two "tagged" gene alterations. Transgenics as such have a very bad perception with the public at present both here and in Europe. Significant percentages of the public perceive genetic engineering as being either environmentally unsound or morally and ethically wrong. Still others attack it on religious grounds. My concern is that if two dairy states like Minnesota and Wisconsin can react to BST as they have, what will happen when transgenics arrive--assuming they do. Scientists in Switzerland, Germany and some of the

Systems Committee Report

A main objective of the BIF systems committee has been to review and discuss standard measures for evaluating whole-herd production efficiency. This can be a very complex undertaking, particularly when economic factors are considered. Regardless, the Systems Committee remains committed to pursuing this area because of its importance to the future profitability of the beef industry.

Concurrently, the NCA-IRM coordinating committee has been proceeding with the development of a model to evaluate cow-calf enterprise efficiency. The purpose of this year's Systems Committee meeting was to discuss key points relative to the selection of the cow-calf enterpise marketing, financial and economic standard performance measures. By combining the expertise of BIF and NCA-IRM, progress in developing standards should accelerate leading to more rapid implementation of the concepts at the producer level.

Following the introduction and background information presented by Danny Sims, Kansas State University, the suggested reproduction and grazing standard performance measures were given by Daryl Strohbehn, Iowa State University. An outline of those standards follows:

Reproduction

- * Based on Exposed Females
  - -Pregnancy Percentage'
  - -Pregnancy Loss Percentage"
  - -Calving Percentage'
  - -Calf Death Loss'
  - -Calf Crop or Weaning Percentage'
- * Calving Distribution"
  - -Cumulative Distribution
    - Calves during first 21 days
    - Calves during first 42 days
    - Calves during first 63 days
    - Calves after first 63 days

Production

- * Based on Exposed Females
  - -Average Calf Weaned Age (months)'
  - -Actual Weaning Weight (lb./hd.)'
    - Steers/Bulls
    - Heifers
    - Average Weaning Weight
  - -Pounds Weaned Per Exposed Female'

Grazed and Raised Feed Acres

* Grazing Acres Per Exposed Female (Ac/Hd)'
* Raised Feed Acres Per Exposed Female'
* Crop Aftermath Acres Per Exposed Female (Ac/Hd)'
* Pounds Weaned Per Acre Utilized by the Cow-Calf Enterprise'
* Dominant Grazing Method - Exposed Female"

Raised/Purchased Feed

* Raised/Purchased Feed Per Breeding Cow"

'Primary efficiency measures that must be supplied by the participant.
"Secondary efficiency measures that the participant may not be able to provide.

A great deal of discussion took place on the standards presented. Weaned calf crop percent, calving distribution and pounds weaned per exposed female received the most attention. The primary center of attention given to each standard was the limitations that exist in the interpretation of each measure. Committee attendees were concerned about national and regional comparisons when large diversities in management and resource bases exist. Discussion pointed out the importance of maintaining descriptive data on the resource base used in each herd. Further, the group in discussions demonstrated the necessity for clear, concise definitions for each performance measure.

An area of concern expressed by a few committee attendees was the limited amount of input information being supplied to the national database. The amount of harvested and purchased feed being utilized was singled out.

When weaned calf crop percent was discussed, the method of calculation was given a great deal of time. Proper adjustments to calves weaned versus the number of females exposed were explained and it was suggested that an example be given and that more discussion be provided in the text as to how to handle different circumstances.

Calving distribution received a great deal of discussion. Kris Ringwall of North Dakota State University presented recent data on the impact different determinations of the starting date had on percent of calves falling in each of the 21 day periods. A committee recommendation was made that the third mature cow be the animal that started the first 21 day period. Much discussion followed the recommendation. After debate, a straw poll was taken and attendees indicated they preferred bull turn out date be used rather than third mature cow. It was then recommended the calving distribution analysis be studied further, but the procedure preferred at this time was bull turn out date. A summary of Kris Ringwall's presentation follows this report.

Dr. Jim McGrann, Agricultural Economist, Texas A & M University then provided an economic perspective of the IRM project with emphasis on the cow-calf enterprise marketing, financial and economic standards performance measures. The following is an outline of his presentation.

Marketing Information

* Marketing Information
    - -Marketing method
    - -Pricing method
    - -Dominant breed

* Payweight Cattle Prices ($/cwt)

Calves	Culls
-Steers/Bulls	-Cows
-Heifers	-Bulls
-Weighted Average	

Financial Position'

* Investment Per Breeding Cow (Value of Assets)
    - -Current assets
    - -Livestock
    - -Machinery and equipment
    - -Other non-current assets
    - -Real estate - land and improvements
    - -total investment

* Debt Per Breeding Cow (Enterprise Liabilities)

* Equity to Assets or Percent Ownership of the Breeding Cow

Financial and Economic Performance Per Breeding Cow and Per cwt. of Calf Weaned

* Total Raised/Purchased Feed Cost

* Total Grazing Cost

* Gross Cow-Calf Enterprise Accrual Revenue

* Total Cow-Calf Enterprise Operating Cost

* Total Financing Cost and Economic Return

* Total Pre-tax Cost Before Non-Calf Revenue Adjustment

* Net Pre-tax Income (After Withdrawals)

* Unit Cost of Production (Economic Break Even Price)
    - -Total Non Calf Revenue

-Total Calf Pre-tax Cost (Non-calf Revenue Adjusted)

* Percent Return on Enterprise Assets (ROA)[1]

* Rate of Economic Return on the Owned Real Estate Investment

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[1]Based on both cost and market valuation of assets.

Key points relative to the selection of the Cow-Calf Enterprise Marketing, Financial and Economic Standard Performance Measures are as follows:

1. Performance measures will be developed from the total farm or ranch financial statements following the guidelines provided by the Farm Financial Standards task force.

2. The Cow-Calf financial and economic performance measures are calculated on a per breeding cow (inventory at the beginning of the operating year) and a per cwt of weaned calf basis.

3. The summary report will have cost and net income calculated on both a financial (accounting) and economic basis.

4. Guidelines will provide specific instructions on preparing the enterprise's financial statements, cattle inventories and calculated procedures for performance measures.

5. Case studies will be used to evaluate guideline procedures by producers on the NCA-IRM Finance Committee and other producers in cooperating states.

6. Guidelines will be presented for review and endorsement by the Beef Improvement Federation. Actual measures, as of May 1991 are shown in the attached summary sheets.

Those attending the Systems Committee meeting provided valuable feedback regarding the proposed measures. It is intended that an update on development of the measures be presented at next year's meeting for possible adoption and inclusion in the BIF Guidelines.

Respectfully submitted,

Jim Gibb, Chairman
Daryl Strobehn, Secretary

The Evaluation of Methods to Calculate a Calving Distribution Table, Cow Herd Inventory and Calf Crop Percentage

K.A. Ringwall and P.M. Berg

A subcommittee report to the BIF System Committee

Jim Gibb appointed Kris Ringwall (North Dakota State University), Daryl Strohbehn (Iowa State University), Roger McCraw (North Carolina State University) and Danny Simms (Kansas State University) to a subcommittee to provide data to the BIF Systems Committee for the development of standards for the calculation of calving distribution tables, cow herd inventories and calf crop percentages. Kris Ringwall reported the following data in each of three areas.

Calculation of the Calving Distribution Table

A recommended calving distribution table is presented in figure 1. The calving distribution table reports the number (expressed as actual calf numbers and/or percentage of total calves born) of calves born within the herd in 21 day intervals. Generally four 21 day periods are presented with those cows calving after 84 days listed as late, and an early period for those cows that calve before the date selected as the initiation of the calving season. Twenty-one day intervals are used since the natural estrous cycle of a cow is 21 days.

Cows need to be reported by age since mature cows (three years old and older) and heifers often have separate bull exposure dates. For the purposes of overall herd evaluation, the herd calving distribution should be based on mature cows, allowing those heifers that calve prior to the initiation date for mature cows to fall in the early category. The initiation of the calving distribution report may seem straight forward, but since gestation length varies between cows and not all cow matings are planned, some thought must be applied to the initiation of the report.

The projected start date for the calving season should be calculated by adding the estimated gestation length to the date the bull was intentionally exposed to any mature cows. A producer should use the breed average gestation length or 285 days if several breeds are involved. Unfortunately, the bull turn out date is not always known. The best predictor of expected calving date based on bull exposure was determined by evaluating 45,832 calf records from 89 beef herds enrolled in the North Dakota Beef Cattle Improvement Association.

Table one indicates that the average projected calving date based on bull exposure was March 12. The first mature cow calved on March 2, the second mature cow calved on March 8, the third mature cow on March 11 and the fourth mature cow on March 13. If the herds were given two 21 day periods to calf, based on bull exposure, 86.09 percent of the cows and heifers had calved. If the distribution table was initiated based on the first mature cow, only 73.37 percent had calved; second mature cow, 82.91 percent calved; third mature cow, 85.96 percent calved and based on fourth mature cow, 87.585 percent calved.

Subcommittee recommendation: The projected start date for the first 21 day period within the calving distribution table should be calculated by adding the estimated gestation length to the date the bull was intentionally exposed to any mature cows (three year old or older cows). A producer should use the breed average gestation length or 285 days if several breeds are involved. If the bull exposure date can not be determined, than the projected start date for the first 21 day period within the calving distribution table should be the date that the third mature cow calves within the herd.

If the calculated first 21 day start date based on bull exposure is 11 days later than when the date the first mature cow calves, the first 21 day period should start with the date the third mature cow calves and disregard the calculated start date based on bull exposure. Two year old heifers should be included in the overall herd distribution table, but two year old heifer calving dates should not be used to initiate the first 21 day period within the calving distribution table.

Calculation of Cow Herd Inventories

Most numerical calculations within a cow herd are generally presented based on a value per cow. Therefore, recommended procedures need to be implemented to reflect proper documentation of cow herd size. Figure two represents the average cow herd inventory for 23 beef herds enrolled in the North Dakota Beef Cattle Improvement Association CHAPS program. These herds have had cow culling data recorded monthly since the spring of 1988.

The overall average reflects the increase in the size of the cow herd following the introduction of replacement heifers prior to breeding and the gradual decline of cow numbers until calving. The maximum number of cows within the herd appears prior to bull exposure and remains relatively constant until fall weaning. The minimum number of cows is at calving, however the inventory has not changed much following the previous falls weaning.

Table 2 reports the herd inventory values for these 23 herds, the mean number of cows calving was 146, the mean number of cows exposed was 172 and mean monthly number of cows maintained throughout the year (perpetual inventory) was 161. The average producer was calving 9.3 percent fewer cows than were on the perpetual inventory and exposing 6.8 percent more cows than were on the perpetual inventory. Therefore, the number of cows exposed over estimates cow numbers by 6.8 percent and the number of cows calving under estimates cow numbers by 9.3 percent.

Table 3 indicates that within these 23 herds, considerable variation can exist within individual herd deviations from the number of cows calving or exposed versus the actual mean monthly cow number. Herd size stability and time of cow culling impact the deviation considerably. A herd's size can be increasing, decreasing or stable and a producer may cull cows in the fall, spring or some combination.

Table 3 illustrates three combinations selected from the 23 herds available. Herd A is decreasing inventory and culls in the fall following weaning. Mean cows exposed over estimates cow numbers by 7.2 percent and mean cows calving under estimates cow numbers by 8.8 percent. Herd B is increasing inventory and culls similar numbers of cows in the spring and fall. Mean cows exposed over estimates cow numbers by 4.1 percent and mean cows calving under estimates cow numbers by 5.0 percent. Herd C is decreasing inventory and culls more cows in the spring. Mean cows exposed over estimates cow numbers by 1.6 percent and mean cows calving under estimates cow numbers by 0.5 percent.

Additional combinations of herd stability and time of culling need to be evaluated to accurately estimate the variability of using mean cows calving or exposed as an estimator of the perpetual cow inventory. The 23 herds evaluated are all spring calving herds, so the impact of fall calving has not been determined.

Subcommittee recommendation: The size of a producers cow herd is the perpetual cow inventory. Mean cows calving or mean cows exposed do not adequately estimate the perpetual cow inventory within the herd. Ranch productivity, if expressed per cow, needs to be the perpetual cow inventory value expressed as a 12 month average. Mean cows calving, mean cows exposed and the perpetual cow inventory each need to be calculated for complete appraisal of commercial cow herd performance.

Calculation of Cow Herd Reproductive Traits

The evaluation of cow herd reproductive performance needs to account for the performance of each cow exposed to the bull. The followings is a brief review of the reproductive successes and failures that ultimately determine the number of calves weaned per cow exposed. The current Beef Improvement Federation standards are still relevant, however the following includes and expands the present standards.

Herd reproductive rates can only be calculated on herds that have an inventory based appraisal record system. Total cows exposed can than be retrieved for subsequent evaluation of reproduction. The following are the traits needed to adequately appraise cow herd reproduction.

Primary Traits:

Estrus rate (mating percentage): Is the number of cows expressing estrus divided by the number of cows exposed to the bull.

Conception rate: Is the number of cows diagnosed pregnant divided by the number of cows expressing estrus.

Prenatal survival: Is the number of pregnant cows that complete the pregnancy with a full term calf divided by the number of females diagnosed pregnant. All term calves are included, even if the calf died at birth. The inverse of prenatal survival is mortality. Prenatal mortality (Pregnancy loss percentage or abortion rate) is the number of pregnant cows that terminate pregnancy before term (abort) divided by the number of females diagnosed pregnant.

Postnatal survival: Is the number of cows weaning a calf divided by the number of cows giving birth to a full term calf. The inverse of postnatal survival is postnatal mortality. Postnatal mortality (Calf death loss) is the number of term calves which died divided by the number of calves born.

Composite Traits:

Pregnancy rate (pregnancy percentage): Is a composite reproductive trait which is estrus rate times conception rate. Since most producers no not obtain mating or estrus data, pregnancy rate can be the number of cows diagnosed as pregnant divided by the number of cow exposed to the bull. The inverse of pregnancy rate is the percent open. Open percentage is the number of cows which failed to express estrus plus the number of cows which failed to conceive divided by the number of cows exposed.

Calving percentage: Is a composite reproductive trait which is pregnancy rate times prenatal survival. If a producer does no pregnancy check cows, than calving percentage is the number of cows that calve divided by the number of cows exposed.

Herd reproductive rate: Is a composite reproductive trait which is pregnancy rate times prenatal survival times postnatal survival.

Calves weaned per cow exposed: Is a composite management trait which is herd reproductive rate times percent pregnant cows kept. Percent pregnant cows kept is the total pregnant cows minus pregnant cows sold divided by total pregnant cows. Total pregnant cows includes live pregnant cows plus pregnant cows that died. The inverse trait is the percent pregnant cows sold. The percent pregnant cows sold is the number of cows diagnosed pregnant that were sold divided by the number of live pregnant cow plus pregnant cows that died.

Subcommittee recommendation: The subcommittee recommends continued efforts towards standardized analysis terminology and calculation procedures involving herd reproductive traits. Agreement is lacking in the use of two traits, herd reproductive rate and calves weaned per cow exposed. Producers and educators do not clearly differentiate between a herd reproductive trait versus a herd management trait.

DAM AGE	# CALVES EACH AGE	NUMBER OF CALVES BORN DURING EACH PERIOD EARLY	1st 21	2nd 21	3rd 21	4th 21	LATE	OPEN/ ABORT
2	9	2	3	1	1	2		
3	5		2	2	1			
4	9	1	5	1			2	
5-11	15		4	5	4	2		1
12+								
TOTAL	38	3	14	9	6	4	2	1
AVERAGE ACTUAL WEAN WEIGHT		528	540	478	453	345	313	

Figure 1. Calving distribution report.

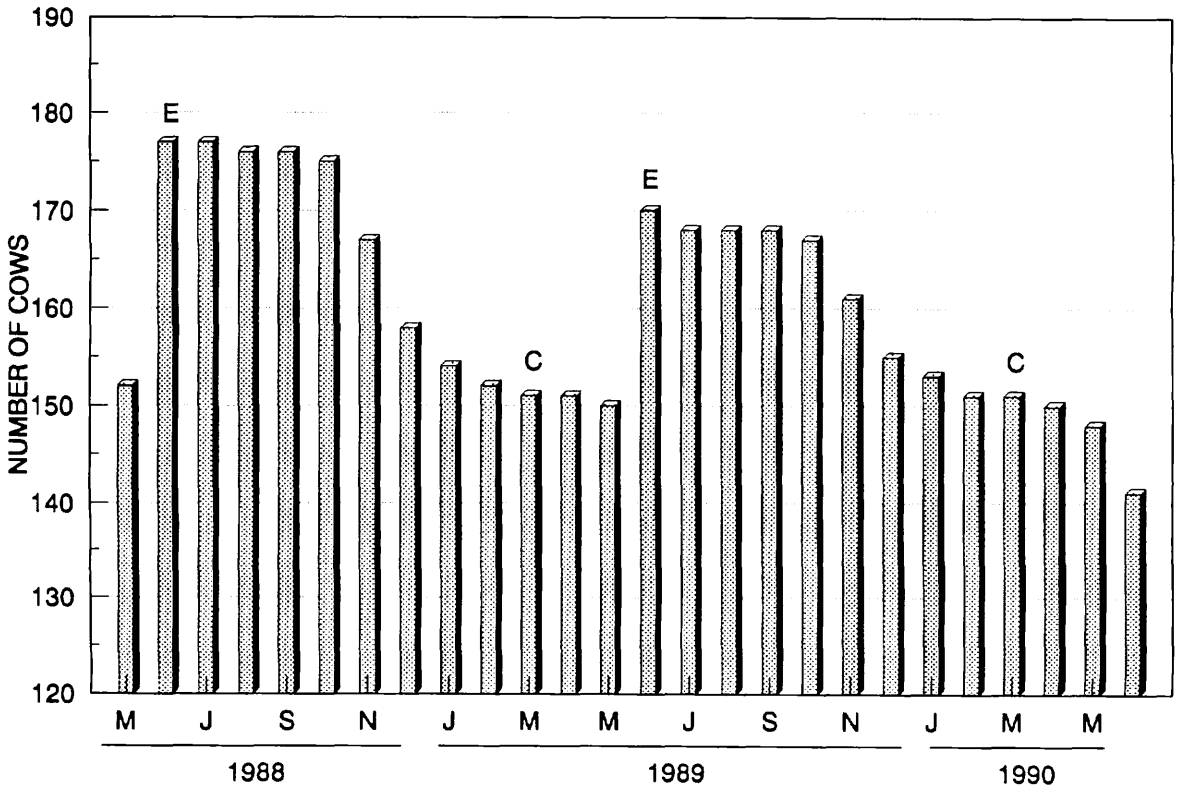

Figure 2. Overall monthly inventory (May 1988 - May 1990).

TABLE 1. PROJECTED START DATE FOR THE CALVING SEASON AND PERCENT OF COW HERD CALVING WITHIN TWO CYCLES

Start of Calving Distribution Table	Date	Percent calving
1st Female	Feb 25	64.6
1st Mature Cow	Mar 02	73.4
2nd Mature Cow	Mar 08	82.9
3rd Mature Cow	Mar 11	86.0
4th Mature Cow	Mar 13	87.6
Calving based on bull exposure date	Mar 12	86.1

TABLE 2. COW INVENTORY (23 Herds)

Mean	Number of cows
Calving	146
Exposed	172
Monthly	161

TABLE 3. THREE INDIVIDUAL'S COW HERD INVENTORY

	Number of cows		
Mean	Herd A	Herd B	Herd C
Calving	291	322	320
Exposed	342	353	324
Overall	319	339	319

CHAPS II

COW HERD APPRAISAL OF PERFORMANCE SOFTWARE

The CHAPS II program is a complete cow herd performance testing program. Calf records may be sent to the North Dakota BCIA for processing or the program can be purchased for individual use. CHAPS II requires an IBM-PC or compatible microcomputer with a minimum of 256K system memory (RAM) and a PC-DOS or MS-DOS operating system of version 2.0 or higher. A minimum of two 360K floppy disks is required to run CHAPS II, but a single 720K or greater floppy disk system or a system with one floppy and a hard disk is necessary to use all program features. The CHAPS II program is menu driven and user friendly. A new yearling program that will utilize the CHAPS II weaning data has been incorporated into the CHAPS II program. The CHAPS II program may be purchased for $200 by contacting NDSU Extension Computer Services, Box 5655, N.D.S.U., Morrill Hall, Fargo, ND 58105-5655 (701) 237-7397.

Individuals who want to send their records to the North Dakota BCIA for processing should request blank input forms for enrolling your calf records. Blank input forms can be requested by contacting NDBCIA, Box 1377, Hettinger, ND 58639 or calling (701) 567-4326. Financial support for the mechanics of running the Cow Herd Analysis Program is obtained by charging $.30 per cow plus a $5.00 annual membership fee. NDBCIA centrally process over 13,000 calf records from over 111 herds with a turn around time of 1.5 days.

A description of the CHAPS II calf program follows.

CHAPS II was developed and is supported by North Dakota State University. CHAPS II provides all the standard performance data as suggested by the Beef Improvement Federation as well as summary reports relating to critical success factors. The calf output is divided by sex and provides birth date, birth weight, calving ease, actual weaning weight, age in days, adjusted 205 day weight, adjusted 205 day ratio, frame score, average daily gain, weight per day of age, confirmation grade and parentage information on each calf. Averages presented are within sex and include an overall sex group average, individual sire averages and cow breed averages for all traits recorded. A sire summary for several traits over all calves is also included. The herd summary page of the calf reports includes a reproductive analysis of the herd, a calving distribution report, an overall growth report, herd uniformity score and a cow culling report. The final page of the calf report is a herd comparison page, designed to monitor all aspects of the cow herd. North Dakota producers are sent the calf data sorted by calf ID and by adjusted 205 day weight. The data could be sorted on six other variables if desired. MPPA's are calculated for all cows within the herd. The cow summaries include the cow ID, age of cow, cow breed, MPPA, number of calves born, number of calves weaned, calving interval, and sire of cow. All the previous years individual calf records are printed with option 1, while three other options will print the cow data sorted by age, MPPA or sire of cow.

A unique feature of CHAPS II is the identification of certain factors which are critical for a sound beef operation to function in the 90's. These factors are called critical success factors and were identified based on 86,297 calf records from 85 herds obtained from the North Dakota Beef Cattle Improvement Association. In order to obtain optimal performance associated with a given set of land and feed resources, a beef producer needs to simultaneously: 1.) Minimize total calf production time (nursing period), 2.) Maximize lbs of calf produced per day of age, 3.) Maximize the percentage of females calving within 42 days from the start of the mature cow calving season, and 4.) minimize replacement rate. As an aid for the development and evaluation of goals relating to critical success factors within a cow herd, CHAPS (Cow Herd Appraisal of Performance Software) was expanded to CHAPS II.

Bench marks were calculated for each critical success factor utilizing 45,832 North Dakota calf records with birth dates from 1986 to 1990. CHAPS II compares each individual producer's performance against the critical success factor bench marks. Bench mark values for each critical success factor, including component traits, are as follows; 1.) Calf production time - 199 days, 2.) Weight per day of age - 2.73 lbs, component traits - birth weight - 86 lbs, average daily gain - 2.37 lbs, 3.) Percentage of females calving within 42 days: heifers - 86%, mature cows - 83%, 4.) Replacement rate - 17.2%, component trait - average cow age - 5.3 years. Ultimately, cattle producers establish goals for the growth and preservation of the operation. CHAPS II evaluates these goals annually and indicates how successful a producer has combined the herd's critical success factors with available nutritional and managerial resources.

States currently enrolled: Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Michigan, Minnesota, Missouri, New Hampshire, New Mexico, North Carolina, North Dakota, Oregon, South Carolina, South Dakota, Tennessee, and Virginia.

Reported to BIF Bull Test Committee May 1991.

Kris Ringwall
Russell Danielson
Philip Berg

CENTER FOR FORAGE DEVELOPED BULLS

Joe Gotti

Stephen F. Austin State University
and
The Texas Forage & Grassland Council

The purpose of our forage developed bull program is to grow bulls on forages for 300+ days. We receive bulls in October, graze them for an entire year, and send them home the following October. Our forage program consists of a mixture of small grain pastures (oats, rye, and ryegrass) from November to May. In May we move to ryegrass and clover that has been over-seeded on our bermuda pastures. The summer grazing program consists of hybrid millet and bermuda pastures from June to the end of the development program on October 1st.

We have been able to average two pounds of gain per day consistently throughout the eight years of the program. We are currently in our ninth year, developing 100 bulls. Throughout the nine years of the program, we have developed over 500 bulls. The cost of our program compares to a grain test, the total weight gain is similar, but we develop bulls that are lean, rangy, and ready to breed cows. The cost of our program is a $50.00 test fee and $1.25 per day. So, for about $480.00, we will develop your bull on forage for 365 days. Our customers are well satisfied with our program, sending more bulls each year.

KING RANCH GAIN TEST HISTORY
Hal Hawkins, King Ranch

The King Ranch, from its inception, continues to be dedicated to developing the best product the ranch can produce. It has always stood for quality and integrity. The Santa Gertrudis breed of cattle was developed and produced because of King Ranch's desire and commitment to improvement.

Some of the early gain testing done on King Ranch began in the mid 1960's. At that time the consideration was to look at weight gain and average daily gain. Many years there were as many as 1,500 to 2,000 bulls tested.

In the early to mid 1970's pasture testing was considered as an alternative to the more expensive confinement tests. For about four years pasture testing was done with varied results. By the late 1970's and early 1980's new technology and ideas were coming of age. King Ranch had built its own feed yard and specifically built into it an area where bulls could be tested and where extensive and exact data could be gathered. Every effort is being made to find and select the very best.

Since 1982, King Ranch has tested over 6,100 head of bulls. Through advanced technology and techniques, data has been gathered on these bulls giving King Ranch the information necessary to make important managerial decisions. The technology used in some or all of the most recent years include:

1. Scrotal circumference measurements
2. Average daily gain
3. Hip height
4. Breeding Soundness Evaluation
5. Ultrasound
6. Serving capacity
7. Pelvic measurements

We now look to the future to find additional ways of evaluating bulls for better selection. We are now exploring the possibilities of examining proteins in sperm cells and how it relates to fertility. We will continue to keep abreast of new and improved ways of genetic selection, fingerprinting, mapping, etc.

PERFORMANCE TESTING - LULING FOUNDATION

L.R. Sprott

Texas A & M University

The Luling Foundation is a private agricultural research foundation and demonstration farm established in 1927 by Mr. Edgar B. Davis. Research is conducted in beef cattle and swine production as well as in horticulture and row crops. Feedlot performance tests for bulls have been conducted for over ten year, and testing under forage conditions was established in 1984 under the cooperative guidance of the Texas Forage and Grassland Council and the Texas A&M University System. Mr. Archie Abrameit is the foundation manager.

All performance testing is done according to BIF guidelines, and 35-day interim and final test reports typically include breed of bull, birthdate, average daily gain (ADG), ADG ratio, weight per day of age (WDA), WDA ratio, hip height, and scrotal circumference. Backfat thickness and rib eye area are obtained by ultrasound. An index calculated by dividing the sum of the ADG and WDA ratios by two is also reported. Some consignors request pelvic area measurements on their bulls, but this is not typically done for all bulls in the test.

Feedlot tests are conducted for the usual 140 day period, and some thought is being given to feed for only 112 days as the recommended minimum according to BIF guidelines. The number of bulls fed each year ranges from 35 to 60 head. A maximum of 15 bulls can be individually fed to accurately assess feed efficiency for interested consignors. Rations typically contain 12 percent crude protein, and roughage content varies by breed of bull with the Brahman influenced bulls receiving the higher roughage rations. All bulls enter the facility under valid health papers, and consignors pay nomination fees based on the number of bulls submitted. There are per head discounts when consigning more than five bulls. Consignors also pay an advance feed fee for feedlot bulls and an advance forage fee if to be tested on forage.

Performance tests on forage were initiated in 1984. Nineteen bulls were tested that year with 50 bulls the following year. Since that time an average of 90 bulls have been tested annually. Initially, testing on forage lasted 300 days, but the summer droughts of 1987 and 1988 forced testing to shift back to the feedlots. To avoid the problem of summer drought, forage testing has been altered to more extensively utilize winter forages for a minimum of 140 days.

Feedlot average daily gains in the early 1980s were 2.75 pounds. The latest feedlot summaries report average daily gains of 3.6 pounds. Average daily gains on forage are expectedly inconsistent due to weather and forage availability, but historically average 1.6 pounds for a 300+ day grazing period. Average daily gains on winter forage are 2.6 pounds over a 140 day period. An optional consignment sale is offered each year in February for feedlot consignors and in May for forage consignors.

JIM WELLS COUNTY BEEF CATTLE IMPROVEMENT ASSOCIATION BULL TEST

Joe C. Paschal
Texas A & M University

The Jim Wells County Beef Cattle Improvement Association Bull Gain Test was first initiated in 1963 in a 140 day feeding trial at the Hank Castelow Feedyard west of Alice, Texas. This gain test was the result of the cattlemen in Jim Wells and surrounding counties (Live Oak, Duval, Brooks, Kenedy, Kleberg, and Bee) wanting to increase their use of performance testing past the stage of adjusting weaning and yearling weights. Their organizations approached the Texas Agricultural Extension Service Jim Wells County Extension Agent Mr. Les Brandeis who assisted in initiating the first tests.

In the early years the number of bulls involved varied from 60 to 160 head of primarily Santa Gertrudis and Beefmaster breeds but also included Hereford, Brahman, Angus, and Red Angus breeds. After Castelow's Feedyard closed, the bull test was moved to Lyke's Brothers Feedyard near Edroy, Texas, for a year then finally to its present location of Chapparossa Feedyard on the Chapparossa Ranch west of La Pryor, Texas. The length of the feeding period was decreased in 1988 to 112 days following a 14 day adjustment period.

The bulls are typically delivered to the Lundell Ranch in Jim Wells County for processing (vaccinations, deworming, weighing, and tagging) in late November then trucked to the Chapparossa Ranch the following day where they are sorted on the basis of weight (light, medium, heavy) into one of seven large feeding traps or pens. The bulls are fed a high roughage, low energy ration for the next two weeks. Usually in the second week of December, a crew of consignors with the Extension Agent then travel to La Pryor to collect initial weights and heights, scrotal circumference and sheath scores and the bulls are fed a higher energy ration (still a growing ration). During the first week of February, 56 day or mid-test measurements are taken (weight, height, scrotal circumference, and sheath scores) including ultrasound measurements for ribeye area and fat thickness.

Final or off test measurements (the same of those taken initially) are taken in early April and the bulls are sorted into cull, keep, and sale groups. The cull bulls are usually fed out and slaughtered, the keep and sale bulls are either shipped back to the Lundell Ranch to be picked up by their owners or placed back on feed. The sale bulls are selected by a committee of consignors that select the better performing bulls in the test for the annual fall bull sale which is held in Alice.

In the last three years (1988, 1989, and 1990), the Jim Wells County BCIA Bull Test has added measurements of hip height, scrotal circumference, ultrasound measurements of ribeye area and fat thickness, and sheath scores. In the past two years, one breeder has incorporated pelvic area measurements of their yearling bulls in the bull test.

The number of bulls increased from 227 in 1987 to 255 in 1988 and peaked at 318 in 1989 decreasing to 184 in 1990, the reduction due in large part to the extensive drought in South Texas during that time. The number of consignors and breeds during those four years were 20 and 3; 26 and 3; 33 and 5; and 26 and 4, respectively. In the 1990-91 bull test, the 184 bulls representing 4 different breeds (Brangus, Santa Gertrudis, Beefmaster and Hereford) gained 3.09 lb/d with pen feed efficiency of 5.93 lb/lb (DM basis) with a cost of gain of $51.26/cwt.

In summary, the Jim Wells County BCIA Bull Gain Test, begun in 1963, is one of the oldest on-going performance tests in Texas. It is unique in it's location (South Texas), it's origin (breeder established), and it's breeds (primarily Brahman influence - Santa Gertrudis and Beefmaster).

Kansas Steer Futurities -

Keith O. Zoellner
Kansas State University

The Kansas Steer Futurity is a test to identify breeding programs and sires within those programs, that are producing calves with superior genetic ability for rate of gain and carcass desirability. Both purebred and commercial producers are given an opportunity to test, on a limited basis, their breeding and management programs.

During the early years of the program, the economic data provided producers was considered secondary in importance; however, it soon became clear that this type of feeding program could be very profitable. This observation led to increased emphasis on accelerated feeding as a market option.

Beef cattle production in Kansas has undergone tremendous changes in the past 20 years. The continued increases in production costs, along with the reduction in per capita beef consumption has caused cow/calf production to be marginal or unprofitable for cow herd owners in many of those years.

Cow herd owners responded by producing calves with heavier weaning weights and faster post-weaning gains. Research at Kansas State University gave evidence that when steers of this type were placed directly on feed shortly after weaning, they would produce desirable carcasses at younger ages, with equal meat tenderness and flavor compared to conventionally fed cattle. This method of accelerated feeding allowed steers to reach market weight at a younger age (12-14 months of age) with improved feed conversion and lower carcass fat than conventional feeding.

History

The effort to study a method to maximize profits and produce an acceptable beef carcass at an earlier age led to the Kansas steer futurity concept, which was started at two locations in the fall of 1974. It allowed producers to test their calves for gainability and profitability in the feedlot. One futurity was co-sponsored by the Kansas Livestock Association and Kansas State University Extension Service, while the other was sponsored by the Guaranty State Bank and Trust of Beloit. Since that time, a total of 76 futurities involving over 7,000 cattle have been conducted at 14 different locations. The current report covers 70 futurities over a 14-year period from 1974 through 1988 on over 6,200 steers.[1]

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[1]Adapted from: Simms, D., J. Mintert, and A. Maddux. 1991. Kansas Steer Futurities: An Economic Analysis of Retained Ownership and a Summary of Cattle Performance from 1974-1988. Kansas Agricultural Experiment Station, Report of Progress 623.

Cattle Management Procedures

The futurity program is an ongoing program with a consistent management routine. It is recommended that spring-dropped calves be weaned and delivered to futurity test sites, usually during November or early December. Nearly all tests are held at commercial custom feedlots and consignors' cattle are fed together in one or two pens. Cattle are weighed on arrival and processed according to the individual feedlot's management program. Most futurities allow a two or three week warm-up period to equalize predelivery management. Cattle are then individually weighed for an official test starting weight and fed to slaughter weights on rations normally fed by the feedlot. After approximately 100 days of feed, cattle are weighed and hip height is measured at most tests.

Producers consigning cattle receive rate of gain and carcass information. Producers are billed directly by the feedlot for feed, medical, and yardage costs and paid directly by the packer on a carcass value basis. With this information they can calculate cost per pound of gain and returns per head based on their individual costs of producing calves to feedlot delivery time.

Futurity cattle are marketed when management of the feedlot feels they are of acceptable weight and fat thickness (.3 -.4 inches). To allow for differences in maturity patterns of various genotypes of cattle, there are normally two or three kill dates for each test. Cattle are sold to packing plants, usually on a grade and carcass weight basis, and carcass data is gathered. Normal selling time is May through June when cattle are approximately 13-15 months old.

Results

Performance of the steers by years is shown in Table 1 and the carcass characteristics are shown in Table 2. Over the 14 years of the futurities, arrival weights increased 180 lbs (110 lbs the last 3 years). Slaughter weights per day of age increased .16 lbs, for 70 lbs increase in slaughter weights per steer. Frame score increased over the 14 years of the futurities while daily gain was essentially unchanged. Fat thickness at slaughter tended to decrease, which lowered numerical yield grades and slightly lowered quality grades. Ribeye area increased but not when expressed on a per unit carcass weight basis.

Detailed economic analysis for the cow/calf phase, from 1974-1988 showed that this phase was profitable in 7 of the 14 years, with an average return of $5.97 per head. Returns were extremely variable, with a low of $-106.79 and a high of $115.80 per head. The economic analysis for the feeding phase during this same period showed profitability in 10 of the 14

Table 1. **Performance of Futurity Steers by Year**

Year	No. head	On weight lb	Final weight lb	Start age, d	Final age, Score	Frame lb	Daily gain, lb	Wt/d age,	Days on feed
1974-75	448	524	1036	271	438	2.0	3.10	2.38	167
1975-76	477	522	1082	281	441	2.5	3.32	2.48	159
1976-77	513	587	1109	281	446	3.0	3.17	2.51	166
1977-78	545	619	1124	284	460	2.6	2.93	2.46	176
1978-79	554	631	1145	286	463	2.6	2.95	2.53	177
1979-80	533	616	1124	281	456	3.1	2.95	2.46	174
1980-81	551	617	1139	283	451	3.4	3.12	2.55	170
1981-82	599	671	1172	296	444	3.9	3.32	2.66	152
1982-83	583	662	1157	279	445	3.4	3.01	2.60	166
1983-84	587	647	1159	288	457	4.2	3.10	2.53	166
1984-85	647	666	1182	288	462	4.9	3.01	2.51	171
1985-86	657	675	1197	287	454	5.1	3.19	2.62	165
1986-87	644	622	1141	280	441	4.3	3.04	2.57	159
1987-88	668	704	1215	297	450	4.9	3.48	2.68	150
14 yr avg		646	1160				3.06	2.68	164

Table 2. **Carcass Characteristics of Futurity Steers by Year**

Year	Carcass wt, lb	USDA quality grade[1]	Yield grade	Fat thickness in	Ribeye area, in^2	% Retail product	Ribeye area/ cwt carcass wt, in^2
1974-75	639	6.9	2.6	.41	11.9	71.1	1.87
1975-76	675	6.8	2.5	.41	13.0	71.7	1.93
1976-77	678	6.8	2.4	.34	12.1	71.9	1.80
1977-78	695	6.3	2.5	.35	13.0	71.5	1.88
1978-79	686	6.2	2.3	.35	12.2	72.4	1.77
1979-80	686	6.5	2.6	.34	12.6	71.2	1.84
1980-81	707	6.6	2.4	.35	12.4	72.0	1.76
1981-82	694	6.3	2.6	.33	12.7	71.3	1.84
1982-83	694	6.5	2.3	.33	12.7	72.3	1.84
1983-84	691	6.1	2.3	.35	12.8	72.5	1.85
1984-85	712	6.6	2.1	.32	13.3	73.3	1.87
1985-86	723	6.2	2.1	.33	13.8	73.3	1.91
1986-87	682	6.5	1.9	.27	12.8	74.0	1.88
1987-88	730	6.3	2.0	.30	13.6	73.9	1.86
14 yr avg	706		2.4	.37	12.9	71.8	

[1]6.0 = Select +, 7.0 = Choice-.

years, with an estimated average return of $38.43 per head. Retained ownership through the feedlot was profitable in 8 of the 14 years with an estimated average return of $44.40, with a low of $-62.55 to a high of $209.60 per head. In 3 years producers would have greater returns selling calves at weaning while in 3 others, they minimized their losses by retaining ownership.

Conclusions

Kansas Steer Futurities have demonstrated that the industry "can feed calves" and that "retained ownership" can be profitable to the cow/calf producer while identifying feedlot and carcass characteristics of the cattle.

This accelerated system of production does allow a producer to take advantage of superior genetics and the economic opportunities it provides. The beef industry has the opportunity to continue to produce quality beef while reducing days to slaughter and taking advantage of efficiency of feed conversion of younger animals. The program is in line with emphasis of the industry on quality meat with high cutability and value based marketing.

Many cooperating Kansas Cow/Calf producers realize that to maximize profit from their beef production systems, their management system must match their genotypes. This has changed their production goals and replacement selection criteria, and stressed the importance of using genetically superior bulls.

The futurities have produced a highly visible program that has helped Extension build rapport with producers, feedlot managers, bankers, and the packing industry. The futurities have provided Extension with data useful in public meetings and has enhanced Extension's working relations with "key" personnel in the livestock industry.

COLORADO'S HEIFER TESTING PROGRAM

Garth W. Boyd and Paul H. Gutierrez[1]
Colorado State University

Introduction

The San Miguel Basin Heifer Test (SMBHT) is one model or approach demonstrating the application of IRM to the replacement heifer management decision facing beef livestock producers. The primary objective of the SMBHT is to use a practical, economical test to objectively identify heifers that excel in reproductive performance. This IRM team-sponsored test was designed much like a bull test because heifers were reared in a similar environment so that genetic defferences could be sorted out. What makes this test unique is that the criteria for success or failure were mostly reproductive parameters, not average daily gain or feed efficiency.

An Integrated Team Effort

The local county Extension Director participated in the SMBHT association as an ex-officio coordinator and helped identify several consignors, the local veterinarian, a local A.I. technician, industry sponsors, and members of the Colorado State University IRM team.

Specific SMBHT rules, which were designed to enhance the chances of selecting profitable replacement heifers, include: 1) no upper limit on the number of heifers consigned, however, a minimum of five heifers <u>are</u> required; 2) consigned heifers must be born after February 1 of the preceding year and their weaning weight cannot be over 50 pounds from the actual heifer weaning weight average of her contemporaries; 3) the breeding season will be restricted to a 25-day AI period following estrus synchronization and a 25-day cleanup with bulls; 4) individual cost of gain will be determined based on a feed efficiency formula calculated using percent of body weight; and 5) a classification system using gold, silver, and bronze categories will be initiated based on a heifers performance using scoring criteria data.

Measuring Reproductive Performance

At the end of the breeding season, the most reproductively efficient heifers were identified by palpation. A scoring system for the SMBHT was designed to emphasize the

[1] Assistant Professor, Department of Animal Sciences and Associate Professor, Department of Economics and Animal Science.

the most important criteria a replacement heifer has to meet. First, did she become pregnant during a short breeding season? If so, when? Seventy points possible. Second, does she have a large enough pelvic area to allow unassisted delivery of a 70 to 80 pound calf? Twenty points possible. And last, was she reproductively mature at the start of the breeding season? Ten points possible. This was assessed using the reproductive tract score.

Producers are interested in individual heifer and average groups scores, but the classification system of gold, silver and bronze has proved to be even more popular for identifying differences in heifers reproductive performance.

Measuring Economic Efficiency

Feed cost per head was determined for each consignor's heifers at the end of each month or feeding period. Other operating costs included transporation, receiving and processing, vet-medicine and breeding fees. The consignor was then billed by the SMBHT association.

Break-even development values (dollars per head) for heifer test scores and heifer pregnancy rates were computed for each consignor heifer, in order to measure economic efficiency of the SMBHT. The market value and reproductive efficiency of the raised replacement heifer is taken into consideration.

Break-even values provided a means to measure reproductive and economic efficiency within an individual group of heifers. Lower break-even values reflecting higher total heifer test scores and/or lower cash costs indicated improvements in economic and reproductive efficiency.

Summary

The SMBHT is in its third year and has proven to be a very successful IRM model for moving beef livestock producers in new directions of replacement heifer management.

Experience gained from Colorado's beef IRM programs, such as the SMBHT, indicate that the successful transfer of integrated information is highly dependent on: 1) the level of understanding between the educator and producer, and 2) a producer driven program at the farm/ranch level.

Table 1. Heifer Test Scoring System

			Points
A.	Pregnancy date	70 points possible	
	Pregnant day 1 of breeding season		70
	Pregnant day 10		60
	Pregnant day 25		45
	Open		0
	Note: One point subtracted for each day later in the season that heifers become pregnant.		
B.	Pelvic area before breeding	20 points possible	
	> 140 cm^2		20
	140-150 cm^2		15
	130-140 cm^2		10
	120-130 cm^2		5
	< 120 cm^2		0
C.	Reproductive tract score	10 points possible	
	4 and 5		10
	3		5
	2		2
	1		0
		Total points possible per heifer	100

RANGE BULL EXCHANGE, INC.

Ken Persyn
P.O. Box 1165
Castroville, Texas 78009

Range Bull Exchange, Inc. is a Texas Corporation found by Kenneth Persyn. Other Stockholders include: Angelina Farms, Don Bacon, Beverly Hills Simbrah, James Blankenship, H.B. Girault, JBS Simmentals, Mille-Cent Ranch, Pete Pawelek & Sons, San Jacinto Cattle Company, Seven V Seven Ranch, Billie Mack Simpson, Thurber Ranch, Guerra Brothers, and Wentz Farming Company.

Range Bull Exchange, Inc. started operation in 1985. Sole purpose to economically develop and market bulls. Originally handled only Simmental and Simbrah bulls.

Bull Program and developing technique have been altered each year to try to provide economical production and optimum marketability.

At present two High Forage Tests are scheduled each year with delivery date of June and November. The tests conclude with the Range Bull Exchange All Breed Bull Sale in late October and mid March.

Bulls are developed on a high roughage diet with the average daily gain maintained to 2.5 to 3.0 pounds per head per day average overall.

The Range Bull Exchange program is designed to provide adequate growth and sufficient performance to allow identification of the top performance individuals within their specific group.

Range Bull Exchange, Inc. provides adequate room for each group to exercise and graze.

Range Bull Exchange, Inc. bulls are not developed in feedlot situations. They have continued access to forage and are limited feed once a day.

All bulls that complete the program are subjected to breeder soundness examination and health tested for shipment anywhere.

Range Bull Exchange, Inc. sales are designed to offer the buyer a second product in the addition that will assure optimum performance.

Range Bull Exchange, Inc. has marketed over 3000 bulls since its start, and presently sells about 500 bulls of all breeds each year. About 20% of being exported to Mexico.

LIVE ANIMAL AND CARCASS EVALUATION COMMITTEE
GENERAL SESSION

A review of the ultrasound live animal evaluation certification program revealed some problem areas with respect to determining the correlation between ultrasound measurements and actual carcass measurements. There also appeared to be some question as to how repeatability should be calculated.

Chairman Crouch appointed a subcommittee chaired by Dr. Ronnie Green, with committee members Dr. Doyle Wilson, Mark Talman, and Dr. Keith Bertrand to extensively evaluate the ultrasound certification process and present their findings and recommendations at the BIF mid-year meeting in 1991.

Discussion was held regarding the feasibility of establishing a permanent site where annual or semi-annual ultrasound certification seminars might be held, with no firm recommendations made.

With respect to the proposed National Beef Carcass Data Collection Program discussed by Dr. Mike Dikeman, Bob Koch moved, seconded by David Nichols, that percent KPH (kidney, heart and pelvic fat) be added to the carcass data collected. The affirmative vote was unanimous.

The live animal and carcass evaluation committee gave unanimous support to the formation of a National Beef Carcass Data Collection Program. Further details are expected in October 1991.

John Crouch, Chairman

BEEF CATTLE ULTRASOUND TECHNICIAN CERTIFICATION: QUESTIONS NEEDING ANSWERS

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Introduction

Recent trends in the beef cattle industry have dictated that we clean up our act in terms of excess fat production. This has resulted in a call from within the industry to put into place a system which will encourage the breeding and feeding of cattle which will yield leaner, yet palatable carcasses. Even though this system currently does not exist, there is little doubt in the minds of most industry leaders that it will come in the not too distant future. Therefore, it is our challenge to devise tools for our breeders to use to aim at the objective of improved carcass merit.

The definition of "ideal" carcass merit is somewhat elusive under our current yield and grading system. Rex Butterfield summed up our objective well when he said:

> "the ideal carcass is one which yields a maximum percentage of muscle, a minimum percentage of bone and enough fat to meet the minimum quality requirements of the marketplace. It must be produced economically within the limits of functionally efficient cattle."

This objective coincides with the fact that we know that our consumer preferences are in the words of Gary Smith "to keep the taste fat and get rid of the waste fat".

Fortunately, we know from collective research results over the past 25 years that a great deal of genetic variation exists both between and within breeds for measures of carcass merit. Levels of additive genetic variability for measures of retail yield and palatability are all in excess of what we generally observe for growth traits such as weaning weight (see Table 1). This indicates that we should be able to make fairly rapid genetic improvement from selection within breeds for these measures.

Larry Cundiff and co-workers at the Roman L. Hruska U.S. Meat Animal Research Center have also reported in past BIF meetings that the magnitude of genetic variability between breeds is roughly equivalent to that within breeds (see Table 2). This infers that we should also be able to make improvement in carcass desirability of slaughter cattle through proper breed selection implemented in designed crossbreeding programs.

Collectively, these facts lead us to the conclusion that we have the opportunity in our current cattle population to produce the kind of cattle desired at the end product level. Terminal sire lines selected for carcass merit matched with maternal dam lines where emphasis is placed on reproductive efficiency and matching of production potential to environmental resources offer the means to this end. However, for this type of system to be effective, carcass merit expected progeny differences (E.P.D.'s) must be implemented in national cattle evaluation programs.

Table 1. Heritability Estimates of Carcass Traits in Beef Cattle

Trait	No. Studies	Avg. h^2
Retail yield (%)	7	.42
Retail weight (lb)	6	.53
Carcass weight (lb)	7	.48
Ribeye area (in^2)	10	.40
12th rib fat (in)	10	.43
Marbling (or QG)	9	.38

(Weighted average of literature estimates)

Table 2. Relativity of Variation Within and Between Breeds for Carcass Parameters in Beef Cattle

Trait	Number of Additive Genetic Std. Deviations Between Most Divergent Breeds
Retail product (%)	5.8
Retail product weight (458 days)	8.2
Marbling score	5.3

(Adapted from Cundiff et al. (1990))

Past meetings of the Beef Improvement Federation have had speakers which have concluded that real-time linear array ultrasonic imaging offers great potential for moving toward carcass merit E.P.D.'s. As a prelude to this year's BIF meeting, a group of researchers working in the live animal prediction of carcass merit utilizing ultrasound technology met for a discussion of where we are currently. It is the intent of this paper to summarize some of that discussion and to specifically make some recommendations regarding ultrasound technician certification programs. A full list of those contributing to this discussion is given as an appendix to this paper.

Discussion

The first question that must be addressed in reference to collection of ultrasound carcass data is that of which traits should be measured. It has become quite standard for ultrasound measurements to consist of estimates of fat thickness and area of the *l. dorsi* at the 12/13th rib juncture. These measurements have been emphasized largely because of their importance in the U.S.D.A. yield grade equation, have become fairly refined and are relatively easy to obtain; therefore, they will most likely be a part of any collection of this kind of performance data in the future. However, there may be other measures which could be much better predictors of yield than just these two.

Since intermuscular fat (i.e. "seam" fat) makes up 50% or more of total carcass fatness, an ultrasonic predictor of this fat depot would be very useful for selection for improved retail yield. Researchers at Iowa State and Texas Tech are attempting to define such measures in locations like the round, forearm, shoulder, brisket, 4/5th rib juncture, 8th rib and others.

The real goal here is to alter the relative proportions of inter- and intra-muscular fat depots. This requires that we be able to predict with some degree of accuracy intramuscular fatness (i.e. "marbling"). There has been much debate about the validity of marbling as the primary determinant of palatability in our current grading system. My purpose here is not to debate that issue but to say that as long as that is our system and "insurance policy" against a bad-eating piece of product, we need to attempt to be able to predict it on the live animal. The point must be clear, however, that any prediction of marbling using ultrasound needs to be **totally free of human subjectivity**.

There seems to definitely be a need for some joint effort by researchers working on these "new" measures to develop some standard protocols. One suggestion that came from our meeting was that perhaps a scanning workshop amongst these groups is in order to go over all of these sites and techniques of measurement with the ultimate goal being the development of an anatomical "scanning guide". Plans are underway for the possibility of such a workshop either around the American Society of Animal Science annual meetings in August or the NC-196 annual meeting in September.

There also exists a variety of different types of ultrasound units currently being used for carcass imaging. Doyle Wilson and his group at Iowa State pointed out in last year's BIF proceedings the different units available and their capabilities. There is no doubt that this technology will continue to improve and evolve with increased use. This raises the question of how technicians will be evaluated given the use of different equipment. Some discussion has been given to a "phantom modelling" approach which would perhaps allow estimation of the differences between the various types of units.

Much of the discussion in the past year regarding evolving equipment has centered around the effectiveness of the new Aloka 500V and 633 units (Corometrics, North Wallingford, CT). When one reviews the literature on accuracy of ultrasonic measures of backfat and ribeye area using equipment prior to the two newer units, the weighted average correlation of a number of studies between actual carcass and live ultrasonic measures is .79 and .69 for backfat and ribeye area, respectively (table 3). When this is compared to the results of studies thus far utilizing the newer Aloka units these correlations have increased to .87 and .78 for the two measures (table 4). The same result has been observed by workers in Australia for ribeye area measurements with the newer equipment but they have observed a slight decrease in accuracy for backfat thickness. It appears that the newer generation equipment does in fact perform more accurately, particularly for measurement of ribeye area, when used by trained technicians.

Because of the fact that accuracy of measurements taken ultrasonically has traditionally been assessed using correlation coefficients, many have been led to believe that backfat thickness estimates are more accurate and more precise than are those for ribeye area. Precision is determined by the size of the deviation between the ultrasonic live and carcass measure. When expressed relative to the average, fat thickness is roughly twice as imprecise as is ribeye area (20.6% vs 9.4% error rates, respectively) in recent data collected in our program (Perkins et al. 1991b). This fact has been repeatedly shown in most research studies where these two traits have been evaluated.

Table 3. Correlations Between Ultrasonic and Actual Carcass Measures Using Equipment Other Than Aloka 500V or 633

Source	12th Rib Backfat	Ribeye Area
Stouffer and Cross (1985)	.78	.87
Turner (1988)	.81-.94	.71-.94
Faulkner et al. (1989)	.89	--
Hale et al. (1989)	--	.74-.82
Stouffer et al. (1989)	.86	.76
Strasia et al. (1989)	.55	--
Houghton et al. (1990)	.87	.78
Smith et al. (1990)	.82	.63
Perkins et al. (1991a)	.76	.60
Weighted Average	.79	.69

Table 4. Correlations Between Ultrasonic and Actual Carcass Measures Using Aloka 500V or 633 Units

Source	12th Rib Backfat	Ribeye Area
Duello et al. (1990)	.87	.75
Moylan et al. (1991)	.87	.76
Green et al. (1991)	.87	.83
Weighted Average	.87	.78

Past ultrasonic estimates of marbling have had two primary problems. They have been of insufficient accuracy to be of use (table 5) and have been made in such a way that they are too prone to human subjectivity. More recent attempts to use ultrasound to predict marbling differences have relied on the distribution of pixel counts corresponding to the 64 shades of grey in the ultrasound image. Only now are we beginning to understand how these types of image analysis results can be used to predict this trait. In a recent study in our program, image analysis pixel distributions of the ribeye area were analyzed with discriminant analysis techniques to quantify marbling in 36 feedlot steers. In that set of animals using images from two separate technicians, we were able to classify animals into the correct quality grade with 100% accuracy from one technician and 97% accuracy for the other technician (Green et al. 1991). Currently we are in the process of validating this procedure on an additional 250 head. One could say that we are cautiously excited about this development!

Table 5. Correlations Between Ultrasonic and Actual Carcass Marbling

Source	Correlation
Stouffer and Cross (1985)	.21
Rouse and Parrish (1987)	.54
Perry et al. (1989)	.56
Brethour et al. (1990)	.60
Moylan et al. (1990)	.46
Weighted Average	.43

Some of the factors which have been identified which affect accuracy and precision of ultrasonic estimates include level of fatness and muscling, sex of animal, age of animal, technician, equipment and technique, changes in tissue character postmortem, removal of hide and effects of hanging carcass versus standing animals. Many of these factors have been evaluated in designed research. There are several unanswered question remaining, however.

Several research programs around the country are currently evaluating the effects of age, weight, nutritional regimen and biological type on ultrasonic estimates of carcass merit. Intensive work is being done in attempting to find not only how accurate different measures are relative to the same measures on the carcass but also **how well the measures predict retail yield and grade**. Larry Cundiff has discussed elsewhere in the proceedings of this meeting all of the issues relating to measurement of breeding cattle including levels of variability in carcass traits in young bulls and accuracy. Research in this whole area is also proceeding at a rapid pace.

Perhaps the biggest unanswered question in relation to use of ultrasound for developing carcass merit E.P.D.'s is how well measurements on young bulls genetically predict performance of their future feedlot steer and heifer progeny. The possibility certainly exists that we are attempting to measure traits in young bulls that are physiologically quite different than the same types of measures in feedlot animals. The research database of measurements on breeding bulls and heifers is growing rapidly, but we **must know the answer to how well these measures translate into carcass merit of feedlot progeny**. This question will be addressed over the next year in studies at Texas A&M, Iowa State and Texas Tech.

Fortunately for all of us, there are concerted efforts currently being given some attention that have ultrasound estimation of carcass E.P.D.'s as a part of their focus. The NC-196 national project group in the body composition area that has been functioning now for a couple of years has addressed and will continue to address many of these research questions. Secondly, the approval has just recently been given for the first phase of funding for a project involving research groups at Iowa State University, the University of Georgia and Cornell University in the carcass merit E.P.D. area. As people interested in beef cattle improvement programs through BIF, we all need to recognize and support these efforts wholeheartedly for the potential that they offer.

Ultrasound Technician Certification

The Live Animal and Carcass Evaluation Committee (LACE) under the leadership of John Crouch has been looking for the past several years at how to "certify" ultrasound technicians who are collecting this kind of performance data. This process started at the 1988 BIF meeting when an ad hoc committee was formed to proceed in this area. Following that meeting two workshops were held, one at Cornell and one at Texas A&M. In January of 1989 the first BIF ultrasound proficiency examination was hosted by Bill Turner and colleagues at Texas A&M which resulted in certification by those standards of 7 technicians. At the 1989 BIF meeting in Nashville, guidelines for certification programs were presented to the LACE committee along with a summary of the first exam at A&M. In February of 1990, a second proficiency examination was hosted by John Hough and colleagues at Auburn University which resulted in the certification of an additional 6 technicians.

The first two proficiency examinations have consisted of completion of a written exam, measurement of a specified number of cattle in a given time and repeated measurement of those same cattle. Technicians have utilized their own ultrasound equipment. Criteria that have been used in these exams have primarily consisted of evaluation of repeatability of measurement (assessed by a minimum correlation between the technicians' first and second measurements) and accuracy (assessed by correlation between ultrasound and actual carcass measurement of backfat and ribeye area). For example, a minimum correlation of .78 between ultrasound and carcass and a minimum repeatability of .85 was used in the exam at Texas A&M. An additional criteria was also proposed in the original guidelines of deviations between ultrasound and carcass measures of no more than .12 in backfat and 1.5 in^2 ribeye area.

In our discussion prior to today's meeting, many folks have argued that the most appropriate way to evaluate technician competency for these measures would be in the form of their variance rather than correlation. We know that correlations can be affected by the variability of the particular sample of animals being evaluated. A more appropriate method would be to look at a measure similar to that used by the Australians of a mean squared deviation.

Not only is there much debate about what the proper statistic for evaluation is, but we also have not put into place any method for determining what is an acceptable level of that criterion. I do not think we can afford to be comfortable choosing an arbitrary level of whatever statistic is utilized, whether it be a correlation coefficient or mean squared deviation or coefficient of variation, etc. This must be answered through some logical evaluation of past research along with some modelling of the effects of imperfect accuracy and repeatability on our breeding value rankings of animals.

There also has been some question as to whether BIF should be performing the duty of certifying ultrasound technicians or whether that was more appropriate for breed associations or other groups. The overwhelming opinion of our group yesterday was that BIF should continue providing this service to the industry.

With all of the changes occurring in this area at the current time, there are many factors which need to be integrated into this certification process. In many ways, it seems that in terms of ultrasound technician certification that we really are attempting to shoot at a moving target. Questions exist regarding: a) what is the most acceptable method and criteria to evaluate technician competency, b) how do we go about setting the minimum levels of these criteria, c) how should we handle equipment differences, d) how do we integrate new and perhaps more meaningful measures as they become defined, e) should all sexes be measured including breeding animals, f) should we expect technicians to also be versed in how these measures should be adjusted and used, and finally g) what is the most efficient location/frequency/protocol for proficiency evaluations?

There is no doubt that we are at a crossroads in the development of this technology. Judging from the points discussed yesterday in our meeting, we need to stop and take a very close look at all of these questions before we proceed further. Therefore, we would strongly urge the LACE committee to appoint an ad hoc study committee to formulate a position paper on these questions and provide recommendations for how to proceed with the BIF ultrasound proficiency evaluation program. This committee could work over the summer and fall with the goal of reporting to the BIF mid-year meeting in November for action. This would allow the next certification process to be underway as early as January 1992.

Appendix

Those contributing to the discussion, part of which has been summarized in this paper were:

Doyle Wilson, Iowa State University
Dave Duello, Iowa State University
J.W. Turner, Texas A&M University
Mark Thallman, Texas A&M University
Alex McDonald, AGBU, Australia
Dorothy Robinson, AGBU, Australia
John Hough, Auburn University
Keith Bertrand, University of Georgia
Larry Benyshek, University of Georgia
Jim Stouffer, PLUS Services, Ithaca, NY
Larry Cundiff, U.S. Meat Animal Research Center, USDA-ARS
Ronnie D. Green, Texas Tech University
John Crouch, American Angus Association

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CURRENT ANGUS EXPECTED PROGENY DIFFERENCES COMPARED TO PROPOSED FIXED 1982 BASE

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Prior to the Spring 1991 National Angus Evaluation, Angus Expected Progeny Differences were adjusted to the average base for the period between 1972 and present. Since 1972 genetic trend for birth, weaning, and yearling weight, and milk production has demonstrated positive increases. While rank correlations between semi-annual analyses remained above .99 for growth traits and above .97 for milk production, the fluctuating base gave rise to decreases in EPD for older animals.

Beginning with the Spring 1991 analysis all Angus EPD were adjusted to the average EPD of base year 1977. (Table 1).

Tables 2, 3, 4, and 5 represent the changes in EPD of all sires, all dams, current non-parents, and those sires currently published in the Spring 1991 Angus Sire Evaluation Report, respectively.

Table 1.

ANGUS GENETIC TREND BY BIRTH YEAR

YEAR	BEPD	WEPD	MEPD	YEPD
1972	-.5	-3.7	-.5	-7.3
1973	-.4	-3.2	-.4	-6.2
1974	-.3	-2.4	-.2	-4.7
1975	-.3	-1.6	-.1	-3.0
1976	-.1	-.8	+.0	-1.6
1977	+.0	+.0	+.0	+.1
1978	+.1	+.9	+.0	+1.6
1979	+.2	+1.9	+.1	+3.5
1980	+.4	+3.1	+.2	+5.8
1981	+.6	+4.7	+.3	+8.8
1982	+.9	+6.6	+.5	+11.6
1983	+1.3	+8.5	+1.0	+15.2
1984	+1.6	+10.6	+1.3	+18.5
1985	+2.0	+12.4	+2.1	+21.5
1986	+2.3	+14.0	+3.1	+24.0
1987	+2.6	+15.7	+4.0	+26.7
1988	+2.9	+17.3	+4.8	+29.6
1989	+3.1	+18.9	+5.9	+32.6
1990	+3.2	+20.7	+7.4	

Table 2.

ALL ANGUS SIRES (53,972) CURRENT VS. 1982 BASE	BEPD	WEPD	MEPD	YEPD
Current Avg. EPD	+1.1	+6.5	+1.6	+10.0
1982 Avg. EPD	+.9	+6.6	+.5	+11.6
Adjusted to 1982 Base	+.2	-.1	+1.1	-1.6

Table 3.

ALL ANGUS DAMS (468,963) CURRENT VS. 1982 BASE	BEPD	WEPD	MEPD	YEPD
Current Avg. EPD	+.6	+3.4	+.6	+4.9
1982 Avg. EPD	+.9	+6.6	+.5	+11.6
Adjusted to 1982 Base	-.3	-3.2	+.1	-6.7

Table 4.

ANGUS NON-PARENTS (3 YRS & LESS, 215,241) CURRENT VS. 1982 BASE	BEPD	WEPD	MEPD	YEPD
Current Avg. EPD	+3.1	+19.0	+5.8	+30.4
1982 Avg. EPD	+.9	+6.6	+.5	+11.6
Adjusted to 1982 Base	+2.2	+12.4	+5.3	+18.8

Table 5.

CURRENT PUBLISHED ANGUS SIRES (MAIN AND SUPPLEMENTAL, 2,772) CURRENT VS. 1982 BASE	BEPD	WEPD	MEPD	YEPD
Current Avg. EPD	+3.6	+23.1	+7.4	+37.2
1982 Avg. EPD	+.9	+6.6	+.5	+11.6
Adjusted to 1982 Base	+2.7	+16.5	+6.9	+25.6

Consideration of a 1982 Base for Simmental and Simbrah
by

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The current base for the Simmental national sire evaluation program is the group of purebred Simmental bulls evaluated in the 1986 sire evaluation run. This group of bulls was the first to be evaluated by Cornell University. To set the base, the weighted sum of these bulls' current EPDs are forced to equal the weighted sum of their 1986 EPDs. The weighting factor is the number of progeny in 1986. For purebred Simbrah bulls, the base is the group of purebred Simbrah sires evaluated in 1987. EPDs are computed for calving ease and maternal calving ease for Simmental and Simbrah sires. Given the fact that only one other breed provides EPDs for calving ease traits, only the weight traits will be included in this presentation.

To examine the effects of changing the definition of the base, the average EPDs for calves born in 1982 were used to set the base. Using the average EPDs for active Simmental sires from the Spring 1991 Sire Summary, these average EPDs were adjusted to a 1982 base (Table 1). After the adjustment to a 1982 base, the average EPDs would be -0.27 lbs for birth weight (BWT), +0.06 lbs for weaning weight (WWT), +0.72 lbs for yearling weight (YWT), +0.45 lbs for maternal weaning weight (MWW), and -0.39 lbs for maternal milk (MMK).

To set the base for purebred Simbrah bulls, the average EPDs for purebred Simbrah calves born in 1982 were subtracted from the average EPDs of active purebred Simbrah sires. The average EPDs for Simbrah are listed in table 2. The average EPDs would be -0.50 lbs, +0.31 lbs, +0.79 lbs, -5.61 lbs, and -5.50 lbs for BWT, WWT, YWT, MWW, and MMK. A problem exists in using 1982 as a base for the Simbrah breed. For that year, the average EPDs for maternal weaning weight and maternal milk represent five calves. Based on the yearly progeny totals for Simbrah, some point in the mid-1980s would serve as a more reliable reference point for Simbrah.

In addition to a 1982 base, other years were examined as base alternatives. The years, 1978 and 1986, were examined as possible base points to see how much change could take place over an eight year period. In table 3, the average EPDs for active Simmental bulls are shown for the the current base, 1978 base, 1982 base, and 1986 base. After examining the genetic trends for Simmental, a base defined somewhere in the late 1970's to early 1980's could be possible.

Table 1. SIMMENTAL AVERAGE EPDS

Trait	Current Base	Base Adjustment	1982 Base
BWT	0.08	0.35	-0.27
WWT	2.12	2.06	0.06
YWT	7.07	6.35	0.72
MWW	1.89	1.44	0.45
MMK	0.83	1.22	-0.39

Table 2. SIMBRAH AVERAGE EPDS

Trait	Current Base	Base Adjustment	1982 Base
BWT	0.08	0.58	-0.50
WWT	0.05	-0.26	0.31
YWT	1.32	0.53	0.79
MWW	0.0	5.61	-5.61
MMK	-0.03	5.47	-5.50

Table 3. Alternative Bases for Simmental

Trait	Current Base	1978 Base	1982 Base	1986 Base
BWT	0.08	-0.54	-0.27	-0.30
WWT	2.12	1.49	0.06	-2.45
YWT	7.07	3.17	0.72	-3.74
MWW	1.89	2.50	0.45	-0.43
MMK	0.83	0.54	-0.39	-0.02

Hereford - Comparative EPD Data: Current vs: 1982 Base

As Hereford performance data is now being calculated the zero year for the different traits is as follows:

Trait	Base Year
Birth Weight	1979
Weaning Weight	1976
Yearling Weight	1976
Milk	1970
Milk + Growth	1974

Average Hereford EPD Values for 1982 are as follows:

Trait	1982 Average EPD
Birth Weight	+0.36 lb.
Weaning Weight	+8.88 lb.
Yearling Weight	+13.25 lb.
Milk	+4.09 lb.
Milk + Growth	+8.53 lb.

Comparison of 1990 Born Hereford Calves EPD Averages, Current vs: 1982 Base

Trait	No. of Animals	EPD Average Current	EPD Average 1982 Base
Birth Weight	54,884	+ 1.80 lb.	+ 1.44 lb.
Weaning Weight	77,142	+22.00 lb.	+13.12 lb.
Yearling Weight	77,142	+34.00 lb.	+20.75 lb.
Milk	76,799	+ 7.00 lb.	+ 2.91 lb.
Milk + Growth	76,799	+18.00 lb.	+ 9.47 lb.

Current data comparison of two Progeny Proven Sires

Bull A	+8.9 lb.	+68 lb.	+120 lb.	+14 lb.	+48 lb.
Bull B	+2.8 lb.	+19 lb.	+ 31 lb.	+ 1 lb.	+11 lb.
Difference	6.1 lb.	49 lb.	89 lb.	13 lb.	37 lb.

Comparison of same two Progeny Proven sires with 1982 base

Bull A	+8.5 lb.	+59 lb.	+107 lb.	+10 lb.	+39 lb.
Bull B	+2.4 lb.	+10 lb.	+ 18 lb.	- 3 lb.	+ 2 lb.
Difference	6.1 lb.	49 lb.	89 lb.	13 lb.	37 lb.

Some things the AHA would need to resolve before publishing data with the year 1982 as the fixed year base point for EPD data are:

1. Does a fixed year base point help with the comparison of animals within the breed?

2. Is the fixed year base point of 1982 worth the effects it would have on the AHA's Progeny Proven and Genetic Resource Sire listing? The following additional percent of bulls would move from a positive to a negative EPD

   6% Weaning Weight
   5% Yearling Weight
   20% Milk
   12% Milk + Growth

3. Does the cattleman need to know that there is a fixed year base point to select animals based on the EPDs or does he still need to compare animals to birth year data?

4. Does the same fixed year base point for all breeds give a false impression the EPDs across breeds can be compared?

National Salers Evaluation - Current compared to 1982 Fixed Base

John Dhuyvetter
Director of Research and Performance Programs

As a relatively new breed registry the American Salers has experienced significant growth in recent years. Since producing its first sire summary in 1988 the American Salers Association has experienced annual registry increases over 20% and an annual doubling of its performance data base. This expansion is reflected in growth of the ASA sire summary from 50 bulls listed in 1988 to 940 in 1991.

Accompanying this significant growth of breed numbers and performance information have been analytical improvements associated with changes from a sire-maternal grandsire model to a multiple trait reduced animal model to a multiple trait full animal model. Additional changes are associated with adoption of genetic perameters specifically determined from the Salers data base and the accounting of age of dam effects initially using BIF standard adjustments, then by specifically determined Salers adjustments and most recently by simultaneous solution in the model.

In spite of a current base policy in which EPDs are fixed to a set of animals of the first analysis (meaning EPDs of sires with an accuracy of .60) and a minimal genetic trend during this period of breed expansion, the data refinements in analysis techniques and large changes in the structure of the data base have produced noticeable changes in EPDs and their distribution between years.

In consideration of a change in the definition of the American Salers Association National Evaluation base to all animals born in 1982, the following adjustments reflect the magnitude of changes from EPDs produced in the 1991 National Salers evaluation under current base procedure.

Trait	Adjustment
Birthweight	- 1.845
Weaning Weight	.721
Yearling Weight	.709
Milk	.189

While the adoption of a fixed 1982 base would slightly raise birth weight EPDs, lower weaning, yearling, and milk EPD's and be associated with a greater distribution of animals with negative numbers, the overall impact would be minimal in relation to evolutionary changes of the Salers National Evaluation.

However, data reporting did not actually take place in 1982, and EPDs on the limited number animals of that birth year (3603) would often be a generation or more removed from direct individual or progeny information. In getting a "good fix", it would be preferable in defining base to a group with a certain birth year at a point in time with a large number of animals with data records such as 1987.

Recognizing the current differences in base definition result in marketing differently scaling of EPDs between breeds and great deal of misunderstanding and erroneous comparisons, the American Salers Association recognizes the need and value for a standardized base within the industry and will support efforts of the BIF committee by adopting a base procedure consistent with its recommendation.

AMERICAN-INTERNATIONAL CHAROLAIS ASSOCIATION

Reverting to a fixed base year of 1982 will have very little effect on the American-Ineternational Charolais Association field data sire summary. The greatest change between 1982 and 1990 data is only -1.599 pounds for weaning weight. Table 1 shows the trait and the appropiate adjustment for converting 1990 data to a fixed base of 1982. To obtain an EPD adjusted to the 1982 base, simply subtract the appropiate number from the current EPD. Table 2 shows the EPDs as listed in the 1990 AICA Sire Summary. Table 3 illustrates the appropriate adjustments for the 1990 sire summary and how they would be listed after adjusting to the 1982 base year. Table 4 illustrates how much change would be made for one sire after adjusting the 1990 data to the 1982 base year.

Table 1

Trait	Adjustment Factor For 1982
Birth weight	0.400
Weaning weight, direct	-0.108
Weaning weight, milk	-1.599
Yearling weight	1.310

Table 2

Trait	Actual 1990 EPD
Birth Weight	1.260
Weaning weight, direct	3.900
Weaning weight, milk	-1.600
Yearling weight	5.650

Table 3

Trait	Actual 1990 EPD	Adjustment Factor for 1982	Adjusted EPD
Birth weight	1.26	-(.400)=	0.860
Weaning weight, direct	3.91	-(-.108)=	4.018
Weaning weight, milk	-1.60	-(-1.599)=	0.001
Yearling weight	5.65	-(1.310)=	4.340

Table 4

Trait	Actual 1990 EPD	Adjustment Factor for 1982	Adjusted EPD
Birth weight	-1.70	-(.400)=	-2.100
Weaning weight, direct	45.70	-(-.108)=	45.808
Weaning weight, milk	5.90	-(1.599)=	4.301
Yearling weight	45.70	-(1.310)=	44.390

Red Angus Association of America

Wayne Scritchlow
Executive Secretary

The Red Angus Association of America was built on the idea of selecting and promoting cattle based upon performance. Since the origin of the breed in 1954 every animal registered has been required to have corresponding weaning weight data included. While birth weights are not mandatory, Red Angus breeders are so dedicated to performance that over 93% of the calves registered in 1990 had actual birth weights accompany their registration applications.

Because of that commitment to performance, Red Angus breeders have had constant and steady genetic improvement. Below are the genetic trends for birth, weaning and yearling weights as well as milk.

The following table contains the adjustment factors needed to adjust Red Angus EPDs to a 1982 base year.

TRAIT	ADJUSTMENT FACTOR
Birth weight	.053
Weaning Weight Direct	6.688
Weaning Weight Milk	4.974
Yearling Weight	8.153

Regardless of the base year used, Red Angus breeders will continue to be strong advocates of performance information, sire summaries and EPD evaluations.

IMPACT OF A 1982 FIXED BASE ON GELBVIEH EPDs

Jim Gibb, Executive Director, American Gelbvieh Association

Shown in Figure 1 are genetic trends for birth weight, weaning weight, yearling weight and milk in Gelbvieh during the period from 1970 through 1990. Values used to represent the trends are birth year average EPDs for all animals for which an EPD could be calculated. As can be observed, weaning weight and yearling weight, the two traits with the most genetic change after 1980, average zero in 1981 while birth weight and milk are near zero.

Figure 2 shows the trends for direct and maternal calving ease. Reported as ratios, both traits average 100 within two years of 1982. While not given, the gestation length trend has remained near zero for the entire 20-year period.

A summary of the impact of fixing the Gelbvieh base at 1982 is represented in Figure 3. These data were derived from results of the 1990 Gelbvieh NCE performed at Colorado State University. The University of Georgia will be conducting future Gelbvieh NCE's and has already begun the preliminary research.

Taking this into consideration, the AGA Board of Directors voted in April, 1991 to fix the Gelbvieh base at 1982 pending results of the Georgia analysis and final B.I.F. recommendations.

Figure 1. Gelbvieh Genetic Trend
Birth - Weaning - Yearling - Milk

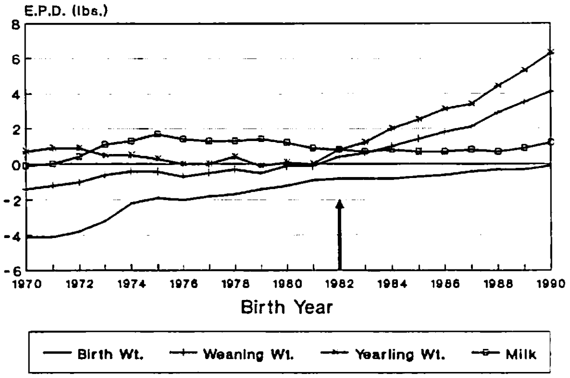


Figure 2. Gelbvieh Genetic Trend
Calving Ease (Direct and Maternal)

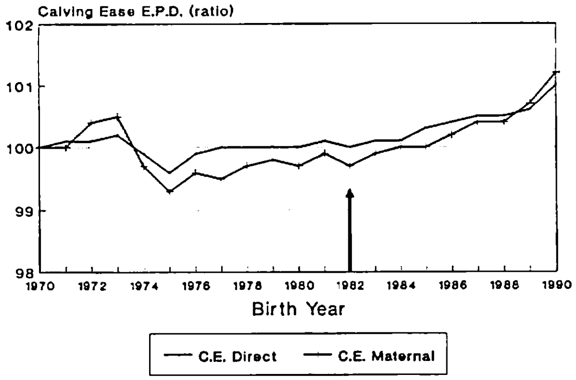
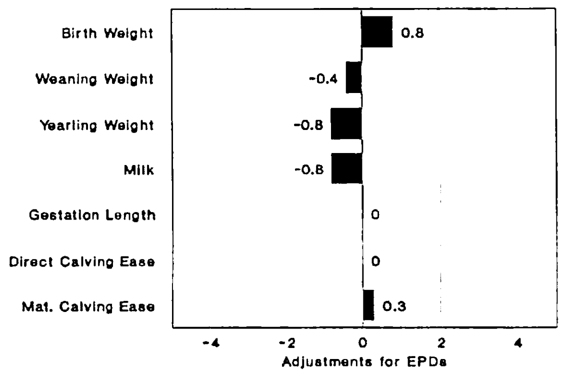


Figure 3. Impact of 1982 Base
American Gelbvieh Assoc.



AMERICAN BRAHMAN BREEDERS ASSOCIATION

Current Compared to 1982 Fixed Base for EPD's

The American Brahman Breeders Association initiated their performance program, known as the Brahman Herd Improvement Records or BHIR, in 1971. When the ABBA brought the BHIR program in-house in the early eighty's, many members who were recording data on their state BCIA program submitted that historical data to the ABBA for inclusion in it's data base. As a result there are limited records for birthyears as early as 1960. In birthyear 1974 there were over 1000 records and in birthyear 1985, over 2500. It has been holding between 2000 and 2500 per year since 1985.

Currently, the base year or "0" year is 1976 or 1977, depending on the trait. However, since most of the records in the data base are for birthyears after 1982, a change to a fixed base of year 1982 would cause minimal change to our breed averages.

In 1982 EPD's for birth weight for all animals ranged from -2.5 to +5.3 with an average of +0.07. Weaning weights ranged from -13.7 to 25.8, averaging +1.86; yearling weights ranged from -20.5 to 43.5, averaging +9.67; milking values ranged from -5.7 to 15.5, averaging +3.08. If the current data for our 1991 sire summary is adjusted to a base year of 1982, net effect would be minimal. Average birth weight EPD would be 0.25, with a range of -4.47 to 6.03; weaning weight average 0.61, with a range of -20.46 to 36.94; yearling weight 1.18, ranging from -34.22 to 61.18; and milking -0.26, ranging from -13.26 to 18.54.

As you can see, to change from a floating base to a fixed base of year 1982, would have very little consequence on the current EPD's within the Brahman breed. The thing that concerns our breed is whether a standard base of whatever year will be interpreted as equating all the breeds and then, incorrectly and prematurely, comparisons will be made across breeds.

As an industry, we have made tremendous advances in the selection tools that are available to the producers. The scientific community has developed more technology than most of us producers can apply. We have a tremendous educational challenge ahead to not only inform the producer of what technology is available, but to make him feel comfortable and confident with his new tools.

We may be moving too fast, not only for the producer but also too fast to adequately document the adjustment factors necessary for between-breed comparisons.

Here in the United States, the terms "Brahman" and "Bos indicus" and "zebu" are all used interchangeably. The American Brahman is one breed of Bos indicus or zebu, just as the Hereford or Angus or Simmental are different breeds of Bos tarus. It is incorrect to equate all Bos indicus as Brahmans. The Nelore, Gyr, Indu Brazil, and Guzerat are four other breeds of zebu that we have here in the States. True, we don't have many, but when you compare a Brangus to a Simbrah are you basing your adjustment factors on a Nelore derived Brangus and Simbrah or on one that is Brahman based?

Up until this point the American Brahman Breeders Association has chosen to register all of the Bos indicus breeds in the Brahman herd book and this has added to the confusion. As the numbers of the others breeds increase, they will likely be separated into the different breeds that they are. Then data will be accumulated for each breed and EPD's developed within each of them.

The crossing of Bos indicus and Bos tarus cattle was probably the single most significant event for the acceptance of crossbreeding in the United States. The ABBA fully embraces crossbreeding and any technology that will enhance the producers' ability to utilize it in his breeding program. But for the moment it seems that the characteristics of the various breeds will be of more economical value than the mere weight gain. I can't see the choice between two breeds being made on the basis of EPD's. After I chose my breeds for whatever my reasons, then I need to be able to compare my choices within that breed.

As we accumulate data on the various crosses in various environmental locations, then I think we can move towards interbreed EPD's. Currently, I think each breed probably has certain traits that need improvement and need the cooperation of the scientific sector to develop and document objective means to achieve the desired improvements. To adjust all breeds to a common base or to develop interbreed EPD's just doesn't seem that it should be a priority at this time. There are more important traits to be measured and evaluated.

The Brahman breed applauds the BIF for its role in the development and standardizing of performance testing. Be assured that we will continue to participate in and support any methods to better evaluate the genetic makeup of cattle. If the industry wants to go to a standard base year of 1982, I feel certain Brahman breeders will have no objection. But I do feel that all of the ramifications should be considered before any changes are recommended.

INTERNATIONAL BRANGUS BREEDERS ASSOCIATION
LOREN JACKSON
EPD STANDARDIZATION TO 1982 BASE YEAR

The International Brangus Breeders Association believes the Beef Improvement Federation serves an important purpose by promoting the standardization of beef cattle record keeping when possible within the industry, provided the standardization increases the accuracy of the data and the accuracy of the interpretation of such data.

The IBBA believes standardization to a common base year by all beef breed associations would enhance the interpretation by cattlemen selecting genetic potential from more than one breed. Although, cattlemen could not directly compare breeds for individual traits, the common base would give a common reference point from which their selections are being made.

Generally speaking, there is still much education to be done regarding the EPD concept, what EPDs mean, and how to implement them in a breeding program.

Unfortunately, too many cattlemen do not understand that each breed's sire summary currently has a different base year. The perception of the average cattleman today is that a zero EPD value is the average value of current animals in the population. In some instances, the breed is several generations removed from a breed average of zero for the trait, while another breed's average is approximately zero for the same trait. This causes a numerical juggling nightmare for cattlemen selecting seedstock from several breeds, trying to remember what is breed average for the selection trait.

Similarly, cattlemen tend to believe that if a bull has a +50 pound EPD for weaning weight, that the bull will increase weaning weights 50 pounds over the average of current bulls available in the population. If in actuality, the average of bulls born that particular birth year is +25, a +50 pound EPD is only 25 pounds above the average.

A common base year used by all beef breeds would place the performance traits more in perspective across breeds. Differences in each breed's genetic trend could be evaluated with less confusion by cattlemen from this point on.

The IBBA believes a common base year would be to the benefit of cattlemen. IBBA is willing to adjust the analysis procedures to a 1982 base year if agreed upon by all breeds. The 1982 base change would reduce Brangus EPDs in the following areas:

Birth weight	- .40
Weaning weight	- 1.21
Yearling weight	- 1.99
Milk	- .78
Total maternal	- 1.38

The IBBA does not believe that across-breed EPDs should be considered at this time. Substantially more research and documentation should be done prior to printing and approving of the across-breed EPD concept. There are a number of questions that must be answered through structured research projects before BIF should consider a stamp of approval on across-breed EPDs. A few of these questions include: 1. Heterotic differences between different breed crosses 2. Reciprocal-cross differences and complimentarity of the crosses 3. The question of genetic environment interactions of various crosses 4. Establishment of breed constants 5. The maternal effects on birth weight, especially with Brahman crosses. These questions should be answered before moving down the road too far. It is important that information with the potential magnitude on the beef cattle industry as across-breed EPDs be substantiated beyond the point of theorized projections.

We should remember that many cattlemen still question the accuracy of EPDs, especially in the milk area. If we are not careful on how we proceed into the across-breed EPD era, we can do more harm than good to the National Cattle Evaluation Program.

We should proceed gingerly with thought, planning and documented proof. Under this approach, across-breed EPDs have a better chance of being welcomed with open arms by the entire beef cattle industry.

Current Or 1982 Fixed Base

American Shorthorn Association

Steve McGill, Performance Coordinator

American Shorthorn Association sire evaluation work is currently done by the group at the University of Georgia. The base population presently used by the American Shorthorn Association consists of the foundation animals on file when the breed's first field data base sire summary was produced in 1987. The breed is, in relative terms, in the early stages of the development of its performance program. Of the cattle on file as of the analysis for the 1991 Sire Summary, 72% were calved in or after 1982. This being the case, a change to a 1982 base would not be a traumatic step for the breed. The American Shorthorn Association would have no opposition should there be a consensus on a need for change.

The necessary adjustments to a 1982 fixed base would be:

Birth EPD	- 0.19 pounds
Weaning EPD	- 1.24 pounds
Yearling EPD	- 1.69 pounds
Milk EPD	- 1.25 pounds

The American Shorthorn Association would like to suggest, in the interest of providing a useful reference for the industry, that BIF publish mean EPD's of the most current nonparent generation for all breeds in a single table and include this table in the proceedings. All the information for such a table is presently available from the breed associations, but is challenging to gather. Publication by BIF on an annual basis would be very useful to many industry segments, especially those working with commercial cattlemen using several breeds in a crossbreeding system. Perhaps the Genetic Prediction Committee would be the appropriate vehicle for such action to originate and work through.

EFFECT OF A 1982 FIXED BASE ON POLLED HEREFORD, SOUTH DEVON AND MAINE-ANJOU EPD'S [1]

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The American Polled Hereford Association (APHA) publishes Polled Hereford EPDs derived from an animal-model analysis performed by the University of Georgia. APHA also conducts sire-model analyses on behalf of the North American South Devon Association and the American Maine-Anjou Association. I have been asked to evaluate the impact of a 1982 fixed base on all three breeds and jointly report the results at this symposium.

Table 1 shows the changes that would occur in each breed's EPDs if adjusted to the proposed standard base. Adopting this base would cause a reduction in all Polled Hereford and Maine-Anjou EPDs, but would cause an increase in all South Devon EPDs with the exception of yearling weight. To help guage the impact of this adjustment on the image of each breed, particularly the commercial image, table 2 presents the adjusted and unadjusted means for the bulls in the 1991 Sire Summary of each breed.

Table 1. EPD Changes Resulting from Adjustment to a 1982 Fixed Base

Breed	Current Base	Birth Weight	Weaning Weight	Yearling Weight	Maternal Milk	Milk plus Growth
Polled Hereford	Fixed (1975)	-0.8	-5.9	-8.4	-1.4	-4.4
South Devon	Floating	+0.1	+0.1	-0.6	N/A	+6.6
Maine-Anjou	Floating	-0.3	-2.1	N/A	N/A	N/A

Table 2. Current and Adjusted EPD Averages for Breed Sire Summary

Breed	Base	Birth Weight	Weaning Weight	Yearling Weight	Maternal Milk	Milk plus Growth
Polled Hereford	Fixed (1975)	+3.1	+19.3	+28.7	+1.1	+10.7
	Fixed (1982)	+2.3	+13.4	+20.3	-0.3	+6.3
South Devon	Floating	+0.7	+3.5	+3.7	N/A	-2.1
	Fixed (1982)	+0.8	+3.6	+3.1	N/A	+4.5
Maine-Anjou	Floating	+1.8	+1.4	N/A	N/A	N/A
	Fixed (1982)	+1.5	-0.7	N/A	N/A	N/A

[1] Presented during the Genetic Prediction Symposium at the 1991 Beef Improvement Federation Annual Meeting, May 17, San Antonio, TX.

CURRENT VS. 1982 FIXED BASE
BEEFMASTER BREEDERS UNIVERSAL
BRUCE ROBBINS

There have been numerous discussions lately concerning EPD's. Such as what they are, where they originate, and what good are they to me. Every breed association producing a sire summary must be able to answer these questions to both their members and potential consumers. The academic world has done a very good job of educating the breed association staff and the state run agencies. Now BIF is asking whether we need to establish a 1982 fixed base or stay with the current system being used.

As it stands currently at Beefmaster Breeders Universal, we have a base year set at 1982. It is there because our performance program is still in the infant stages, just this year surpassing 50,000 records being processed in its 10th year of existence. We want to produce a sire summary that gives a factual straight forward look at our cattle from a performance point of view. This comparison being based off of records being sent in to our association via our voluntary performance program.

As for comparing our voluntary performance program to other breeds in terms of records processed, length of time in existence or overall emphasis to breeder from the association there simply is no comparison. With this in mind it seems very difficult to imagine arbitrarily picking a year to base all the information that would service all the breed associations fairly. There are several obvious problems that could arise such as:

1) trying to keep the breeder or consumer from comparing across breeds since we all have the same base year,
2) explaining to both breeder and consumer why the EPD values are changing because of base year change, and
3) the merchandising of some breeds would be dramatically changed which would pose a whole new set of hurdles.

The bottom line for EPDs should be to give a breeder or consumer an idea of what they may realistically expect from that individual or breed. Therefore, it seems as though the idea of establishing a base year, be it fixed or floating, should be the responsibility of the breed association and BIF should be ready to help guide and assist each breed in whatever choices they make.

GENETIC PREDICTION PROGRAMS IN AUSTRALIA

Keith Hammond
Animal Genetics and Breeding Unit[1]
University of New England, NSW, Australia

I interpret "prediction programs" in a somewhat wider context than is generally done and will briefly describe our approach to the design and implementation of a breeding information service.

DECISION AIDS IN CATTLE BREEDING

Maximising short- and long-term profit involves decision-making, and implementing these decisions effectively and efficiently. Decisions are based on information; the better the information the better the decisions providing the information is correctly used.

The 9 key decision areas applying to **seed-stock breeders** are:

1. To breed or buy replacement stock?
2. Which breeding enterprise to pursue, e.g. straight breeding with Herefords for young cattle production, or crossing Brahmans and Limousins to breed heavy steers or a two-breed rotational crossing of Angus and Simmental to supply crossbred female and feeder steer markets.
3. What is improvement, in terms of maximising profit?
4. What recording system - a complex of questions/decisions?
5. What to cull - to maximise gains from the current herd?
6. What to select - to maximise genetic gains?
7. What to mate, including age at first mating, mating structure and the use to be made of artificial breeding technologies?
8. How effective is the whole breeding program - in terms of maintaining cash flow and maximising long-term return on investment?
9. How to merchandise the results?

These decisions are not independent; and they need to be addressed repeatedly, initially and throughout the life of the breeding operation.

Imperatives for **seed-stock buyers** differ, with the above decision areas 1, 3 to 7 and 9 still applying, with some changes in emphasis, and areas 2 and 8 being combined into a new question: Where to buy? Seed-stock buyers may place different levels of emphasis on some traits to seed-stock breeders. Take the trait serving capacity for example. A bull breeder would use a high serving capacity bull to maximise the genetic progress for serving capacity in his herd and possibly also for female fertility. Any increase in the number of calves resulting from the matings of that bull is a bonus to the bull breeder. A bull buyer is primarily interested in this trait to maximise the size of calf crops resulting directly from the matings of that bull. The buyer obtains no benefit from genetic change for serving capacity in the herd because he doesn't breed bulls. The possible increase in female fertility of the next generation of heifers is a bonus.

A breeding information service needs to recognise the different imperatives of the seed-stock producer and buyer, if an industry is to receive all necessary decision aids from the service. Of course, the seed-stock producers long-term breeding direction, or breeding objective, should be based primarily on his clients cost structures.

DESIGNING A BREEDING INFORMATION SERVICE

We were fortunate that economic pressures forcing Australian producers to move from a harvesting mode to a productivity mode did not really arrive until the early 70's. This occurred at about the same time as electronic computing and communications were becoming available to the industry and the development and

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[1] AGBU is a joint unit of NSW Agriculture and Fisheries and The University of New England.

first usage of the BLUP mixed model prediction theory. This theory heralded a new era in animal breeding for, unlike previous procedures, BLUP offered a more natural structure to the range of genetic theory and its application.

The stage was set to address the question: How to design and implement a breeding information service that provided the necessary decision aids to the industry?

The Australian beef industry is only about one quarter the size of the US industry, but there are many structural similarities between the two. Individual breeds in Australia did not have the resources to design and develop their own breeding information service. The National Beef Recording Scheme (NBRS) is the central information service for the industry's breeding operations. It was funded initially by industry and government. NBRS is based on two segments, which are being increasingly integrated, viz.

1. **A data management and processing service** covering the day-to-day registration and related business requirements of breed societies.
2. **An analytical segment**, which will eventually provide most of the decision aids required by the producer-users.

The commercial arm of NBRS is operated from the Agricultural Business Research Institute on the campus of The University of New England and the research and development arm for the analytical segment is focused at AGBU. The Scheme's computing strategy is based on VAX minicomputers from the US manufacturer Digital Equipment Corporation, applications software written in the Powerhouse 4th generation language, DEC networking products and IBM compatible computers at the farm level. Four VAX minis have been installed at the central data processing site and these are networked into breed society offices throughout Australia. Under the product name BREEDPLAN International this system is being taken up by breed societies in other countries.

The world is becoming smaller, and undoubtedly the use of standard computing and analytical procedures will help breeders and buyers of seed-stock internationally understand and use the modern terms and technologies and promote the international exchange of genetic material. I also strongly believe that such a strategy makes better use of the relatively small expert scientific resource internationally - we certainly have not developed the service in Australia alone but have been assisted by scientists from many countries, particularly the US.

DESIGNING THE ANALYTICAL SEGMENT

I shall now outline the strategy we have used to design and develop the analytical segment of the BREEDPLAN International breeding information service.

The 'Modern Breeding Approach'

Although most texts of animal genetics and breeding deal with the many facets of genetic theory and sometimes interpret each in terms of what it means for achieving genetic change, it is generally very difficult for those who wish to use these descriptions in practice to obtain a clear global appreciation.

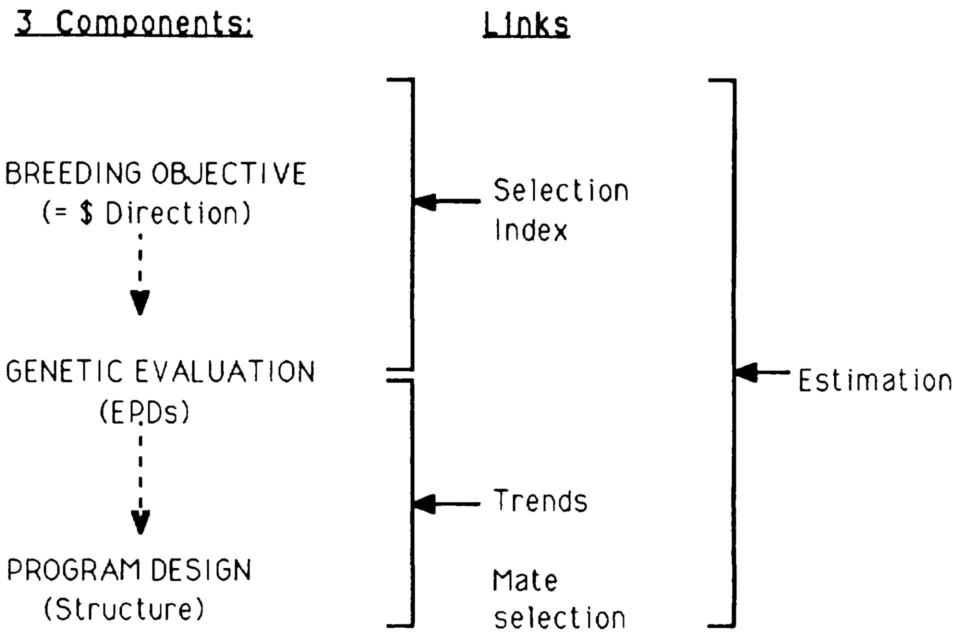
The basic approach to genetic improvement in the beef industry is summarised by the so-called Modern Breeding Approach. It provides a simple and practical conceptual approach to manipulating genotypic variation within and between populations of animals. It is diagrammed in Figure 1.

Only 3 primary components cover all formal and practical aspects of breeding, viz.

1. **The Breeding Objective.** Establishes the direction to breed in economic terms (the $ direction). This has been done intuitively in the industry to date - no calculation, just by guess and 'experience'. It can also be done using formal calculation, and is already done this way in some other industries. I believe that in the future it will be necessary to use a formal approach if the beef industry is to maximise the exploitation of genetics.

2. **Genetic Evaluation.** Provides the estimates of genetic merit (we use the EBV convention which is EPDx2) for each animal for the measures and combinations of measures; and, if required the estimate of risk (Accuracy) associated with each EPD. Genetic evaluation enables animals to be ranked on their overall economic merit (for a particular breeding objective).

FIGURE 1: THE MODERN BREEDING APPROACH



3. **Breeding Program Design.** Establishes the optimum mating structure (including numbers of females per sire) and amount of selection, and the optimum period parents are used in the herd, breed or sector of it.

Components 1. and 2. are linked by the **selection index** (that formally or mentally derived combination of measures - or separate EPDs - which has the maximum association with $ Direction). Components 2. and 3. are linked by the genetic changes or **trends** achieved in the breeding operation; and by a future development termed **mate selection** which will not simply rank animals on their estimated genetic merit, as EPDs do, but will identify the mating combinations which best fit the $ Direction (breeding objective) established for the enterprise.

Finally, **Estimation** of the necessary parameters, such as economic values, heritabilities and correlations, and breed and cross differences, provides the formal 'backbone' to the total breeding operation.

This conceptual approach is directed specifically at supplying to the industry all the key breeding decision aids in a ready and easy to use form necessary to reliably generate rapid gains in productivity and product quality.

The approach requires that cost-effective and accurate measurements exist which relate to all traits in the breeding objective. This is certainly not currently the case for the range of major production-marketing combinations in the beef industry. Better direct and indirect measurements of reproduction, production and product, including low cost measures which can be taken on the whole herd early in life, and automated measures, will form an increasingly active area of research and development.

Evolution

Breeding information services must evolve. The correct evolutionary path must:

1. Be technically sound, otherwise substantial time and money will eventually be wasted in overcoming the technical deficiencies.
2. Promote industry uptake, feed-back and learning. Here the current and anticipated future industry structures are important considerations.
3. Involve a minimum of back-tracking - once users of a service are given some concept or piece of information it is difficult to withdraw it.
4. Provide for system upgrades to easily 'slot in' both in the field and at the processing centres.
5. Contribute as much data as possible to the research and development program for the service.

The Strategy

Based on these requirements a long-term research and development strategy was established in the early 80's. Key components of this included:

- Basing the breeding information system design on the Modern Breeding Approach.
- Working towards a system which enables the individual breeding enterprise to receive customised results for genetic evaluation, breeding objective and program design, to promote ownership and maximise competitiveness.
- Starting with the development and transfer of the genetic evaluation component, to:
  - Give breeders and buyers results which they can easily use and relate to,
  - Minimise operational back-tracking,
  - Integrate readily with the breed society segment of the system, and
  - Generate the data necessary to further develop the system.
- Utilising from the outset the BLUP procedure and multiple trait animal model in the genetic evaluation component.
- Initially introducing only within-herd evaluation followed by across-herd, with these being designed to be complementary, and subsequently integrating them by incorporating an updating procedure for use in interim analyses for across-herd participants.
- Including as many as possible of the EPDs being sought by users and others and as early as possible, as:
  - Suitable measures come to hand,
  - More efficient computing algorithms are developed, and
  - Computing capacity permits,

  to give users a 'feel' for what's important and generate some data to use in estimating the genetic and environmental parameters.
- Continuing research throughout on:
  - Understanding the behaviour of the analytical components,
  - Fine tuning, and
  - Upgrading the operational design, e.g. improved conceptual designs for input/output, guidelines for herd data structure design, designing a comprehensive diagnostics system to accommodate both the processing centre and end users,

  to improve total system reliability for the diverse data structures involved. Wherever possible we involve in this challenging R&D program other appropriate scientific groups willing to collaborate efficiently and effectively.

PROGRESS TO DATE

Prior to 1985 there was little genuine interest in Australia in performance recording. There was also minimal use of artificial insemination except in the grading up programs of the European breeds. These breeds encouraged performance recording and several British breeds established sire reference schemes as a first step to across-herd evaluation.

We first used BLUP technology in the Australian industry for a small across-herd analysis for the Simmental breed in 1982, for the growth traits and employing a maternal grandsire model. This early learning step led to the introduction in 1985 of a multiple-trait animal model system for within-herd evaluation, the BREEDPLAN system. At about the same time it became possible to import live cattle from the USA, leading to an influx of genetic material which was highly promoted and widely used by AI.

The introduction of the BREEDPLAN within-herd analysis system, followed by the first across-herd (GROUP BREEDPLAN) analysis in 1986, involving just 14 Angus herds, and the influx of US genetics has seen a major turnaround in the level of performance recording by Australian seed-stock producers.

In 1991 we will have GROUP BREEDPLAN analyses for10 breeds, including the first *Bos indicus* breed (Brahman). However, only 35% of the industry's annual bull requirement is being provided from BREEDPLAN/GROUP BREEDPLAN herds; although it is as high as 75% in the Angus breed.

The third generation of this genetic evaluation component of the system is now being implemented. It adds:

- The first male and female reproduction traits, viz. scrotal size, days to calving, and direct and daughters calving ease.
- The first carcase traits, viz. fat depth and eye muscle area.
- Full integration of the within-herd and across-herd evaluation procedures for those herds that are sufficiently linked to contribute effectively to across-herd evaluation.
- A separate option for the more extensively run *Indicus* breeding operations in the tropics and sub-tropics, known as the 900-day option.
- Accuracies for all animals in the across-herd analysis, using a new procedure based on the multiple-trait animal model system.
- A new approach to solving the mixed model equations known as the Implicit Animal Model to further reduce computing requirements. This allows our biggest data set of 150,000 animals to be run on the powerful minicomputers.

In addition, the first generation of the customised breeding objective component is being introduced. This allows consultants servicing the system to help individual breeding enterprises establish their economic values for the traits of interest and index weightings for the EPD's. Of course, it also enables the use of sub-indexes e.g. calving ease index, reproductive index, carcase index, and has the potential to markedly simplify some reports to users.

LESSONS

We have still quite a way to go to cover the complete concept but the strategy is proving effective.

Data accumulating on the system are not proving as valuable for use in further system development as we had hoped. We would need to wait many years and even decades to obtain sufficiently reliable estimates of all necessary parameters if we relied on this source of data alone, despite the rapid uptake of the system. Data sets of research station herds are not of sufficient size to achieve reliable and complete sets of parameters. To overcome the deficiency field research programs are being implemented involving good numbers of user herds and field assistance to produce detailed and complete sets of data incorporating all growth, reproduction and carcase measurements. As soon as possible we will also include measures of intake.

The uncertainty with some estimates of parameters has meant the first generation of reproduction and carcase evaluation analyses have needed to be run separately from the growth analysis. The reproduction analysis also includes the weight measurements to utilise the relationships between scrotal size, days to calving and live weight. The carcase analysis includes the weight taken at the time of scanning because of its relationship with fat depth and rib eye area.

We underestimated the importance of management groups early on in the evaluation of growth. The ability to record all management groups is important to obtaining unbiased predictions because differences between management groups account for such a large part of the total variation in each of the weight traits. Of course, management group structure is also the primary determinant of linkage in the data sets of individual herds and across-herds. We have intensified our effort in these areas and will continue to do so to help users appreciate just how important data structure is to maximising return on their investment in recording.

Initially, we underestimated the importance of first introducing within-herd evaluation, before users graduate to also being involved in across-herd evaluation. The within-herd system promotes better understanding of the procedures and encourages individual producers to generate better data sets.

Finally, we did not anticipate the strong demand for carcase evaluation developing as early as it did. The introduction of portable real-time scanning equipment was a windfall as it enabled measurement of fat depth and eye muscle area on **all** potential breeding animals whereas the number of direct carcase records produced by a breeding herd is generally very small. However, large-scale genetic evaluation for traits such as marbling will continue to be very difficult in the medium-term, primarily for these logistical reasons and due to the lack of portable live animal measuring equipment which is reliable and can be used cost-effectively.

FUTURE GOALS

Important goals of the current R&D program include:

1. Increasing the proportion of bulls coming from herds in GROUP BREEDPLAN to 75 percent or above.
2. Continuing to expand the system to provide EPDs for all commercially important traits; whilst making the system sufficiently flexible to permit individual breeders and breeds to utilise only the EPDs of importance to them.
3. Continuing development of the computing strategy to ensure the growing breed data sets and other upgrades can be analysed using the GROUP BREEDPLAN system on minicomputers.
4. Combining the important growth, fertility and carcase traits into the one analysis.
5. Continuing development of the breeding objective component to provide one or more breeding indexes customised for each individual breeder's goals.
6. Commencing development of the third component of the Modern Breeding Approach, the breeding program design module.
7. Further upgrading the system diagnostics to assist users to maximise return on investment in breeding.

Eventually each breed and seed-stock producer will have access to a fully integrated, comprehensive, custom service, enabling them to maximise (economic) gains for the market or markets at which they are directed. Some will use it and use it wisely, and some won't. Buyers of seed-stock and of seed-stock products will increasingly target the winners, internationally!

GENETIC PREDICTION OF ULTRASOUND EVALUATION IN AUSTRALIA

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A National Carcase Evaluation Project was commenced in Australia in early 1989. The objective of the project is to implement an ongoing system for genetic evaluation of carcase traits for the Australian beef industry. That is not a small challenge.

The difficult challenge is to obtain unbiased measurements in seed-stock herds. There are two basic options. The first is organised progeny test programs which involve the direct measurement of carcases. This can provide comprehensive information on both the yield and quality traits. The second is to use ultrasonic scanning technology to measure carcase traits directly in seed-stock herds. Only traits which contribute to yield can be measured at this stage with ultrasound. Both progeny testing and scanning are being used in Australia.

The feedlot progeny test program involving four breeds (Angus, Murray Grey, Hereford and Poll Hereford) is underway but after two years a total of only 70 sires have been evaluated for the four breeds. This program is currently being expanded to evaluate more sires and more breeds.

Ultrasonic scanning of cattle in seed-stock herds has been used extensively in the Carcase Evaluation Project to measure fat depth and rib eye area (REA). This paper is confined to our experience with ultrasound measurement and the prediction model that has been developed to provide Estimated Breeding Values (EBVs) for these traits.

Our first major task in the project was to establish a network of competent scanning technicians who could provide a commercial measurement service to breeders. We therefore conducted two training courses with a major input from Lorna Pelton of the Livestock and Carcase Evaluation Service at Texas A&M University. An accreditation system based on the Guidelines established by Texas A&M was also implemented.

To quickly obtain a large set of measurements on unselected groups of animals a rebate of $2.50 per head was paid to breeders who provided scan measurements on at least 80 percent of their total progeny drop including heifers. This rebate was reduced to $1.25 in the second year and will not be available after June this year. The rebate was available only to those breeders whose cattle were scanned by an accredited assessor. Most breeders have provided measurements for both bulls and heifers.

Rib eye area is scanned at the 12/13th rib site and fat depth is scanned at two sites; the 12/13 rib site and the p8 rump site. Fat depth is measured at the p8 rump site because it is the standard site of measurement in the AUS-MEAT carcase description system used by Australian processors (packers). The rump site is used because it is less prone to damage during removal of the hide. Since the project commenced some 14,000 cattle have been scanned with most of them being Hereford, Poll Hereford and Angus. The average age of cattle scanned was approximately 450 days.

Accreditation of Scanners

The accreditation system was established under the auspices of the Australian Meat and Livestock Research and Development Corporation. Five of the seven scanners that have been accredited currently offer a commercial service to breeders. About 75 percent of the scanning has been carried out by one technician. All accredited scanners are required to pass the standard accreditation test on an annual basis.

The accuracy level achieved by our accredited scanners is shown in the Table 1.

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[1] AGBU is a joint unit of NSW Agriculture and Fisheries and The University of New England

TABLE 1: Results achieved by seven accredited scanners for their initial accreditation

	Rump Fat (mm)		Rib Fat(mm)		REA (cm^2)	
	Average	Best	Average	Best	Average	Best
Correlation with carcase measurement	0.92	0.96	0.91	0.94	0.82	0.90
Standard error between repeat measurements	1.16	0.95	0.78	0.61	5.1	3.1

Equipment

The scanning technicians have generally used an Aloca 210 DXII with a 3.0 MHz linear array transducer or a Toshiba SAL 32B with a 3.5 MHz transducer. Two technicians have recently purchased Aloca 500V scanners with the 17.5cm variable frequency transducer. The two Aloca models were compared by an experienced scanner under accreditation conditions with a total of 60 measurements on 30 animals. The results are shown in Table 2.

TABLE 2: Comparison of the Aloca 210 and Aloca 500V scanning machines

	Rump Fat(mm)		Rib Fat(mm)		REA (cm^2)	
	210DX	500V	210DX	500V	210DX	500V
Correlation with carcase measurement	0.86	0.85	0.87	0.84	0.87	0.90
Standard error between repeat measurements	0.78	1.05	0.58	0.95	5.21	2.73

The results show that the accuracy of measurement of Rib Eye Area was slightly improved and the accuracy of measurement of fat depth was slightly decreased. For the Aloca 500V the slight decrease in accuracy of fat measurement may have been due to a lack of experience with the 500V scanner at the time of the comparison. The results obtained with the Aloca 210 by this technician were very good so substantial improvement could not be expected.

The relative accuracy of different methods of interpreting the image in measuring REA was also compared. The three methods were:

1. Tracing and measurement with a planimeter.
2. Fitting an ellipse to approximate the REA on the screen of the Aloca 500V scanner.
3. A computer aided tracing and area calculation developed in Australia (The CARD System).

The results are shown in Table 3. CARD had the highest correlation with the carcase measurement but the ellipse measurement was surprisingly good. Scanning technicians generally find it advantageous to minimize the time taken to scan each animal by recording the images on video tape for later processing. It is interesting to note that the ellipse approximation can provide a reasonably accurate result at the time of scanning.

TABLE 3: Comparison of three techniques of interpreting the scan image of Rib Eye Muscle Area

	Tracing	Ellipse*	CARD**
Correlation with carcase data	0.93	0.94	0.94
Standard error between repeat measurements	3.67	3.64	3.10

* Ellipse: Area of Eye Muscle determined using ellipse on screen of Aloca 500V machine.
** CARD: Computer Aided Rib Eye Determination

Genetic Parameters

A preliminary estimation of genetic parameters was reported by Robinson et. al (1990). Combined estimates from the analysis of three breed groups are shown in Table 4. These are used in the genetic evaluation analysis.

TABLE 4: Heritabilities and environmental and genetic correlations for scan traits in Australia

	Live Weight	Rump Fat	Rib Fat	REA
Liveweight	**0.55**	0.25	0.22	0.30
Rump Fat	0.20	**0.40**	0.60	0.20
Rib Fat	0.25	0.90	**0.25**	0.12
EMA	0.60	0.15	0.40	**0.25**

Heritabilities on the diagonal, genetic correlations below the diagonal and environmental correlations above the diagonal.

The heritabilities of these measurements of fat depth and rib eye area are moderate. When taken together with the good relationship between scan and carcase measurements, they strongly support the technical adequacy of the technology for use in breeding decisions when appropriately analysed. The genetic parameters are currently being re-estimated on the considerably larger set of data we now have available.

Estimated Breeding Values

In Australia we use the convention of Estimated Breeding Value (EBV) instead of Estimated Progeny Difference (EPD). An EBV is exactly twice the value of an EPD. The genetic evaluation system used for within-herd evaluation is known as BREEDPLAN and for across-herd evaluation it is known as GROUP BREEDPLAN. It utilises a multi-trait animal model of BLUP. The solving process to calculate EBVs simultaneously utilises all measurements on each animal and its relatives, so less precision is required when taking a single measurement than for example if a scan measurement was utilised as part of the payment system for carcases. Of course, care is still required to ensure that there is a good relationship between scan and direct carcase measurement.

A decision was made early in the project to analyse breeders' results as Estimated Breeding Values rather than report adjusted phenotypic values. Since early 1990 we have calculated EBVs for two carcase traits for 140 individual herds. The two traits are Rib Eye Area and Fat Depth at the p8 rump site, adjusted to constant age. A BREEDPLAN type model is used to calculate the EBVs from the measurement of liveweight at the time of scanning, rib eye area and the two fat measurements. In late 1990 we ran the breed genetic evaluation for carcase traits for the Angus breed and in early 1991 we ran the second Angus analysis and the first analysis for the Hereford breed.

The initial reaction of seed-stock producers to the first EBVs for carcase traits has been one of mild confusion because they are not too sure how to incorporate two EBVs which are indicators of yield into a total breeding program. We are currently evaluating the possibility of producing an EBV for Estimated Saleable Meat Yield or Estimated Lean Meat Yield. The advantage of using Lean Meat Yield is that it overcomes the problem of the variation in trim levels which is applied for different end markets. If we provide an EBV for the Saleable Meat Yield or Lean Meat Yield which incorporates the contributions of Fat Depth and Rib Eye Area I believe the picture will become clearer to breeders.

The Future

The future is about maximising the amount of retail product or lean meat from the breeding herd and ensuring it is of adequate quality for the export or domestic consumer.

The Australian AUS-MEAT carcase description system now includes a prediction equation for the yield of lean meat from a carcase. The AUS-MEAT Chiller Assessment Scheme currently used for the high quality export markets includes quality assessments such as marbling and meat texture. The messages are starting to become clearer to the commercial breeders and seed-stock producers in Australia. They are therefore starting to request tools to allow maximum exploitation of genetic variation for carcase traits.

Ultrasound technology is currently limited to measurement of yield traits. Lake (1991) gives some optimism that we may in the future be able to measure the quality traits of marbling and tenderness in the live animal.

Already in Australia we have started to accumulate a combination of measurements taken on live animals using ultrasonics and measurements taken on carcases from designed progeny testing. For fat depth and rib eye area there are measurements from both sources. One of our goals is to have a BLUP model which can utilise data from both sources to provide the best prediction of genetic merit for the important traits. This model will become even more important if we can start to measure quality traits in the live animal.

The introduction of ultrasonic scanning and the use of the information for genetic evaluation in Australia has been challenging and requires further refinement. However, we have made enough progress to suggest that ultrasound measurement of carcase traits in live animals will play an increasingly important role in the future genetic evaluation of carcase traits for the Australian seed-stock industry.

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ULTRASOUND ESTIMATION OF CARCASS EPD'S[1]

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"The beef industry should conduct research aimed at clearly identifying the genetics of carcass merit. The industry should work in earnest to develop improved genetic predictors of carcass merit. In light of developing technology, this should include further development and application of EPD's (Expected Progeny Differences) and a search for major gene effects (gene probes) for carcass traits."

The War on Fat, A Report from the Value Based Marketing Task Force, National Cattlemen's Association and Beef Industry Council of the National Livestock and Meat Board, August, 1990.

The variation that exists in composition of beef carcasses is vast and under a high degree of genetic control. The range for mean differences among breeds is about equal to that found within breeds for retail product as a percentage of carcass weight (Cundiff et al., 1986). When both between and within breed genetic variation are considered, the range in breeding value from the fattest Jersey steers to the leanest Chianina steers is about a 30% in retail product. Thus, significant genetic change can be realized from selection both between and within breeds.

Breeds can be selected to optimize performance levels in crosses for the most important bioeconomic traits with a high level of precision much more quickly than selection within breeds. However, once between breed genetic variation has been exploited by selection of the desired breeds used in crossbreeding programs, continued genetic improvement is dependent on intrapopulation selection and genetic variation available within the breeds. Within breed variation is virtually restored generation after generation by the Mendelian process; while variation between breeds, accruing only gradually over many generations can only be exploited when abrupt changes are made in selection goals and diverse germ plasm is available.

This review will focus on specific questions concerning opportunity to exploit genetic variation within breeds through use of EPD's for predictors of carcass composition measured ultrasonically on live animals.

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[1] Prepared for the Carcass Genetics Study Team, Research and Education Committee, National Cattlemen's Association and presented at Beef Improvement Federation Annual Convention, May 15-18, 1991, San Antonio, TX.

Question 1: ***Are ultrasonic estimates of fat thickness and rib eye area taken on live animals accurate predictors of corresponding traits in carcasses?***

Correlations between ultrasonic live animal and carcass estimates of fat thickness and rib eye area have been evaluated extensively (Table 1). Correlations between ultrasonic live animal and carcass estimates for fat thickness (average r = .65) and longissimus area (average r = .52) in diverse groups of cattle have been relatively high. Correlations of this magnitude indicate that about 42 percent (r = .65; r^2 = .42) of the variation in carcass fat thickness can be accounted for by variation in live animal fat thickness or vice versa. Recent studies at Iowa State (Wilson, personal communication) and Texas (Turner, personal communication) indicate that improvements in real-time ultrasound equipment have allowed for more accurate measurements of anatomical reference points and improved correlations between live and carcass measures of fat thickness and rib eye area (Duello et al., 1990). Ultrasonic estimates of fat thickness and rib eye area are useful predictors of corresponding carcass traits.

Question 2: Most studies have involved steers or heifers with relatively high levels of fat thickness and considerable variation in fat thickness (See means and standard deviations in Table 1). ***Are ultrasonic estimates of fat thickness and rib eye area taken on live animals accurate predictors of corresponding carcass traits in bulls?***

In a study involving only 39 Angus bulls, McReynolds and Arthaud (1970) found that the correlation between ultrasonic live animal and carcass fat thickness tended to improve as bulls increased in age and average fat thickness as follows:

Age, days	Fat thickness, in. Mean	St. Dev.	Correlation
230	.07	.02	-.05
272	.09	.02	.33
312	.11	.02	.44
354	.15	.05	.22
396	.18	.04	.61

In a study involving a much larger number of bulls (824 Hereford yearlings), Lamb et al. (1990) reported a correlation of .39 between ultrasonic live animal and carcass fat thickness. The mean fat thickness was .36 inches and the standard deviation was .14 inches in their study.

Duello et al. (1990) reported correlations averaging .82 and .85 between live and carcass measures of fat thickness in steers and bulls (averaged over three frame sizes). Correlations between live and carcass estimates of rib eye area were higher in bulls (.79) than in steers (.63). More recent results (Wilson, personal communication) indicate that correlations are about as high in bulls (.85) as steers (.91) between live and carcass measures of fat thickness and equally as high in bulls (.83) as in steers (.82) between live and carcass measures of rib eye area. In the Iowa studies, fat thickness averaged about .36 inches in bulls and .50 inches in steers.

These results indicate that the correlation between ultrasonic live animal and carcass estimates of fat thickness are equally as high in bulls as in steers when fed to achieve relatively high levels of fat thickness. At low levels of fat thickness (more common in bulls than in steers), correlations between live and carcass estimates of fat thickness may be lower. Perhaps errors of measurement, either on the live animal or on the carcass, account for a relatively greater proportion of the variation in cattle with relatively low levels of fatness and tend to reduce correlations. The correlation between ultrasonic live and carcass estimates of rib eye area are equally as high or slightly higher in bulls as in steers.

*Question 3: **Can ultrasound be used to estimate differences in marbling in live animals?***

Brethour (1990) studied the relationship between ultrasound speckle and marbling score in 9 groups of steers, 3 groups of heifers and 2 groups of bulls (n = 619) representing diverse breeds and crosses. The average correlation was .5. Duello et al. (1990) reported average correlations of .17 in steers and .39 in bulls between live ultrasound and carcass estimates of marbling. Further research is needed to optimize ultrasound transducer design and signal processing for the measurement of marbling, and other tissue characteristics of interest, in live animals and in carcasses, and to determine how well marbling can be estimated ultrasonically in slaughter cattle and in contemporary groups of bulls or heifers developed under management systems typical of those used for development of replacements.

Question 4: How accurately do carcass measures of fatness and rib eye area predict carcass composition?

Numerous studies have documented that fat thickness measured on the carcass is a good predictor of percentage carcass fat or lean. For example, in a study of 2,453 crossbred steers produced in a Germ Plasm Evaluation Program at the U.S. Meat Animal Research Center the following phenotypic correlations were estimated (Koch et al., 1982):

	Correlation
Carcass fat thickness and carcass fat trim percentage	.77
Carcass fat thickness and carcass retail product percentage	-.74
Carcass rib eye area and carcass fat trim percentage	-.20
Carcass rib eye area and carcass retail product percentage	.27
Actual kidney fat percentage and carcass fat trim percentage	.45
Actual kidney fat percentage and carcass retail product percentage	-.43

Carcass fat thickness is a good predictor of either fat trim percentage or retail product percentage. Carcass fat thickness is a better predictor than carcass rib eye area of either fat trim percentage or retail product percentage. Actual kidney fat percentage is better than rib eye area but not as good as fat thickness as an indicator of fat trim or retail product percentage. In the study of Koch et al. (1982), the mean fat thickness was .48 inches and the standard deviation for fat thickness was .13 inches.

Estimates of fat thickness, rib eye area, estimated kidney fat and carcass weight are used to predict USDA yield grades and cutability (Murphey et. al., 1960). Estimated cutability is moderately heritable (.33) and has a high genetic correlation (.86) with actual yield of retail product (Cundiff et al., 1971). Thus, use of EPD's for estimates based on the USDA cutability equation should be effective in changing carcass composition.

Question 5: Neither live nor carcass measures of fat thickness are estimated without error. ***Are live animal estimates of fat thickness as reliable as predictors of carcass fatness as carcass estimates of fat thickness?***

Wallace et al., (1977) reported correlations between ultrasonic live animal estimates of fat thickness and total yield of retail product in a study of 27 steers of mixed Hereford and Angus breeding:

	Correlation
Ultrasonic fat thickness (12th rib) and retail product %	-.72
Carcass fat thickness (12th rib) and retail product %	-.73
Ultrasonic rib eye area and retail product % (Operator A)	.04
Ultrasonic rib eye area and retail product % (Operator B)	-.12
Carcass rib eye area and retail product %	.04

These results indicate that ultrasonic estimates of fat thickness may be equally as good as carcass estimates of fat thickness as predictors of retail product yield. Neither ultrasonic or carcass estimates of rib eye area were useful as predictors of retail product yield. Steers in their study had a fat thickness mean of .49 inches and standard deviation of .17 inches.

In a trial involving twenty steers of mixed breeding and 10 Hereford bulls in Britain and twenty young bulls of the Danish Black and White breed in Denmark, Anderson et al. (1983) reported the following results:

	Correlation[2]
Ultrasonic fat thickness (10th rib, 3 inches from midline) and % lean in carcass	-.26
Ultrasonic fat area (10th rib, area between 0 and 5.9 inches from midline) and % lean in carcass	-.32
Rib eye muscle area (10th rib, area between 0 and 5.9 inches from midline) and % lean in carcass	.21
Rib eye muscle area (1st lumbar, area between 0 and 5.9 inches from midline) and % lean in carcass	.28

[2] Correlations (averaged for two operators and two machines (Scanogram and Danscanner) between ultrasonic live animal fat and rib eye measurements with percentage lean in the carcass. Fat thickness (10th rib, 3 inches from midline) had a mean of .33 inches and a standard deviation of .19 inches.

Anderson et al. (1983) did not report correlations of carcass estimates of fat thickness or rib eye area with percentage of lean. They concluded that the percentage of lean was best correlated with fat measurements, whereas muscle area was best correlated with dressing percentage and lean to bone ratio.

Results suggest that ultrasonic fat thickness on live animals may be equally as useful as a predictors of retail product percentage as carcass fat thickness. The magnitude of the correlations of either ultrasonic live animal or carcass estimates of fat thickness with percentage carcass lean is likely lower in bulls than in steers.

Question 6: How accurately do ultrasonic live animal and carcass measures of fat thickness predict carcass composition in bulls?

Alliston (1982) studied the use of ultrasonic measurements of rib eye area and fat thickness at the 10th and 13th rib, and 3rd lumbar vertebra of 50 Hereford bulls. The mean and standard deviation for fat thickness taken about 5 inches from the midline at the 13th rib was .24 and .08 inches, respectively. The best single measurement of fat thickness for predicting percentage carcass fat or percentage carcass lean was fat thickness taken at 5 inches from the midline at the 13th rib (r = .75 with fat %; r = -.66 with lean %).

Danish and Dutch scientists (Jansen et al., 1985) studied ultrasonic estimation of carcass composition in young (15 months of age) Black and White bulls (n = 64). The bulls averaged 1037 lb in live weight and produced relatively lean carcasses containing and average of 65.9% lean and 16.6 % fat. The residual standard deviation for percentage lean was reduced only a slight amount (from 1.91 to 1.78) by us of ultrasonic fat area as a predictor of percentage carcass lean (consistent with a correlation of -.36).

Bailey et al. (1986) evaluated accuracy of ultrasonic estimates of compositional characteristics of Holstein X Friesian bulls (n = 260) in three weight categories (750, 1036, 1322 lb). Carcasses contained and an average of 12.9 % fat and 68.6% lean at 750 lb, 16.2% fat and 66.8% lean at 1036 lb and 18.8% fat and 65.3% lean at 1322 lb. Live animal measurements evaluated as predictors of fat and lean percentage included Danscanner longissimus area and area of subcutaneous fat (over the rib eye) at the first lumbar vertebra. Correlations between ultrasonic fat thickness and percentage carcass fat was significant in heavy bulls averaging 1322 lb (r = .36) but were not significant in lighter weight groups (r = .31 in 750 lb bulls; r = .18 in 1036 lb bulls). The pooled correlation between ultrasonic fat area and percentage separable fat was .28 (P<.05) indicating that ultrasonic fat area prediction can only account for about 8% of the variation (r^2) in percentage carcass fat in young bulls. Correlations between ultrasonic longissimus area and percentage of lean in the carcass were all positive, but non significant (r = .28, in 750 lb bulls; r = .23 in 1036 lb bulls and r = .17 in 1322 lb bulls).

Lamb et al. (1990) reported a phenotypic correlation of .39 between ultrasonic live animal and carcass estimates of fat thickness in a study of 824 Hereford bulls. The phenotypic correlations between ultrasonic live animal fat thickness and carcass yield grade and cutability (estimated with the USDA prediction equations, Murphey et al., 1960) were .28 and -.29 respectively. Carcass fat thickness had a mean of .19 and a standard deviation of .09 inches and slaughter weight had a mean of 872 lb and a standard deviation of 18 lb in the bulls evaluated.

Results indicate that in bulls, ultrasonic fat estimates predict % lean or % fat in the carcass about as well as estimates of carcass fat thickness. However, in bulls it appears that the correlation between ultrasonic (or carcass) estimates of fat thickness (or area) and % lean or % fat in the carcass are lower than in steers. As bulls are fed to heavier weights and higher average levels of fatness, the correlations improve between ultrasonic (or carcass) estimates of fatness and % lean or % fat in the carcass.

Question 7: Phenotypic relationships, such as those reviewed above, are the relevant parameters when the objective is to estimate carcass characteristics of animals attributable to both genetic and environmental effects. However, heritabilities and genetic correlations between ultrasonic live animal and carcass composition are also needed if the objective is to estimate EPD's (Expected Progeny Differences) or to assess effects of selection for ultrasonic live animal estimates of fat or muscle depth or area. ***What are the heritabilities and genetic correlations of ultrasonic live animal with carcass measures of fat or muscle depth or carcass composition?***

Only limited research has been conducted on the heritability of ultrasonic estimates of fat or muscle depth or area. Even less information is available on genetic correlations between ultrasonic live animal measures and corresponding carcass traits or carcass composition.

Lamb et al. (1990) reported the following estimates of genetic parameters in a study of 824 Hereford bulls by 95 sires:

	Heritability	Genetic correlation with ultrasonic fat thickness
Ultrasonic fat thickness	.24	----
Carcass fat thickness	.24	.45
Marbling	.33	.21
Yield grade	.24	.18
Estimated cutability	.23	-.20

Heritability of fat thickness measured ultrasonically on live animals was 24 percent. The estimates of genetic correlation indicate that selection for less fat thickness measured ultrasonically on live animals would gradually reduce carcass fat thickness, improve yield grade and cutability, but reduce marbling.

Arnold et al., (1990) estimated heritability of ultrasonic estimates of fat thickness and rib eye area on 3,482 yearling Hereford bulls and heifers by 441 sires in 254 contemporary groups. Heritability estimates for weight constant ultrasonic estimates of fat thickness and rib eye area were .26 and .25, respectively. The heritability estimate for fat thickness is in very close agreement with that of Lamb et al. (1990).

Selection for traits with this level of heritability (comparable to that for weaning weight) can be very effective if based on EPD's involving a relatively large data base.

CONCLUSIONS

Ultrasonic estimates of fat thickness and rib eye area are useful predictors of corresponding carcass traits.

Correlations between ultrasonic live and carcass estimates of fat thickness are equally as high in bulls as in steers at the same degree of fatness. If average levels of fat thickness are low, these correlations are relatively low.

Ultrasonic live and carcass estimates of fat thickness are about equally useful as predictors of carcass composition.

Ultrasonic estimates of fat thickness are moderately heritable. Selection for ultrasonic estimates of fat thickness based on EPD's involving large data sets could be effective and gradually improve USDA yield grade and cutability but reduce marbling.

Correlations between ultrasonic live and carcass estimates of rib eye area are at least as high in bulls as is steers. Ultrasonic live and carcass estimates of rib eye area are not highly correlated to carcass composition.

Before genetic prediction procedures for ultrasonic live animal measures of carcass composition can be recommended research is needed in the following areas (Wilson, 1991):

1. "Identification of measurements that can be made on the carcass and consequently with ultrasound on live animals which are predictive of carcass composition.

2. "Development of appropriate procedures for dealing with differences in mean levels of fatness and differences in variation in cattle in diverse contemporary groups (i.e., different sexes, ages and feeding regimes).

3. "Development of growth models, within breed and sex, from serial scanning that will allow proper adjustment of scan records to a common end point.

4. "Estimation of heritabilities and genetic correlations for ultrasound measurements at specific reference points for use in genetic evaluation programs for carcass merit."

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TABLE 1. REPORTS OF CORRELATION BETWEEN ULTRASONIC LIVE ANIMAL AND CARCASS ESTIMATES OF FAT THICKNESS AND RIB EYE AREA IN STEERS OR HEIFERS

		Fat thickness			Rib eye area		
Researcher(s)	Number Animals	Mean	SD	Corre-lation	Mean	SD	Corre-lation
Temple et al. (1956)[a]	60			.63			--
Rowden (1958)[a]	38			.70			--
Stouffer and Wellington (1960)[a]	54			.35			.49
	82			--			.22
	16			--			.85
Wallentine (1960)[a]	18			.50			--
	64			--			.43
Davis and Long (1962)	60			.90			.87
Hedrick et al. (1962)	47	.64	.20	.53	9.58	1.02	.58
	28	.66	.18	.63	10.10	1.00	.89
	57	.70	.20	.43	9.82	1.17	.78
Laughprecht (1962)[a]	54			--			.68
Ritter et al. (1963)[a]	41			--			.80
Burgkart and Doroszewski (1964)[a]	42			--			.91
Stouffer (1966)[a]	54			.35			.49
	82			.32			.22
	16			.54			.85
	47			.42			.57
Watkins et al. (1967)	40	.94	.37	.80	10.49	1.19	.57
	40	.40	.25	.93	11.11	1.08	.37
	40	.44	.17	.72	10.91	.79	.37
McReynolds and Arthaud (1970)	24	.22	.06	.38	--	--	--
Gillis et al. (1973)	107	.70	.22	.73	9.91	.95	.34
	65	.51	.22	.65	8.57	1.17	.56
Wallace et al. (1977)	27				11.02	.97	.60
Oltjen, et al. (1989)	315	.54	.17	.81	12.15	1.25	.43
Duello et al. (1990)	84			.82			.63
Weighted average				.65			.52

[a]From Gillis et al. (1973)

BIF REPRODUCTION COMMITTEE MEETING

San Antonio, TX
May 17, 1991

The meeting was called to order by Chairman Keith Vander Velde. Previously named the Reproduction and Growth Committee, it was suggested and unanimously approved to put the Growth component back into the Central Test Committee.

The first item of discussion involved scrotal circumference (SC) and the appropriate adjustment factors. Keith shared Canadian data from Dr. Glen Coulter, suggesting a breed effect on scrotal circumference and the fact that growth patterns differ among breeds.

Georgia researchers have suggested scrotal circumference adjustment values of .024 cm/day for Hereford bulls and .041 cm/day for Brangus bulls between 330 and 430 days of age. This research also indicates that age of dam adjustment would be appropriate for valid comparison.

Dr. John Hough discussed the first year's data of an Auburn University project entitled Selection for Scrotal Circumference in Hereford Cattle. The objectives of the study were to determine the direct and indirect responses to selection based on SC EPDs. The largest and smallest SC EPD sires (accuracy $>.5$) available in the Hereford breed were utilized A.I. The High line yearling SC EPDs averaged $1.7 \pm .3$ cm, the Low line yearling SC EPDs averaged $-.8 \pm .1$ cm. Sires were similar in growth and maternal EPDs. Sires in each line were bred to a random half of the females. A total of 49 A.I.-sired calves were produced, 22 from the High line sires and 27 from the Low line. There were 25 total bull calves and 24 heifer calves produced.

Significant ($P<.01$) differences were found in weaning, yearling and 15-month SC between the selection lines. Weaning SC for High line bull calves was larger by $2.2 \pm .7$ cm than Low line calves. Yearling SC for High line bulls was larger by $3.5 \pm .9$ cm. Realized response to selection in yearling SC was greater than expected by over 40%. Scrotal circumference for 15-month old High line bulls was larger by 2.6 ± 1.0 cm than for Low line calves. Since the SC difference at yearling age was greater than at 15 months, the Low line bulls appear to sexually mature later with respect to SC.

Age of puberty was determined on the heifer calves using gomer bulls and obtaining weekly blood samples for progesterone analysis from weaning until 15 months of age. There was a 62 ± 28 day (269 ± 20 vs 331 ± 20 days, $P<.05$) advantage in age of puberty for the High line heifers.

It was noted that although response to selection appears to be promising, these results are based only on one year's data on a total of 49 calves and should be viewed cautiously.

Keith Zoellner presented a project proposal for using data from bulls at Central Test Stations and on-farm tests throughout the country to establish appropriate scrotal circumference adjustments.

The objectives of the project would be:

1) to determine scrotal circumference growth curves and age adjustments for young beef bulls of various genotypes.

2) to determine the relationships between scrotal circumference at 6 to 8 months and 12 to 15 months of age.

Data will be collected from spring 1991 born bulls participating in selected on-farm and central bull tests starting in the fall of 1991. Scrotal measurements will be taken at weaning or time of delivery to central test, at 56 to 84 days from the end of the test and at the end of the test. The typical associated weights and measures of bull testing programs will also be collected.

Individuals should contact either Keith Zoellner or Bob Schalles, Department of Animal Sciences and Industry, Kansas State University or Rick Bourdon, Department of Animal Science, Colorado State University, if they are interested in participating in this project.

At our 1990 meeting in Canada, this committee decided to poll the breed associations in regard to their intentions of generating and publishing EPDs affecting the reproductive complex. The traits of interest included gestation length, scrotal circumference and pelvic area. Doug Hixon and Tom Troxel agreed to develop a survey and get the response from the various associations. This was completed (April, 1991) with the following responses received to the indicated questions:

1. a) Do you presently publish a SC EPD?

   Yes __2__ No __12__

   b) If you answered "No" to 1.a do you have any plans to publish a SC EPD?

   Yes __6__ No __5__

   Summary of comments associated with Question 1: Those that answered "Yes" to 1.b are in the process of building the data base required for a meaningful analysis.

2. a) Do you presently publish a gestation length (GL) EPD?

   Yes __1__ No __12__

   b) Do you have any plans to generate a GL EPD?

   Yes __1__ No __6__ Undecided __3__

   Summary of comments associated with Question 2: It is difficult to obtain meaningful data. Natural breeding dates are difficult to gather. Therefore, virtually all data comes from A.I. certificates where a lot of the data reflects 282 days. Those associations in the undecided category were evaluating the data they had to determine if they had enough meaningful data, if there was enough genetic variation and if it was favorably enough related to other economically important traits.

3. Do you have any plans to publish a pelvic area (PA) EPD?

   Yes __5__ No __6__ Undecided __1__

   Summary of comments associated with Question 3: Those indicating "Yes" are in the process of building a data base. The "Undecided" association has a research project in progress to evaluate pelvic growth, adjustment factors and relationships with birth weight, growth and calving ease. One individual commented that he thought a reproduction/calving ease index that combined BW EPD and PA EPD would be useful in reducing dystocia.

Discussions about the survey suggested that breeders should be reminded to report actual breeding and calving dates to improve the usefulness of a GL EPD.

After considerable discussion on the effects of genetics on the reproductive complex, a subcommittee to include Jim Brinks, Rick Bourdon, Dave Notter and Sara Hansen will be asked to evaluate the data and determine whether heritability estimate of calving date (interval) would be possible and/or useful. The subcommittee is asked to report back to this committee at next year's meeting.

Sally Northcutt from Iowa State University gave a short presentation on their project with the American Angus Association with the objective being to generate a mature size EPD. They are currently collecting data with the projection to generate a mature size EPD in 1992. This project was presented and discussed in more detail in the Genetic Prediction Committee meeting.

Respectively submitted,

Doug L. Hixon,
Secretary

MINUTES
GENETIC PREDICTION COMMITTEE
BIF
San Antonio, TX - 1991

At 2 PM on 17 MAY 1991, Dr. Larry Cundiff called the committee meeting to order. Larry noted, that after the report of the breeds on the current compared to a 1982 fixed base that was part of the morning symposium, the breeds would be polled as to their interest in fixing the base to a particular set of animals of a particular birth year. Hop Dickenson expressed concern that if the base was fixed that breeders might assume that they could then make across breed EPD comparisons. Larry responded that this would not be the case but considered the idea of including this in the poll to the breeds.

Then Mrs. Sally Northcutt gave a report on work at Iowa on the American Angus Association data to develop genetic predictions (EPDs) of mature size. This presentation sparked much conversation at the meeting and in the halls.

Mr. Kevin Maher of DESTRON gave a presentation on electronic animal identification to the committee. This presentation led to a number of questions concerning its use. It was noted by Keith Hammond of Australia that possibly BIF should suggest guidelines in terms of an acceptable code for numbering of animals.

Then Dale Van Vleck reported on an update of the US MARC data breed table adjusted to the 1982 fixed base. He reported problems in the analyses of the data free of specific heterosis effects, but top cross studies involving the use of a common tester (Hereford and Angus) can only estimate general combining ability. Problems existed in the reported information from the 1982 fixed base, so the breed table was held until the study was complete.

Cundiff asked Willham (Chair of a subcommittee to develop guidelines for across breed EPDs) to report. Willham reported on the committee meeting and said that the writing of guidelines would be put off until there was a breed and heterosis table and a consensus on a fixed base for the animal evaluations of the breeds.

Brett Middleton of APHA asked that for pedigree estimates of EPDs, that none be reported unless the EPDs for both the sire and dam were available. He suggested that this be included in the guidelines for genetic prediction.

Concern surfaced on the use of a negative genetic correlation between direct and maternal meaning weight in that high growth bulls appeared to have low milk EPDs. This brought up the subject of different parameter estimates (variances and covariances) being used in the several animal evaluation programs and how this would affect across breed EPDs. There was little discussion because of the time.

The meeting was concluded by Larry Cundiff. Appendix A is the report on mature size EPDs given by Dr. Northcutt. Appendix B is a paper titled "Heterosis and the Breed Table" by Dr. Van Vleck and R. Nuñez-Domingues. Appendix C is a copy of the poll conducted by Dr. Cundiff and a tabulation of the results. Members of the genetic prediction committee responded to questions concerning the fixing of base for breed genetic predictions. Some 200 people attended the committee meeting.

R. L. Willham
Secretary

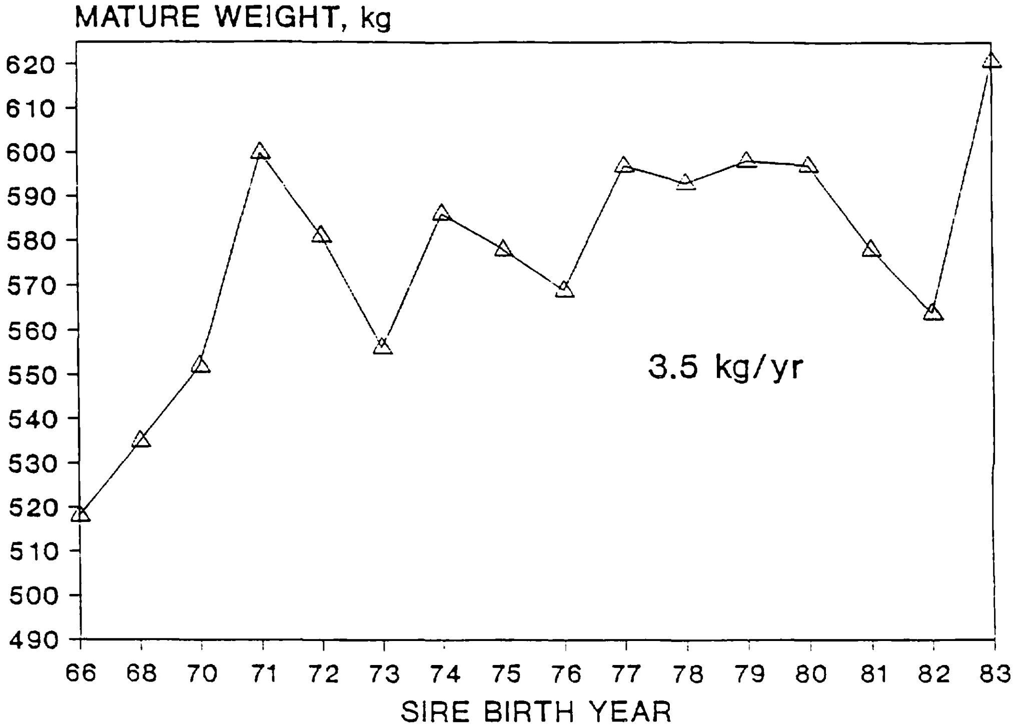
PREDICTING MATURE SIZE IN ANGUS CATTLE

S. L. Northcutt and D. E. Wilson
Iowa State University

The mature-size database consisting of cow weights, heights and body condition scores (1-9 scale) contained 28,391 records (January 1991) on females of all ages. About 52% of the cow weights had body condition scores. Available cow weights with condition scores were used to compute adjustment factors for adjusting cow weight to a condition score 6. Adjustment factors in kg were as follows: + 116 (score 2), + 91 (score 3), + 69 (score 4), + 39 (score 5), -40 (score 7), -86 (score 8). Results indicated that body condition score was a significant source of variation in cow weight.

Mature-size EPDs were computed using records on cows at least 5 years old with complete mature weight, height and condition score data. A total of 256 sires were evaluated using mature-size data collected on 2732 daughters. Requiring cows to have complete records for the traits limited the number of sires evaluated. A multiple-trait sire model including fixed contemporary group, sire genetic group, random sire and residual error, as well as sire and maternal grandsire relationships was used to determine sire EPDs for mature weight (adjusted for condition) and height. Heritability estimates were .45 for mature weight and 83 for mature height. The genetic correlation between weight and height was .78 and the phenotypic correlation was .58.

Figures 1 and 2 depict phenotypic trend for mature weight and height, respectively, in Angus cattle. Trend lines indicate a significant increase ($P<.01$) in mature weight and height over a 17-yr period of 59.5 kg and 7.3 cm, respectively. Positive genetic trend has occurred in the Angus breed for mature weight and height and indicated in Figures 3 and 4. Mature weight and height increased significantly ($P<.01$) at .9 kg/yr and .25 cm/yr, respectively. Plans are to include the yearling and 2-yr-old weight and height data of daughters in the multiple-trait model to allow young sires to be evaluated for mature size.



Weight adjusted for body condition

Figure 1. Phenotypic trend for mature weight in Angus cattle

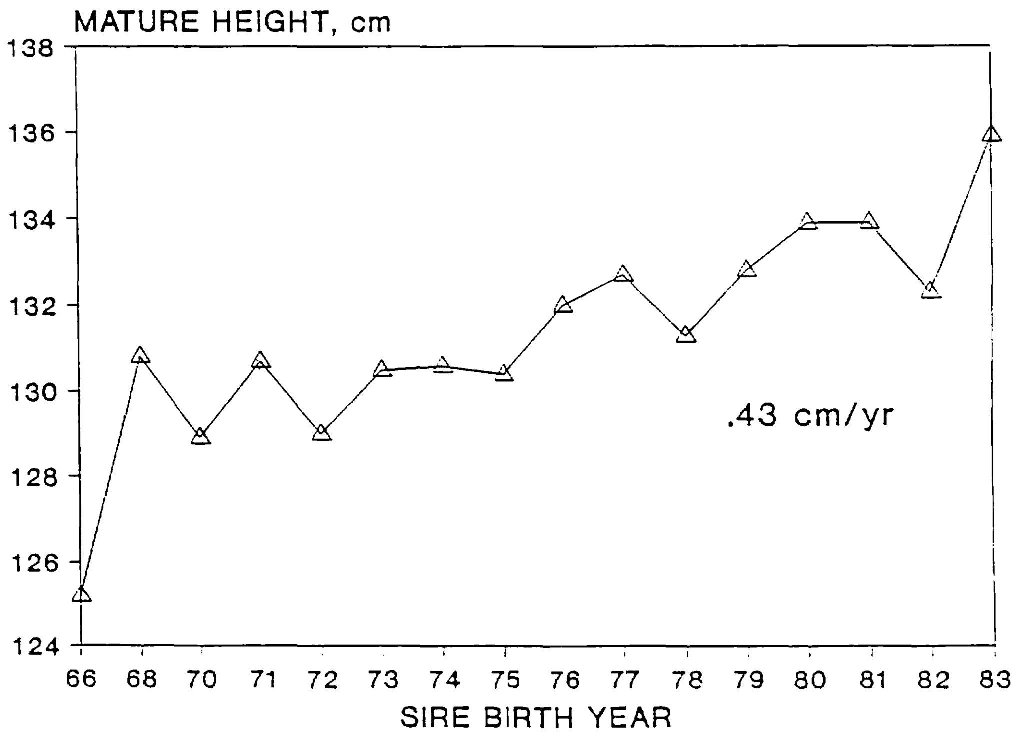
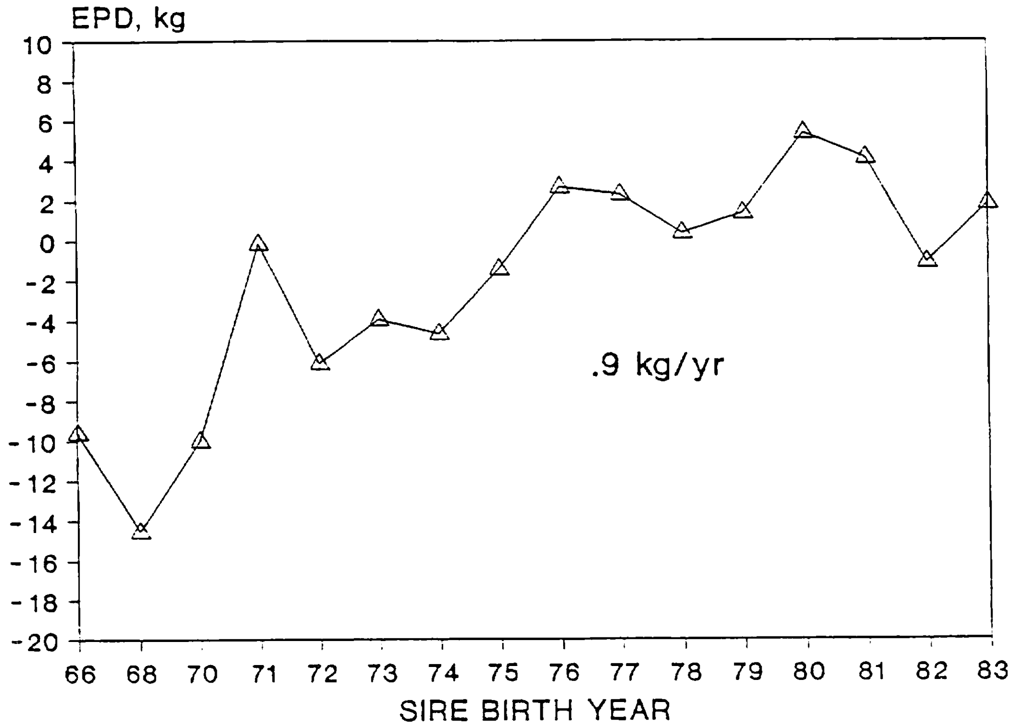


Figure 2. Phenotypic trend for mature height in Angus cattle



Weight adjusted for body condition

Figure 3. Genetic trend for mature weight in Angus cattle

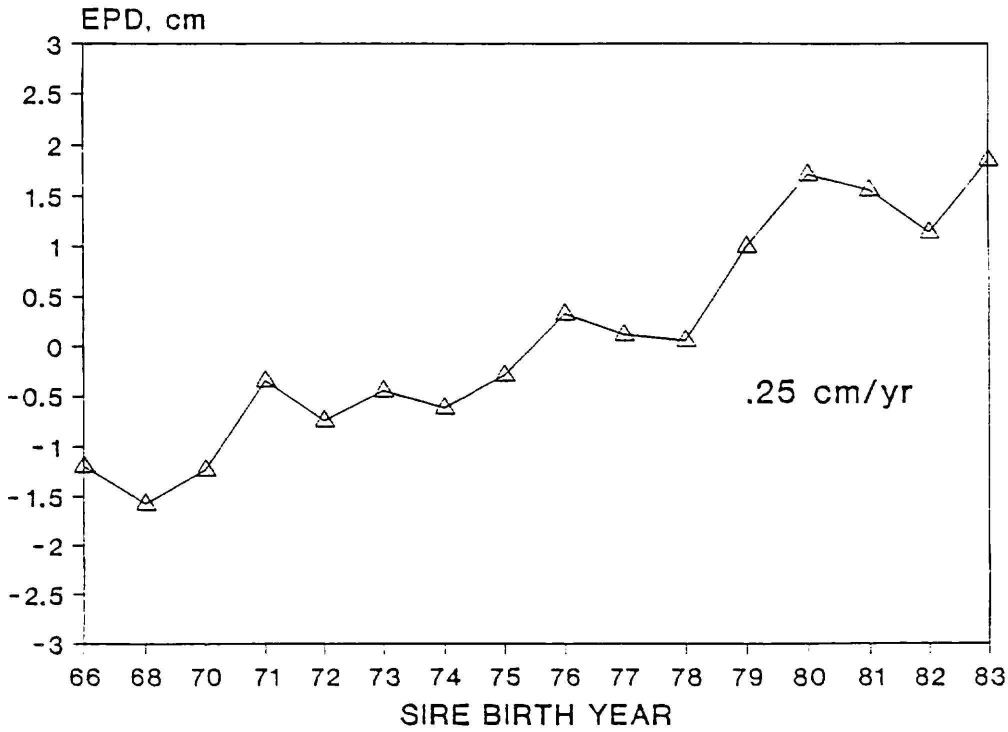


Figure 4. Genetic trend for mature height in Angus cattle

APPENDIX B

Heterosis and the Breed Table

L. D. Van Vleck[1] and Rafael Núñez-Dominguez[1]

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Introduction

The Notter-Cundiff breed table presented at the 1989 BIF meeting when updated to a 1982 base can be computed from the regression equation:

$$\begin{matrix} \textit{MARC} \\ \textit{breed} \\ \textit{constant} \end{matrix} + b \begin{pmatrix} \textit{Average} & & \textit{Average EPD} \\ \textit{Breed EPD} & - & \textit{for MARC bulls} \\ \textit{for } 1982 & & \textit{of same breed} \end{pmatrix}$$

This equation is repeated for each breed to create the breed comparison table. The MARC breed constant is based on estimates of differences among breeds used in crossbreeding projects at the USDA Roman L. Hruska Meat Animal Research Center (MARC). The regression coefficient, b, is the regression of the progeny record on its sire's EPD and is expected to be 1 (one unit increase in progeny performance for each unit increase in the EPD of its sire). The difference between the average EPD for the breed of the sire for a specific base year (e.g., 1982) and the average EPD for sires of that breed used at MARC adjusts the breed constant to a 1982 equivalent. Thus, if all assumptions are satisfied, EPD's from all breeds included in the table and with a 1982 base can be compared. Among the assumptions needed for a fair comparison are; 1) equal variances for each breed, 2) equal heritabilities, etc. for each breed, and 3) calculation of the 1982 base is the same for all breeds. (The recommendation of the committee of E. J. Pollak was that the fixed base include EPD's for all animals of that

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breed born in 1982). These questions need to be addressed. The purpose of this discussion, however, is to examine the expected values of the breed constants estimated from F_1 data at MARC because a fair comparison depends on the difference in breed constants being estimable, i.e., that the difference in estimates contains only the breed differences or only the breed differences and a common constant. For many years researchers have been aware that estimates of heterosis and breed effects are confounded in two-way cross data (see for example, the review and discussion of Wyatt and Franke, 1986). Several references are listed in the reference list. The emphasis in many crossbreeding studies, however, was on estimation of heterosis effects, or breed effects averaged over certain heterotic matings. The breed constants making up a breed table are of critical concern because they are used to compare bulls of different breeds. If different magnitudes of specific heterosis (dependent on breeds involved) appear in the breed constants, then the breed comparisons may be biased and may not reflect the direct genetic differences among the breeds.

The problem in examining the estimates of breed constants arises from dependencies in the coefficients of the estimating equations -- the least squares equations. A model that follows the Robison (Robison et al., 1981) approach of including direct, maternal and heterosis effects as regression variables seems simple enough because regression coefficients do not usually create dependencies in least squares equations but in this case of a top cross experiment they do. For example, a set of data from 3-way crosses (6 breeds and 4 with maternal contributions) results in 29 equations for the 29 parameters to estimate but with 11 constraints needed to obtain solutions. The first problem is to determine constraints that will yield solutions so that expectations of the breed differences are easy to examine. A function in SAS/IML (ECHELON, Elswick et al., 1991) allows easy determination of what are estimable functions of the parameters. Function, RREF, in MATLAB does the same thing -- the reduced row echelon function. Examination of output from ECHELON or RREF results in good choices of constraints. The second step is to obtain expectations of solutions for various models that might be used in terms of the underlying complete model. For example, for the Notter-Cundiff table, the breed constants are estimated with a breed of sire and breed of dam model; for maternal constants, the model includes breed of sire, breed of maternal grand sire and breed of maternal grand dam. The expectations of the solutions for, for example, breed of sire effects must be taken with the full model that includes not only breed direct and maternal effects but also specific heterosis effects.

An example will be used to illustrate the confounding of breed direct and specific heterosis effects. The MARC crosses to produce F_1 progeny utilized only Hereford (H) and Angus (A) cows. For illustration, crosses also will involve Limousin (L) and Charolais (C) bulls as well as Hereford and Angus bulls. The crosses (breed of sire, breed of dam) will be HA, AH, LH, LA, CH, CA. Records of Hereford and Angus purebreds (HH and AA) can be added to the analysis. The full model will include direct genetic effects of sire breed i, g_i, and dam breed j, g_j, maternal genetic effects of dam breed j, m_j, and if crossbred, direct heterosis effects, h_{ij}. Table 1 gives the models for the six F_1's and for the two purebreds. The numbers of each were chosen for illustration only. Unequal numbers were chosen deliberately. Table 1 gives the full model for the example. When a simpler model such as the breed of sire, breed of dam model is used for the analysis, the expectations of solutions will be in terms of Table 1.

TABLE 1. F_1 example

Cross	No.	Model
HA	3	$.5g_H + .5g_A + m_A + h_{HA}$
AH	2	$.5g_H + .5g_A + m_H + h_{HA}$
LH	2	$.5g_L + .5g_H + m_H + h_{LH}$
LA	1	$.5g_L + .5g_A + m_A + h_{LA}$
CH	2	$.5g_C + .5g_H + m_H + h_{HC}$
CA	3	$.5g_C + .5g_A + m_A + h_{AC}$
HH	3	$g_H + m_H$
AA	2	$g_A + m_A$

Analysis models

The full model can be written as illustrated. For an F_1 progeny of a cross of sire breed i and dam breed j, the fixed part of the model is:

$$.5g_i + .5g_j + m_j + h_{ij}$$

For a purebred progeny of breed i (i = H or A), the fixed part of the model is:

$$g_i + m_i.$$

Notice for the example with breeds H, A, L and C, there are four g terms, two m terms and five h terms for a total of 11 parameters. When only F_1 data are used, dependencies among the 11 least squares equations require 5 constraints. When the HH and AA records are added, the 11 equations require 3 constraints. Thus, even with a full model, separation of g, m, and h terms will not be possible. Also note that all 11 effects will be treated as regression variables (the maternal effects could be treated as two levels of a maternal factor).

For the full model, the five constraints for the F_1 data were chosen based on the ECHELON function so that contrasts between breed direct effects could be obtained with coefficients of one so that what heterosis effects were contained in the expectations of the breed differences could be easily seen. Typical contrasts of interest are shown below. Contrasts with breed direct effects for breed A would be similar to those with breed H.

<u>Expectations of breed direct contrasts, F_1 records with full model</u>

The E[ ] expression indicates what fixed parts of the model are contained in the solutions. The constraints chosen were $\hat{m}_H = 0$ and all $\hat{h}_{ij} = 0$ except $\hat{h}_{HL}$. The ^'s indicate solutions after constraints are imposed. Then:

$$E[\hat{g}_H - \hat{g}_A] = g_H - g_A + 2(h_{HC} - h_{AC})$$
$$E[\hat{g}_H - \hat{g}_L] = g_H - g_L + 2(h_{HA} - h_{AL})$$
$$E[\hat{g}_L - \hat{g}_C] = g_L - g_C + 2(h_{AL} - h_{AC})$$
$$E[\hat{m}_A] = m_A - m_H$$
$$E[\hat{h}_{HL}] = (h_{HL} - h_{AL}) - (h_{HC} - h_{AC})$$

On the right of the equal signs are what the differences in breed constants actually estimate. In addition to the desired breed differences in direct genetic value, each contrast contains a <u>different</u> set of heterosis effects. When $g_H - g_A$ is wanted, $2(h_{HC} - h_{AC})$ comes with it, the difference in specific heterosis of H with C and A with C. When $g_H - g_L$ is wanted, $2(h_{HA} - h_{AL})$ comes with it and when $g_L - g_C$ is wanted, $2(h_{AL} - h_{AC})$ comes with it. Similar patterns can be obtained for $g_H - g_C$, $g_A - g_L$, and $g_A - g_C$.

If all h_{ij} are equal then the breed contrasts are clean, that is: $E[\hat{g}_i - \hat{g}_j] = g_i - g_j$. In other words, the procedure is valid if $h_{HA} = h_{HL} = h_{AL} = h_{AC} = h_{LC}$. The important question is what is the likely magnitude of differences in the specific heterosis terms among breeds in the analysis.

Expectations of breed direct contrasts, F_1 and HH, AA with full model

The situation is even more complicated when the purebred Hereford and Angus are included in the analysis.

$$E[\hat{g}_H - \hat{g}_A] = g_H - g_A$$
$$E[\hat{g}_H - \hat{g}_L] = g_H - g_L - 2h_{AL}$$
$$E[\hat{g}_L - \hat{g}_C] = g_L - g_C + 2(h_{AL} - h_{AC})$$
$$E[\hat{m}_A] = m_A - m_H$$
$$E[\hat{h}_{HA}] = h_{HA}$$
$$E[\hat{h}_{HL}] = h_{HL} - h_{AL}$$
$$E[\hat{h}_{HC}] = h_{HC} - h_{AC}$$

Because HH, AA, HA, and AH are a complete diallel, the $g_H - g_A$ contrast is clean. Expectations of the other contrasts, however, contain different functions of the specific heterosis effects. In fact, contrasts such as $\hat{g}_H - \hat{g}_L$, $\hat{g}_A - \hat{g}_L$, $\hat{g}_H - \hat{g}_C$, and $\hat{g}_A - \hat{g}_C$ contain the negative sum of two heterosis effects, whereas the contrast for the two breeds without purebred data, $\hat{g}_L - \hat{g}_C$, contains the sum of two heterosis effects and the negative sum of two others. If specific heterosis effects are all equal, however, the breed contrasts can be made to contain the same extra heterosis effects by adding or subtracting the appropriate solutions of heterosis effects, $\hat{h}_{HA}$, $\hat{h}_{HL}$, or $\hat{h}_{HC}$.

Equal Heterosis Model

If all heterosis effects can be assumed to be equal, then only the fraction of heterosis is in the model and specific heterosis effects are ignored. With F_1 data, heterosis is 100% for all animals. Purebreds would have 0% heterosis. The model for F_1 data is:

$$.5\ g_i + .5\ g_j + m_j + 1\ h$$

The model for purebred records is:

$g_i + m_i + 0\ h$, as before.

Now constraints are easy to impose with only one being required for either F_1 or F_1, HH, and AA records combined. If only F_1 data are used, h serves as a kind of overall mean term and is ignored. Thus, solutions are easy to obtain but when expectations of solutions are looked at, based on the full model that contains specific heterosis effects, some unusual coefficients of the heterosis effects appear in the expectations of breed contrasts.

Expectations of breed direct contrasts; F_1 data

$$E[\hat{g}_H - \hat{g}_A] = g_H - g_A + .71(h_{HL} - h_{AL}) + 1.29(h_{HC} - h_{AC})$$
$$E[\hat{g}_H - \hat{g}_L] = g_H - g_L + 2h_{HA} + .86(h_{HC} - h_{AC} - h_{HL}) -1.14\ h_{AL}$$
$$E[\hat{g}_L - \hat{g}_C] = g_L - g_C + 1.14(h_{HL} - h_{HC}) + .86(h_{AL} - h_{AC})$$
$$E[\hat{m}_H] = m_H - m_A$$

What can be noticed is that if the specific heterosis effects are all equal, the contrasts are clean, that is, $E[\hat{g}_i - \hat{g}_j] = g_i - g_j$, because the coefficients of the heterosis effects in the expectations sum to zero for all contrasts.

Expectations of breed direct contrasts, F_1, HH and AA data

The expectations are again complicated by the use of the HH and AA purebred records although a general heterosis effect can be included in the model.

$$E[\hat{g}_H - \hat{g}_A] = g_H - g_A$$
$$E[\hat{g}_H - \hat{g}_L] = g_H - g_L + 2h_{HA} -1.25\ h_{HL} -.75\ h_{AL} + .15(h_{HC} - h_{AC})$$
$$E[\hat{g}_L - \hat{g}_C] = g_L - g_C + 1.25\ h_{HL} +.75\ h_{AL} -.95\ h_{HC} -1.05\ h_{AC}$$
$$E[\hat{m}_H] = m_H - m_A + .16(h_{HL} - h_{AL}) + .28(h_{HC} - h_{AC})$$
$$E[\widehat{heterosis}] = h_{HA} + .03(h_{HL} - h_{AL}) + .06(h_{HC} - h_{AC})$$

The estimate of the g_H - g_A difference is unbiased by heterosis. The other direct breed contrasts include complex combinations of heterosis effects. But, because the coefficients of heterosis effects sum to zero for all breed contrasts, the breed contrasts for direct effects will be unbiased if all specific heterosis effects are equal. The maternal breed difference also includes heterosis effects but is not important for calculating the breed table for direct effects.

Breed of sire, breed of dam model; no purebreds

The most important model for analysis is the one that considers only the sire and dam breeds. This model with only F_1 records is the basis of the breed constants which are the starting points for calculating the Notter-Cundiff breed table. When the expectations of estimates of breed differences (one-half in this case) are examined, functions of specific heterosis effects are present as with other analysis models. Again, as before, the fractions of the specific heterosis effects sum to zero so that if all specific heterosis effects are equal, then the sire breed contrasts are unbiased estimates of one-half direct genetic breed differences. The pattern of the heterosis effects with positive and negative fractional coefficients is more complex than before and seems to be affected by the number of animals represented in each cross.

$$E[\hat{S}_H - \hat{S}_A] = .5(g_H - g_A) + .36(h_{HL} - h_{AL}) + .64(h_{HC} - h_{AC})$$

$$E[\hat{S}_H - \hat{S}_L] = .5(g_H - g_L) + h_{HA} + .43(h_{HC} - h_{HL} - h_{AC}) - .57h_{AL}$$

$$E[\hat{S}_L - \hat{S}_C] = .5(g_L - g_C) + .57(h_{HL} - h_{HC}) + .43(h_{AL} - h_{AC})$$

$$E[\hat{S}_H - \hat{S}_A - \hat{D}_H] = m_H - m_A$$

Breed of sire, breed of dam model; F_1, HH and AA purebreds

If the HH and AA purebreds are included in the example, the expectations of the breed contrasts become even more complex than when records from HH and AA are not used.

$$E[\hat{S}_H - \hat{S}_A] = .5(g_H - g_A)$$

$$E[\hat{S}_H - \hat{S}_L] = .5(g_H - g_L) + .48h_{HA} -.64h_{HL} -.36h_{AL} + .05(h_{HC} - h_{AC})$$

$$E[\hat{S}_L - \hat{S}_C] = .5(g_L - g_C) + .03h_{HA} + .63h_{HL} + .37h_{AL} -.47h_{HC} -.53h_{AC}$$

$$E[\hat{D}_H - \hat{S}_H + \hat{S}_A] = m_H - m_A -.11h_{HA} + .15(h_{HL} - h_{AL}) + .27(h_{HC} - h_{AC})$$

With the purebreds in the analysis, the fractional coefficients for specific heterosis terms no longer sum to zero for all contrasts. In the example, the g_H - g_A contrast is unbiased. The g_H - g_L contrast contains more negative than positive fractions of specific heterosis while the g_L - g_C contrast contains a small fraction of h_{HA} in addition to other specific heterosis effects with coefficients that sum to zero.

Significance of Expectations of Breed Contrasts

If specific heterosis effects are equal for all breed crosses used in forming the breed table, then no bias will result from the sire breed, dam breed analysis with the HH, AA purebreds not included. If the specific heterosis effects are not equal, then the magnitude of the bias and its importance in across breed sire comparisons will depend on how different the specific heterosis effects are. To illustrate this point, assume that average weaning weight is about 450 lb. As heterosis effects are typically described as a percentage of the mean, then a specific heterosis effect of 4% would equate to 18 lb and one of 6% to 27 lb. Now to quantify the example for the sire breed, dam breed model with no purebreds, we will pretend the following specific heterosis effects are true:

h_{HL}:	6% = 27 lb	h_{AL}:	4% = 18 lb
h_{HC}:	6% = 27 lb	h_{AC}:	4% = 18 lb
h_{LC}:	5% = 22.5 lb	h_{HA}:	8% = 36 lb

These numerical equivalents of the specific heterosis effects will be substituted into the expectations of the breed contrasts:

$$E[\hat{S}_H - \hat{S}_A] = .5(g_H - g_A) + .36(27-18) + .64(27-18)$$

$$= .5(g_H - g_A) + 9 \text{ lb}$$

$$E[\hat{S}_H - \hat{S}_L] = .5(g_H - g_L) + 36 + .43(27-27-18) -.57(18)$$

$$= .5(g_H - g_L) + 18 \text{ lb}$$

$$E[\hat{S}_L - \hat{S}_C] = .5(g_L - g_C) + .57(27-27) + .43(18-18)$$

$$= .5(g_L - g_C)$$

With these fictitious specific heterosis effects, the desired contrast of $g_L - g_C$ is unbiased because of the assumption of equal specific heterosis effects for H with L and C and for A with L and C. The $.5(g_H - g_A)$ contrast would be biased by 9 lb in favor of Hereford EPD's compared to Angus EPD's. The $.5(g_H - g_L)$ contrast is biased by 18 lb in favor of the Hereford EPD's compared to the Limousin EPD's. Are biases as large as 9 lb and 18 lb important? For weaning weight, such differences would be important because the range in breed constants ($\hat{S}_{largest} - \hat{S}_{smallest}$) is about 30 lb. Thus biases of 9 to 18 lb would change the rankings of the breeds and, therefore, the breeds of sires that would be ranked highest on across breed EPD's based on the breed table. We must remember that this is a fictitious example. The real questions are 1) whether differences in specific heterosis effects are as large as 2% to 4% of the phenotypic mean and 2) whether such relatively small but potentially important differences for across breed evaluations can be accurately estimated. Whether or not these questions can be answered, the questions need to be considered in deciding whether to use a breed table based on crossbred data.

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Koger, M., F. M. Peacock, W. G. Kirk, and J. R. Crockett. 1975. Heterosis effects on weaning performance of Brahman-Shorthorn calves. J. Anim. Sci. 40:826.

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Pollak, E. J. 1990. A common base. Beef Improvement Fed. annual mtg. pp 89-95.

Robison, O. W., B. T. McDaniel, and E. J. Rincon. 1981. Estimation of direct and maternal additive and heterosis effects from crossbreeding experiments in animals. J. Anim. Sci. 52:44.

Wyatt, W. E. and D. E. Franke. 1986. Estimation of direct and maternal additive and heterotic effects for preweaning growth traits in cattle breeds represented in the southern region. Southern Cooperative Series, Bulletin 310, pp 1-35.

BIF GENETIC PREDICTION COMMITTEE BALLOT

1. Should BIF recommend a uniform fixed base in time for use in genetic evaluations by all breeds? Check one: Yes ______, No _______

2. If a majority of the Genetic Prediction Committee favors fixing the base, should it be fixed at 1982? or should it be fixed at 1985, then changed subsequently every five years (i.e., 1985 until 1995, then 1990 until 2000, etc.)? Check one: 1982 ______, 1985 then changed subsequently every five years ______.

3. If a majority of the Genetic Prediction Committee favors fixing the base, should base include all animals born in that year? or all sires born in that year? Check one: All animals ______, All sires ______

4. Will fixing the base lead the industry to erroneously conclude that the EPD's can be compared across breeds? Check one: Yes ______, No ______. If this is a problem, what should be done about it?

Other Comments:

Signature optional:

________________________________ Name

____________ Date

RETURN BALLOT BY MAY 28 TO:

Larry V. Cundiff
USDA-ARS-USMARC
PO Box 166
Clay Center, NE 68933

RESULTS OF POLL

Breed and/or Person	Fix Base?	When?	Who?	Confusion?
Angus - Crouch	No	N/A	All An.	Yes
Simmental - Cunningham	Yes	1982	All An.	No
Hereford - Dickenson	No	N/A	N/A	Yes
Salers - Dhuyvetter	Yes	1982	All Sires	No
Brahman - Forgason	No	1985	All An.	Yes
Charolais - Garrett	No	1985	All An.	Yes
Red Angus - Stritchlow	Yes	1985	All An.	Yes
Gelbvich - Gibb	Yes	1985	All An.	No
Brangus - Jackson	Yes	1982	All An.	Yes
Shorthorn - McGill	Yes	1982	All An.	?
Polled Herefords	No	1982	All An.	Yes
Beefmaster - Robbins				
Limousin - Vandewert	Yes	1985	All An.	Yes
Benyshek	No	1985	All An.	Yes
Pollak	Yes	Not Imp	All An.	?
Brinks	Yes	1982	All An.	No
Willham	Yes	1985	All An.	Yes

As of 12 JUNE 1991, there were 10 wishing a fixed base and 6 who selected 1982. One wanted just all sires in the base year but 14 wanted all animals born in the year. Ten feared confusion from fixing the base while 4 thought it no confusion with 2 questioning confusion. The majority, 60% favored fixing the base.

MINUTES OF BEEF IMPROVEMENT FEDERATION
BOARD OF DIRECTORS MEETING

Holiday Inn - KCI
Kansas City, Missouri
November 2-3, 1990

The BIF Board of Directors held its mid-year board meeting at the Holiday Inn - KCI in Kansas City, Missouri on November 2 & 3, 1990.

Board members present for the meeting were Jack Chase, President; Jim Leachman, Vice-President; Charles McPeake, Executive Director; Ron Bolze and Don Boggs, Regional Secretaries; Frank Baker, Paul Bennett, Glenn Brinkman, Larry Cundiff, Bruce Cunningham, Robert Dickinson, Loren Jackson, Marvin Nichols, Keith Vander Velde, Wayne Vanderwert and Gary Weber.

Board members not in attendance were Glynn Debter, Jim Gibb, Doug Hixon, Steve McGill, Paola de Rose, Darrell Wilkes and Leonard Wulf.

Also in attendance was Bruce Howard, a former board member who sat in for Paola de Rose while on leave. In addition, Tom Troxel from Texas A&M was in attendance.

President Chase called the meeting to order at approximately 8:30 a.m. on Friday, November 2, 1990 and the following items of business were transacted.

President Chase welcomed Bruce Howard back as a temporary replacement for Paola de Rose while she is on leave.

Membership Report - McPeake distributed copies of the membership report. A copy is attached. The report showed that 34 state organizations, 17 breed associations and 18 other firms or organizations had paid membership dues as of September 1, 1990. Membership report accepted with some question from Bruce Howard about Canadian memberships.

Financial Report on 1990 Convention - Bruce Howard reported on the financial report for the Canadian conference. The Canadian conference was an even money or 0 cost basis for BIF. The proceedings are printed and in the mail. Bruce brought along copies for the board. On behalf of all Canadians, Bruce expressed a sincere gratefulness for BIF coming to Canada. Frank Baker moved that Bruce express our thanks to the Canadians for the outstanding job with the convention and the finances. Keith Vander Velde seconded. Motion passed.

Financial Statement for 1990 to Date. McPeake provided copies of two financial statements to date. Copies are attached. The report was that the statements had been done while the office was in Oklahoma and the other statement when the office was moved to Georgia.

The statements were read by McPeake. Bob Dickinson moved approval, Bruce Cunningham seconded. Motion passed.

Budget for 1991. McPeake distributed copies of the proposed budget for 1991. Concerning the convention portion of the budget, Frank Baker moved budget approval with necessary changes made to bring in line with Texas A&M numbers. Keith Vander Velde seconded. Motion passed.

Appointment of Nominating Committee - President Chase appointed the following nominating committee: Keith Vander Velde, Chairman; Paul Bennett and Leonard Wulf.

Appointment of Awards Committee - President Chase appointed the following awards committee: Wayne Vanderwert, Chairman; Marvin Nichols and Loren Jackson.

Review Standing Committee - Discussion started with dialogue of asking John Crouch to chair the Live Animal and Carcass Evaluation Committee while not being a member of the Board. Jim Leachman moved and Frank Baker seconded that John Crouch remain Chairman. Motion passed. Bruce Howard talked about pages 108-109 of 1990 BIF Proceedings. Bruce stated Canada has existing program he would send to John. Ask John to plan and consider what the committee recommends. Certification needs to be omitted.

Genetic Prediction - Larry Cundiff. Discussed trial information on 1982 base as a means of evaluating fixed and floating bases. Simply a review. This is primarily for the least trauma committee.

1. Reports
2. Recommendations
3. Research for ultrasound on genetic parameters. Mature size prediction recommended as potential item of interest for the genetic prediction committee.

Central Test Station - Ron Bolze. Ron visited about what had been done in the past in terms of low birth weight EPD calving ease bulls and scrotal circumference adjustments through test stations. Feed efficiency was looked upon with importance at stations that gather such information. Cundiff suggested maybe Doyle Wilson to address testing steers with contemporary bulls.

Systems - Jim Gibb. Some discussion was held on standardization of computer programs. In addition, the need to be studying the methodology sire summaries to strive for uniformity.

Reproduction Committee - Keith Vander Velde - After discussion these items were focused: gene mapping, scrotal adjustments, gestation length and EPDs on reproductive traits.

1992 Convention Site Selection - McPeake read a letter John Crouch had received from Don Lawson of Australia. Don talked about budget cutbacks, depressed economy and suggested maybe the Australian traveling audience might be limited for a meeting in Hawaii. Of the two locations remaining, North Carolina and Oregon, the latter seemed to be a logical location if we were to have visitors from Australia. Don Boggs moved that Oregon host BIF in 1992 with North Carolina as an alternate. Bruce Cunningham seconded. Motion passed.

BIF Update. After McPeake discussed possible changes in Update format because of change in location and what he could get accomplished it was suggested that he emphasize the importance of the authors getting proper recognition of their prepared articles. BIF was also not given credit in some instances.

Loss of Board Member. It was discussed at length what happens in the case of resignations in terms of filling vacancies. It was suggested that in 1991 the caucuses be held at 2:00 p.m. on May 16.

Discussion of Factsheet Review. Don Boggs brought up to date what had been done in terms of the revisions and stage of development for each BIF factsheet along with authors of each. He continued with discussion of the review process and time required.

Printing Additional Guidelines. McPeake reported he had located a printer that could do the job and that he would check further to insure quality. The price was very reasonable, in fact, more inexpensive than original.

BIF Convention Timing. The history of when the convention had been held was discussed. Frank Baker suggested it could be backed up a bit to avoid A.I. season. Would probably get some squeak from University types that teach. Suggested time was the first week in May.

Use of Across Breed EDPs Incorrectly. Across breed EPDs were discussed with how across breed charts were being used and as approved by BIF which is incorrect. It was suggested that each breed run on a common base and discuss the effects at convention with Larry Cundiff to summarize.

Convention and Program. Tom Troxel distributed a prepared packet and reported on convention facilities while encouraging board input at anytime. Tom emphasized that presented suggestions are strictly tentative. The prepared packet was excellent to include times, dates and tour agendas. Tom proposed May 15-18, 1991 as the dates for the conference. It was suggested that a tour to the western art museum be considered. After further discussion of activities Bob Dickinson moved that the convention registration fee be $85.00 with a $25.00 late registration fee and the student fee would remain at $15.00. Paul Bennett seconded. Motion carried. Bruce Howard moved that if in the event that it is required for a convention to break even, BIF will contribute toward the cost of the following eligible expenses: plaques, photos, speakers, printing, postage and ribbons, on condition that all convention expenses are first offset by registration revenues and sponsorships. Frank Baker seconded. Motion carried. McPeake discussed air travel reservation possibilities with the travel agent currently used by the American Angus Association. After no board opposition he was given a nod of approval to contact.

New Business. Don Boggs asked for help in strengthening his state BCIA. After discussion, a general consensus was that sharing information is appropriate and maybe could be a possible theme in Oregon. Bruce Howard discussed thinking about the 25th anniversary in 1993.

There being no further business the meeting was adjourned at 11:15 a.m. on November 3, 1990.

Respectfully Submitted,

Charles McPeake

Charles McPeake
BIF Executive Director

BEEF IMPROVEMENT FEDERATION
STATEMENT OF ASSETS, LIABILITIES AND FUND BALANCE
CASH BASIS
DECEMBER 31, 1990

ASSETS:	
Cash in Checking Account	12,559.05
Cash in Saving Certificate	35,000.00
TOTAL ASSETS	47,559.05
LIABILITIES:	
FICA Payable	16.57
TOTAL LIABILITIES:	**16.57**
FUND BALANCE	
Balance December 31, 1989	44,381.79
Current Year Excess	3,160.69
TOTAL FUND BALANCE	47,542.48
TOTAL LIABILITIES & FUND BALANCE	47,559.05

BEEF IMPROVEMENT FEDERATION
STATEMENT OF REVENUES AND EXPENSE
CASH BASIS
January 1, 1990 - December 31, 1990

REVENUE:	
Dues	10,019.00
Proceedings & Guidelines	1,781.75
Interest	2,220.73
TOTAL REVENUE	**14,021.48**
EXPENSE:	
Accounting Services	985.00
Salaries	1,191.49
Payroll Taxes	249.97
Office Expense & Postage	2,630.80
Telephone	25.65
Miscellaneous Expense	25.11
Convention Expense	289.20
Director's Travel	897.01
Holiday Inn (Mid-Year Board Meeting)	1,160.86
Printing Expense	3,159.70
Registration	246.00
TOTAL EXPENSE	10,860.79
EXCESS OF REVENUE OVER EXPENSE	**3,160.69**

AGENDA
BIF BOARD OF DIRECTORS MEETING
WYNDHAM SAN ANTONIO
SAN ANTONIO, TEXAS
Wednesday, May 15, 1991

1. Clear Agenda - Chase

2. Minutes - McPeake

3. Treasurer's Report - McPeake

4. Membership Report - McPeake

5. Report on Texas Convention - Tom Troxel

6. Plans for 1992 Convention in Oregon - William Zollinger

7. Future Convention Invitations - McPeake
   a. North Carolina
   b.
   c.

8. Standing Committee Reports - Plans for the Convention
   a. Live animal and carcass evaluation - John Crouch
   b. Central bull test - Ron Bolze
   c. Genetic prediction - Larry Cundiff
   d. Systems - Jim Gibb
   e. Reproduction and growth - Keith VanderVelde

9. Election of Directors - McPeake

10. Eastern Regional Secretary Position - Chase

11. Generation of New and Revised Factsheets - Boggs

12. EPD Slide Set From Kentucky - McPeake

13. Elect New Officers - Nominating Committee - Keith VanderVelde, Chm.

14. New Business

15. Awards - Wayne Vanderwert

MINUTES OF BEEF IMPROVEMENT FEDERATION
BOARD OF DIRECTORS MEETING
Wyndham San Antonio
San Antonio, Texas
Wednesday, May 15, 1991

The BIF Board of Directors held its convention board meeting at the Wyndham San Antonio in San Antonio, Texas, on May 15 through 18, 1991.

Board members present for the meeting were Jack Chase, president; Jim Leachman, vice-president; Charles McPeake, executive director; Ron Bolze, Doug Hixon, and Don Boggs, regional secretaries; Frank Baker, Paul Bennett, Glenn Brinkman, Larry Cundiff, Bruce Cunningham, Glynn Debter, Paola deRose, Robert Dickinson, Jim Gibb, Doug Hixon, Loren Jackson, Marvin Nichols, Keith Vander Velde, Wayne Vanderwert, Gary Weber, and Leonard Wulf.

Board members not in attendance were Steve McGill and Darrell Wilkes. NCA was represented by Chuck Lambert.

Also attending the meeting were Tom Troxel and Bill Zollinger of Texas and Oregon, respectively. They serve BIF as conference hosts.

President Chase called the meeting to order at approximately 3:15 p.m. on Wednesday, May 15, 1991, and the following items of business were transacted.

President Chase opened the meeting and greeted our hosts for 1991 and 1992, Drs. Tom Troxel and Bill Zollinger. Tom thanked the BIF board with a special welcome for its cooperation and for coming to Texas. Further, he presented numbers of registrations for the various activities during the convention. As of 3:00 p.m. numbers were 331 Awards banquet, 316 lunch, 310 breakfast on Friday, 138 King Ranch Tour, 43 Hill County Tour, and 185 Lone Star Brewery tour. Tom continued discussion on room shortages and arrangements to cover the shortfall. Tom also expressed appreciation to the other Texans for their strong support in readying for the 1991 convention.

Vice-President Leachman asked about the convention budget and Tom brought the board up to date with the final tally inconclusive until all expenses have been received.

President Chase requested that nominees be seated in front at reserved tables in order to expedite the recognition process. Speakers were to include Mr. George McAlester for the banquet and Mr. Red McCombs for the Friday breakfast.

The board expressed its appreciation for the excellent fashion that Texas had carried out its host responsibilities. A job well done.

Bill Zollinger welcomed BIF to Oregon in 1992 and continued by discussing dates and options for the meetings with differences in dates and hotels. He also requested input for tour organization as he deals with timing, scheduling and budgeting.

After discussion of dates and hotel options Don Boggs moved that May 6-9, 1992, be the dates for the 1992 annual meeting and conference. Paul Bennett seconded. Motion carried. Bill passed out information on hotel available for those dates which is the Red Lion Hotel/Jantzen

Beach in Portland, Oregon. Bill requested that if the mid-year meetings were to be held on November 1 and 2 that he would send a substitute since he has scheduling problems on those particular dates. Vice-President Leachman moved that the mid-year boarding meeting be held November 8-9, 1991, in Denver, Colorado. Jim Gibb seconded. Motion carried.

Minutes of the Last Meeting. Copies of the minutes of the board meeting held November 2-3, 1990, in Kansas City were distributed by McPeake prior to the board meeting. Bruce Cunningham moved that the minutes be accepted as written. Bob Dickinson seconded and the minutes were approved.

Treasurer's Report. McPeake provided copies of the treasurer's report for the calendar year 1990 and for 1991 from January through April. Jim Gibb moved approval. Don Boggs seconded. Motion carried.

Membership Report. McPeake distributed copies of the membership report. A copy is attached. The report showed that 30 state organizations, 21 breed associations and 17 other firms had paid membership dues as of May 10, 1991.

Future Convention Invitations. McPeake discussed the invitations from states through 1993. Those invitations are Oregon in 1992 and North Carolina in 1993. After further discussion Larry Cundiff agreed to check on Nebraska as a possible site for 1994.

Election of Directors. McPeake discussed the director election with vacancies and eligibility requirements. President Chase ask Jim Gibb to coordinate the elections at 1:30 - 2:00 p.m. on Thursday, May 16.

Eastern Regional Secretary Position. President Chase discussed Ron Bolze's recent move to Kansas and out of the eastern region. After discussion Chase asked for names of people that have an interest. Ron Bolze suggested Ronnie Silcox of Georgia and Wayne Wagner of West Virginia as people in Extension with strong interests in performance beef cattle. Other names were suggested and after discussion Frank Baker moved that Ronnie Silcox be first choice and Wayne Wagner second choice in/case Ronnie did not accept. Keith Vander Velde seconded. Motion carried.

Generation of New and Revised Factsheets. Don Boggs brought the board up to date on the factsheets and stressed that most of them were too long. Frank Baker suggested four pages for a factsheet.

EPD Slide Set From Kentucky. McPeake discussed the EPD slide set and as dialogue continued thoughts were expressed dealing with who would handle distribution, cost of production and the need to stay within the Guidelines for EPD's. President Chase appointed a committee with Jim Gibb, Chairman, Loren Jackson and Doug Hixon to contact Dr. Debra Aaron at the University of Kentucky for revision and developmental procedures.

Standing Committee Reports. Plans for the convention were given for the following committees and respective chairman.

a. Live animal and carcass evaluation - John Crouch
b. Central bull test - Ron Bolze
c. Genetic prediction - Larry Cundiff
d. Systems - Jim Gibb
e. Reproduction and Growth - Keith Vander Velde

Nominating Committee - Chairman of the nominating committee Keith Vander Velde met with the committee and concluded the following nominations, Jim Leachman for President and Marvin Nichols for Vice President. After no other nominations were made Keith Vander Velde moved the nomination cease and the two be elected by acclamation. Paul Bennett seconded. Motion carried.

Awards at 1991 Convention. The following awards were presented:

Seedstock Producer of the Year	- Summitcrest Farms, Ohio
Commercial Producer of the Year	- Dave & Sandy Umbarger, Oregon
Continuing Service Award	- John Crouch, Missouri
Pioneer Award	- Bill Turner, Texas
	- Bob Long, Texas

New Business. Keith Vander Velde suggested that growth and reproduction should not be together as a single committee. Larry Cundiff suggested growth be combined with central test because of relativity. Jim Leachman moved this change occur and Keith Vander Velde seconded. Motion passed.

There being no further business the meeting was adjourned.

Respectfully Submitted,

Charles A. McPeake

Charles A. McPeake
Executive Director

BEEF IMPROVEMENT FEDERATION
STATEMENT OF ASSETS, LIABILITIES AND FUND BALANCE
CASH BASIS
January 1, 1991 - April 30, 1991

ASSETS	
Cash in Checking Account	19,691.30
Cash Deposit With Cooperative Extension Service	600.00
Cash in Savings Certificate	35,000.00
TOTAL ASSETS:	55,291.30
LIABILITIES:	
None	00.00
TOTAL LIABILITIES:	00.00
FUND BALANCE:	
Balance December 31, 1990	47,542.48
Current Year Excess	7,748.82
TOTAL FUND BALANCE	55,291.30
TOTAL LIABILITIES & FUND BALANCE	55,291.30

BEEF IMPROVEMENT FEDERATION
STATEMENT OF REVENUES AND EXPENSE
CASH BASIS
JANUARY 1, 1991 - APRIL 30, 1991

REVENUE:	
Dues	8,850.00
Proceedings and Guidelines	1,015.67
TOTAL REVENUE	9,865.67
EXPENSE:	
Salaries	541.42
Payroll Taxes	92.78
Office Expenses & Postage	729.53
Printing Expense	753.12
TOTAL EXPENSE	2,116.85
EXCESS OF REVENUE OVER EXPENSE	7,748.82

PAID - BIF MEMBER ORGANIZATIONS AND AMOUNT OF DUES FOR 1991
As of May 15, 1991

STATE BCIA'S	DUES
Alabama	$100.00
Buckeye Beef (Ohio)	$100.00
California	$100.00
Colorado	$100.00
Florida	$100.00
Georgia	$100.00
Hawaii	$100.00
Illinois	$100.00
Indiana	$100.00
Iowa	$100.00
Kansas	$100.00
Kentucky	$100.00
Minnesota	$100.00
Mississippi	$100.00
Missouri	$100.00
New Mexico	$100.00
North Carolina	$100.00
North Dakota	$100.00
Oklahoma	$100.00
Oregon	$100.00
Pennsylvania	$100.00
South Carolina	$100.00
South Dakota	$100.00
Tennessee	$100.00
Texas	$100.00
Utah	$100.00
Virginia	$100.00
Washington	$100.00
West Virginia	$100.00
Wisconsin	$100.00

Breed Associations

American Angus	$600.00
American Beefalo	$50.00
American Brahman	$200.00
American Chianina	$200.00
American Gelbvieh	$200.00
American Hereford	$500.00
American Int'l Charolais	$300.00
American Polled Hereford	$500.00
American Red Poll	$100.00
American Salers	$200.00
American Shorthorn	$200.00
American Simmental	$300.00
American Tarentaise	$100.00
Beefmaster Breeders	$300.00
Canadian Charolais	$200.00
Canadian Hereford	$100.00
Canadian Simmental	$100.00
International Brangus Breeders	$300.00
North American Limousin	$300.00
Red Angus	$200.00
Santa Gertrudis Breeders	$200.00

Others

Beefbooster Cattle Ltd.	$100.00
Canadian Hays Converter Association	$100.00
Great Western Beef Expo	$50.00
Manitoba Agriculture	$100.00
National Assoc. of Animal Breeders	$100.00
National Cattlemen's Association	$100.00
NOBA, Inc.	$100.00
Ontario Beef Cattle Performance	$100.00
Rancho Arboleda	$50.00
Ronald Schlegel	$50.00
Select Sires, Inc.	$100.00
Taylors Black Simmental	$50.00
Turner Bros. Farms, Inc.	$50.00
21st Century Genetics	$100.00
King Ranch	$50.00
Tri-State Breeders Corp.	$100.00
Connors State College	$100.00

BIF MEMBERS WHO HAVE NOT PAID MEMBERSHIP DUE FOR 1991 (as of May 15, 1991)

STATE BCIA'S

Idaho	$100.00
Montana	$100.00
New York	$100.00
Wyoming	$100.00

Breed Associations

Salers Association of Canada	$100.00

Others

American Breeders Service	$100.00
Barzona Breeders Association	$100.00
North American South Devon	$100.00
Maritime Beef Testing Society	$100.00
Livestock Dev. Div., Canada	$100.00
Montana Stock Growers	$100.00

THE SEEDSTOCK BREEDER HONOR ROLL OF EXCELLENCE

John Crowe	CA	1972
Dale H. Davis	MT	1972
Elliot Humphrey	AZ	1972
Jerry Moore	OH	1972
James D. Bennett	VA	1972
Harold A. Demorest	OH	1972
Marshall A. Mohler	IN	1972
Billy L. Easley	KY	1972
Messersmith Herefords	NE	1973
Robert Miller	MN	1973
James D. Hemmingsen	IA	1973
Clyde Barks	ND	1973
C. Scott Holden	MT	1973
William F. Borror	CA	1973
Raymond Meyer	SD	1973
Heathman Herefords	WA	1973
Albert West III	TX	1973
Mrs. R. W. Jones, Jr.	GA	1973
Carlton Corbin	OK	1973
Wilfred Dugan	MO	1974
Bert Sackman	ND	1974
Dover Sindelar	MT	1974
Jorgensen Brothers	SD	1974
J. David Nichols	IA	1974
Bobby Lawrence	GA	1974
Marvin Bohmont	NE	1974
Charles 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 Chesnut	WA	1975
George Chiga	OK	1975
Howard Collins	MO	1975
Jack Cooper	MT	1975
Joseph P. Dittmer	IA	1975
Dale Engler	KS	1975
Leslie J. Holden	MT	1975
Robert D. Keefer	MT	1975
Frank Kubik, Jr.	ND	1975
Licking Angus Ranch	NE	1975
Walter S. Markham	CA	1975
Gerhard Mittnes	KS	1976
Ancel Armstrong	VA	1976
Jackie Davis	CA	1976
Sam Friend	MO	1976
Healy Brothers	OK	1976
Stan Lund	MT	1976
Jay Pearson	ID	1976
L. Dale Porter	IA	1976
Robert Sallstrom	MN	1976
M. D. Shepherd	ND	1976
Lowellyn Tewksbury	ND	1976
Harold Anderson	SD	1977
William Borror	CA	1977
Robert Brown, Simmental	TX	1977
Glen Burrows, PRI	NM	1977
Henry, Jeanette Chitty	FL	1977
Tom Dashiell, Hereford	WA	1977
Lloyd DeBruycker	MT	1977
Wayne Eshelman	WA	1977
Hubert R. Freise	ND	1977
Floyd Hawkins	MO	1977
Marshall A. Mohler	IN	1977
Clair Percel	KS	1977
Frank Ramackers, Jr.	NE	1977
Loren Schlipf	IL	1977
Tom & Mary Shaw	ID	1977
Bob Sitz	MT	1977
Bill Wolfe	OR	1977
James Volz	MN	1977
A. L. Frau		1978
George Becker	ND	1978
Jack Delaney	MN	1978
L. C. Chestnut	WA	1978
James D. Benett	VA	1978
Healey Brothers	OK	1978
Frank Harpster	MO	1978
Bill Womack, Jr.	AL	1978
Larry Berg	IA	1978
Buddy Cobb	MT	1978
Bill Wolfe	OR	1978
Roy Hunt	PA	1978
Del Krumwied	ND	1979
Jim Wolf	NE	1979
Rex & Joann James	IA	1979
Leo Schuster Family	MN	1979
Bill Wolfe	OR	1979
Jack Ragsdale	KY	1979
Floyd Mette	MO	1979
Glenn & David Gibb	IL	1979

Peg Allen	MT	1979	E. A. Keithley	MO	1983
Frank & Jim Willson	SD	1979	J. Earl Kindig	MO	1983
Donald Barton	UT	1980	Jake Larson	ND	1983
Frank Felton	MO	1980	Harvey Lemmon	GA	1983
Frank Hay	CAN	1980	Frank Myatt	IA	1983
Mark Keffeler	SD	1980	Stanley Nesemeier	IL	1983
Bob Laflin	KS	1980	Russ Pepper	MT	1983
Paul Mydland	MT	1980	Robert H. Schafer	MN	1983
Richard Tokach	ND	1980	Alex Stauffer	WI	1983
Roy & Don Udelhoven	WI	1980	D. John & Lebert Shultz	MO	1983
Bill Wolfe	OR	1980	Phillip A. Abrahamson	MN	1984
John Masters	KY	1980	Rob Bieber	SD	1984
Floyd Dominy	VA	1980	Jerry Chappell	VA	1984
James Bryan	MN	1980	Charles W. Druin	KY	1984
Charlie Richards	IA	1980	Jack Farmer	CA	1984
Blythe Gardner	UT	1980	John B. Green	LA	1984
Richard McLaughlin	IL	1980	Ric Hoyt	OR	1984
Bob Dickinson	KS	1981	Fred H. Johnson	OH	1984
Clarence Burch	OK	1981	Earl Kindig	VA	1984
Lynn Frey	ND	1981	Glen Klippenstein	MO	1984
Harold Thompson	WA	1981	A. Harvey Lemmon	GA	1984
James Leachman	MT	1981	Lawrence Meyer	IL	1984
J. Morgan Donelson	MO	1981	Donn & Sylvia Mitchell	CAN	1984
Clayton Canning	CAN	1981	Lee Nichols	IA	1984
Russ Denown	MT	1981	Clair K. Parcel	KS	1984
Dwight Houff	VA	1981	Joe C. Powell	NC	1984
G. W. Cornwell	IA	1981	Floyd Richard	ND	1984
Bob & Gloria Thomas	OR	1981	Robert L. Sitz	MT	1984
Roy Beeby	OK	1981	Ric Hoyt	OR	1984
Herman Schaefer	IL	1981	J. Newbill Miller	VA	1985
Myron Aultfathr	MN	1981	George B. Halterman	WV	1985
Jack Ragsdale	KY	1981	David McGehee	KY	1985
W. B. Williams	IL	1982	Glenn L. Brinkman	TX	1985
Garold Parks	IA	1982	Gordon Booth	WY	1985
David A. Breiner	KS	1982	Earl Schafer	MN	1985
Joseph S. Bray	KY	1982	Marvin Knowles	CA	1985
Clare Geddes	CAN	1982	Fred Killam	IL	1985
Howard Krog	MN	1982	Tom Perrier	KS	1985
Harlin Hecht	MN	1982	Don W. Schoene	MO	1985
William Kottwitz	MO	1982	Everett & Ron Batho		
Larry Leonhardt	MT	1982	& Families	CAN	1985
Frankie Flint	NM	1982	Bernard F. Pedretti	WI	1985
Gary & Gerald Carlson	ND	1982	Arnold Wienk	SD	1985
Bob Thomas	OR	1982	R. C. Price	AL	1985
Orville Stangl	SD	1982	Clifford & Bruce Betzold	IL	1986
C. Ancel Armstrong	KS	1983	Gerald Hoffman	SD	1986
Bill Borror	CA	1983	Delton W. Hubert	KS	1986
Charles E. Boyd	KY	1983	Dick & Ellie Larson	WI	1986
John Bruner	SD	1983	Leonard Lodden	ND	1986
Leness Hall	WA	1983	Ralph McDanolds	VA	1986
Ric Hoyt	OR	1983	Roy D. McPhee	CA	1986

W. D. Morris & James Pipkin	MO	1986
Clarence Van Dyde	MT	1986
John H. Wood	SC	1986
Evin & Verne Dunn	CAN	1986
Glenn L. Brinkman	KS	1986
Jack & Gini Chase	WY	1986
Henry & Jeannette Chitty	FL	1986
Lawrence H. Graham	KY	1986
A. Lloyd Grau	NM	1986
Mathew Warren Hall	AL	1986
Richard J. Putnam	NC	1986
Robert J. Steward & Patrick C. Morrissey	OR	1986
Leonard Wulf	MN	1986
Charles & Wynder Smith	GA	1987
Lyall Edgerton	CAN	1987
Tommy Branderberger	TX	1987
Henry Gardiner	KS	1987
Gary Klein	ND	1987
Ivan & Frank Rincker	IL	1987
Larry D. Leonhardt	WY	1987
Harold E. Pate	AL	1987
Forrest Byergo	MO	1987
Clayton Canning	CAN	1987
James Bush	SD	1987
Robert J. Steward & Patrick C. Morrissey	OR	1987
Eldon & Richard Wiese	MN	1987
Douglas D. Bennett	TX	1988
Don & Diane Guilford and David & Carol Guilford	CAN	1988
Kenneth Gillig	MO	1988
Bill Bennett	WA	1988
Hansell Pile	KY	1988
Gino Pedretti	CA	1988
Leonard Lorenzen	OR	1988
George Schlickau	KS	1988
Hans Ulrich	CAN	1988
Donn & Sylvia Mitchell	CAN	1988
Darold Bauman	WY	1988
Glynn Debter	AL	1988
William Glanz	WY	1988
Jay P. Book	IL	1988
David Luhman	MN	1988
Scott Burtner	VA	1988
Robert E. Walton	WS	1988
Harry Airey	CAN	1989
Ed Albaugh	CA	1989
Jack & Nancy Baker	MO	1989
Ron Bowman	ND	1989
Jerry Allen Burner	VA	1989
Glynn Debter	AL	1989
Sherm & Charlie Ewing	CAN	1989
Donald Fawcett	SD	1989
Orrin Hart	CAN	1989
Leonard A. Lorenzen	OR	1989
Kenneth D. Lowe	KY	1989
Tom Mercer	WY	1989
Lynn Pelton	KS	1989
Lester H. Schafer	MN	1989
Bob R. Whitmire	GA	1989
Dr. Burleigh Anderson	PA	1990
Boyd Broyles	KY	1990
Larry Earhart	WY	1990
Steven Forrester	MI	1990
Doug Fraser	CAN	1990
Gerhard Gueggenberger	CA	1990
Douglas & Molly Hoff	SD	1990
Richard Janssen	KS	1990
Paul E. Keffaber	IN	1990
John & Chris Oltman	WI	1990
John Ragsdale	KY	1990
Otto & Otis Rincker	IL	1990
Charles & Ruby Simpson	CAN	1990
T. D. & Roger Steele	VA	1990
Bob Thomas Family	OR	1990
Ann Upchurch	**AL**	**1991**
Nicholas Wehrmann & Richard McClung	**VA**	**1991**
John Bruner	**SD**	**1991**
Ralph Bridges	**GA**	**1991**
Dave & Carol Guilford	**CAN**	**1991**
Richard & Sharon Beitelspacher	**SD**	**1991**
Tom Sonderup	**NE**	**1991**
Steve & Bill Florschuetz	**IL**	**1991**
R. A. Brown	**TX**	**1991**
Jim Taylor	**KS**	**1991**
R. M. Felts & Son Farm	**TN**	**1991**
Jack Cowley	**CA**	**1991**
Rob & Gloria Thomas	**OR**	**1991**
James Burns & Sons	**WI**	**1991**
Jack & Gini Chase	**WY**	**1991**
Simmitcrest Farms	**OH**	**1991**
Larry Wakefield	**MN**	**1991**
James R. O'Neill	**IA**	**1991**

SEEDSTOCK BREEDER OF THE YEAR

John Crowe	CA	1972	A. F. "Frankie" Flint	NM	1982
Mrs. R. W. Jones	GA	1973	Bill Borror	CA	1983
Carlton Corbin	OK	1974	Lee Nichols	CA	1984
Leslie J. Holden	MT	1975	Ric Hoyt	OR	1985
Jack Cooper	MT	1975	Leonard Lodoen	ND	1986
Jorgensen Brothers	SD	1976	Harry Gardiner	KS	1987
Glenn Burrows	NM	1977	W. T. "Bill" Bennett	WA	1988
James D. Bennett	VA	1978	Glynn Debter	AL	1989
Jim Wolfe	NE	1979	Doug & Molly Huff	SD	1990
Bill Wolfe	OR	1980	**Summitcrest Farms**	**OH**	**1991**
Bob Dickinson	KS	1981			

THE COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

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

Carl Odegard	MT	1982
Marvin & Donald Stoker	IA	1982
Sam Hands	KS	1982
Larry Campbell	KY	1982
Lloyd Atchison	CAN	1982
Earl Schmidt	MN	1982
Raymond Josephson	ND	1982
Clarence Reutter	SD	1982
Leonard Bergen	CAN	1982
Kent Brunner	KS	1983
Tom Chrystal	IA	1983
John Freitag	WI	1983
Eddie Hamilton	KY	1983
Bill Jones	MT	1983
Harry & Rick Kline	IL	1983
Charlie Kopp	OR	1983
Duwayne Olson	SD	1983
Ralph Pederson	SD	1983
Ernest & Helen Schaller	MO	1983
Al Smith	VA	1983
John Spencer	CA	1983
Bud Wishard	MN	1983
Bob & Sharon Beck	OR	1984
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
Don Moch	ND	1984
Neil Moffat	CAN	1984
William H. Moss, Jr.	GA	1984
Dennis P. Solvie	MN	1984
Robert P. Stewart	KS	1984
Charlie Stokes	NC	1984
Milton Wendland	AL	1985
Bob & Sheri Schmidt	MN	1985
Delmer & Joyce Nelson	IL	1985
Harley Brockel	SD	1985
Kent Brunner	KS	1985
Glenn Harvey	OR	1985
John Maino	CA	1985
Ernie Reeves	VA	1985
John E. Rouse	WY	1985
George & Thelma Boucher	CAN	1985
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 Adamsson	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. M. & D. A. McGee	IL	1988
William E. White	KY	1988
Frederick M. Mallory	CA	1988
Stevenson Family	OR	1988
Gary Johnson	KS	1988
John McDaniel	AL	1988
William A. Stegner	ND	1988
Lee Eaton	MT	1988
Larry D. Cundall	WY	1988
Dick & Phyllis Henze	MN	1988
Jerry Adamson	NE	1989
J. W. Aylor	VA	1989
Jerry Bailey	ND	1989
James G. Guyton	WY	1989
Kent Koostra	KY	1989
Ralph G. Lovelady	AL	1989
Thomas McAvoy, Jr.	GA	1989
Bill Salton	IA	1989
Lauren & Mel Shuman	CA	1989
Jim Tesher	ND	1989
Joe Thielen	KS	1989
Eugene & Ylene Williams	MO	1989
Phillip, Patty & Greg Bartz	MO	1990
John J. Chrisman	WY	1990
Les Herbst	KY	1990
Jon C. Ferguson	KS	1990
Mike & Diana Hooper	OR	1990
James & Joan McKinlay	CAN	1990
Gilbert Meyer	SD	1990
DuWayne Olson	SD	1990
Raymond R. Peugh	IL	1990
Lewis T. Pratt	VA	1990

Ken and Wendy Sweetland	CAN	1990	Reuben & Connee Quinn	SD	1991
Swen R. Swenson Cattle Co.	TX	1990	Dave & Sandy Umbarger	OR	1991
Robert A. Nixon & Son	VA	1991	James A. Theeck	TX	1991
Murray A. Greaves	CAN	1991	Ken Stielow	KS	1991
James Hauff	ND	1991	John E. Hanson, Jr.	CA	1991
Pat Hardy	GA	1991	Charles & Clyde Henderson	MO	1991
J. R. Anderson	WI	1991	Russ Green	WY	1991
Ed & Rich Blair	SD	1991	Bollman Farms	IL	1991
			Craig Utesch	IA	1991

COMMERICAL PRODUCER OF THE YEAR

Chan Cooper	MT	1972	Sam Hands	KS	1982
Pat Wilson	FL	1973	Al Smith	VA	1983
Lloyd Nygard	ND	1974	Bob & Sharon Beck	OR	1984
Gene Gates	KS	1975	Glenn Harvey	OR	1985
Ron Blake	OR	1976	Charles Fariss	VA	1986
Steve & Mary Garst	IA	1977	Rodney G. Oliphant	KS	1987
Mose Tucker	AL	1978	Gary Johnson	KS	1988
Bert Hawkins	OR	1979	Jerry Adamson	NE	1989
Jeff Kilgore	MT	1980	Mike & Diana Hooper	OR	1990
Henry Gardiner	KS	1981	Dave & Sandy Umbarger	OR	1991

AMBASSADOR AWARD

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. de Baca	The Ideal Beef Memo	IA	1990

PIONEER AWARDS

Jay L. Lush	Iowa State University	Research	1973
John H. Knox	New Mexico State University	Research	1973
Ray Woodward	American Breeders Service	Research	1974
Fred Willson	Montana State University	Research	1974
Charles E. Bell, Jr.	USDA-FES	Education	1974
Reuben Albaugh	University of California	Education	1974
Paul Pattengale	Colorado State University	Education	1974
Glenn Butts	Performance Registry Int'l	Service	1975
Keith Gregory	RHLUSMARC	Research	1975
Bradford Knapp, Jr.	USDA	Research	1975
Forrest Bassford	Western Livestock Journal	Journalism	1976
Doyle Chambers	Louisiana State University	Research	1976
Mrs. Waldo Emerson Forbes	Wyoming Breeder	Breeder	1976
C. Curtis Mast	Virginia BCIA	Education	1976
Dr. H. H. Stonaker	Colorado State University	Research	1977
Ralph Bogart	Oregon State University	Research	1977
Henry Holszman	South Dakota State University	Education	1977
Marvin Koger	University of Florida	Research	1977
John Lasley	University of Florida	Research	1977
W. L. McCormick	Tifton, Georgia Test Station	Research	1977
Paul Orcutt	Montana Beef Performance Assoc.	Education	1977
J. P. Smith	Performance Registry Int'l	Education	1977
James B. Lingle	Wye Plantation	Breeder	1978
R. Henry Mathiessen	Virginia Breeder	Breeder	1978
Bob Priode	VPI & SU	Research	1978
Robert Koch	RLHUSMARC	Research	1979
Mr. & Mrs. Carl Roubicek	University of Arizona	Research	1979
Joseph J. Urick	US Range Livestock Experiment Station	Research	1979
Byron L. Southwell	Georgia	Research	1980
Richard T. "Scotty" Clark	USDA	Research	1980
F. R. "Ferry" Carpenter	Colorado	Breeder	1981
Clyde Reed	Oklahoma State University		1981
Milton England	Panhandle A & M College		1981
L. A. Moddox	Texas A & M College		1981
Charles Pratt	Oklahoma		1981
Otha Grimes	Oklahoma		1981
Mr. & Mrs. Percy Powers	Texas		1982
Gordon Dickerson	Nebraska		1982
Jim Elings	California		1983
Jim Sanders	Nevada		1983
Ben Kettle	Colorado		1983
Carroll O. Schoonover	University of Wyoming		1983
W. Dean Frischknecht	Oregon State University		1983
Bill Graham	Georgia		1984
Max Hammond	Florida		1984
Thomas J. Marlowe	VPI & SU		1984
Mick Crandell	South Dakota State University		1985
Mel Kirkiede	North Dakota State University		1985
Charles R. Henderson	Cornell University (Retired)		1986

Everett J. Warwick	USDA-ARS (Retired)	1986
Glenn Burrows	New Mexico	1987
Carlton Corbin	Oklahoma	1987
Murray Corbin	Oklahoma	1987
Max Deets	Kansas	1987
George F. & Mattie Ellis	New Mexico	1988
A. F. "Frankie" Flint	New Mexico	1988
Christian A. Dinkel	South Dakota State University (Retired)	1988
Roy Beeby	Oklahoma	1989
Will Butts	Tennessee	1989
John W. Massey	Missouri	1989
Donn and Sylvia Mitchell	Manitoba, Canada	1990
Hoon Song	Agriculture Canada	1990
Jim Wilton	University of Guelph, Canada	1990
Bob Long	**Texas Tech**	**1991**
Bill Turner	**Texas A&M**	**1991**

CONTINUING SERVICE AWARDS

Clarence Burch	OK	1972
F. R. Carpenter	CO	1973
E. J. Warwick	DC	1973
Robert De Baca	IA	1973
Frank H. Baker	OK	1974
D. D. Bennett	OR	1974
Richard Wilham	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**

ORGANIZATIONS OF THE YEAR

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

NOMINEES FOR SEEDSTOCK PRODUCER OF THE YEAR

Richard Beitelspacher
Beitelspacher Ranch
Bowdle, South Dakota

Thirty-two years ago Richard and Sharon Beitelspacher began their Simmental herd by artificially inseminating a base Angus herd. Today the operation consists of 400 registered Simmental cows and 110 commercial cows.

For 21 years the Beitelspacher's have kept herd records through the performance program of the American Simmental Association. These individual performance records, which include EPDs, feed conversion, carcass data and calving intervals, are used in selecting herd bulls and culling cows.

Artificial insemination has been used extensively since the beginning of their Simmental operation. Today 60% of the cows are artificially inseminated. Throughout the years they have been involved in several experiments involving heat synchronization.

Richard is a member of the American Simmental Association and the South Dakota Simmental Association where he is the Junior Association's Advisor and a Past Board Director.

Nominated by South Dakota Beef Cattle Improvement Association

Ralph Bridges
Bridges Angus Farm
Lexington, Georgia

In his teens he was a Master 4-H Club member; today he owns one of Georgia largest purebred operations. In 1944 he purchased his first Angus heifer; today he owns 500 purebred Angus cattle, 700 commercial cattle and 150 stockers.

Ralph Bridges has been a cattleman for fifty years. He and his wife Margaret started from scratch and have built a successful family farm on 1200 acres and another 2000 leased acres.

In the eight years of keeping performance records with the Angus Herd Improvement Record, he has observed increases in the average weaning weights about 100 lbs. The calf crop percentage has consistently been 90% or higher.

Bulls produced at Bridges Angus Farm have been high selling or high performing at central test stations in Georgia, South Carolina and Tennessee.

Artificial insemination, embryo transfer, and estrous synchronization are all used to take advantage of high growth and high maternal germ plasm in the Angus breed.

Ralph is on the board of directors of the American Angus Association, president of the Georgia Angus Association and vice president of the Georgia Cattlemen's Association.

Nominated by Georgia Cattlemen's Association

Jack Cowley
Tranquility Brangus Ranches
Sacramento, California

Jack Cowley has 400 Brangus cows in his seedstock breeding herd and 300 cows in his commercial herd.

Jack artificially inseminates anywhere from 60-70% of his cows. In his breeding program, the cows and heifers are mated with bulls that complement their individual EPD traits.

Improvements made over time in his herd include the percentage calf crop which has increased 25% -- from 65% to 90%. Weaning weights have also increased more than 75 lbs. for heifers and bulls.

Fertility is an important criteria in his selection for the seedstock herd. Bulls are selected to increase weaning and yearling weights with minimum impact on birth weights.

Jack has served as director of the California Beef Cattle Improvement Association, the WCBBCA and the IBBA along with serving in several other executive positions in each organization.

Nominated by California Beef Improvement Association

Mac & Frank Felts
R. M. Felts & Son Farm
Springfield, Tennessee

R. M. Felts raised five sons on a cattle farm in Robertson County during the 1900s. Two of these sons were Frank and Mac Felts. Frank became an engineer until 1972 when he retired and came back to the farm where his brother Mac was running a commercial herd along with a road construction business.

After much research, the brothers decided to launch a purebred Simmental herd in 1975 aimed at producing bulls to be used in the commercial industry. The Felts have never shown any cattle. Yet, their reputation for producing top performing, sound, functional Simmental increased.

In the Central Tennessee Bull Test Station, they had the top performing bull of their breed six times and the top performing overall breeds twice during an eight-year period. In 1988 Select Sires purchased a bull at the test station from them.

Because both brothers were over 75 years of age, they dispersed their herd selling 256 lots for a $2306 average with cattle going to 16 states and some of the top purebred herds in the nation.

Frank died in December, 1990.

Nominated by the Tennessee Beef Cattle Improvement Association

Dave and Carol Guilford
Guilford Farms
Clearwater, Manitoba

Dave and Carol Guilford own a farm that was started in 1905 by Dave's grandfather. They are continuing the family tradition of raising Polled Hereford cattle and have 450 head including 160 seedstock cows and 20 commercial cows.

Yearling weights and maternal breeding values are used in selecting replacement females, along with EPDs and the fertility of their mothers.

Fertility and milking ability are the selection criteria used in the seedstock herd. Cows must be bred in 70 days and produce a calf with an index of 95 or higher at weaning to remain in the herd.

Dave has served as president and director of the Manitoba Hereford Association and is a member of the Canadian Hereford Association.

Nominated by Canadian Hereford Association

Jim Burns
James Burns and Sons Farms
Almond, Wisconsin

In 1978 Jim Burns began developing a performance-oriented Simmental herd of 600 cows. Jim has used the most up-to-date innovations along with a strict adherence to performance. Last year he installed a computer data entry system that feeds herd data directly to the breed association.

Artificial insemination is used on all of his cows and is done so in a 75-day breeding season.

EPDs are used in selecting for calving ease, birth weights and maternal performance. EPDs are also Jim's main culling tool. Birth and maternal traits are evaluated as well as adjusted 205-day weights and ratios.

Improvements made in his herd since 1978 include an increase in the average adjusted 205-day weights and in the average adjusted 365-day weights in over 100 lbs. each.

Nominated by Wisconsin Beef Improvement Association

Jack & Gini Chase
Buffalo Creek Red Angus
Leiter, Wyoming

Jack and Gini Chase have 290 purebred cows and 270 commercial cows in their Red Angus operation.

The Chases produce moderately framed cattle, emphasizing calving ease and fertility, that complement the larger breeds instead of attempting to outpower them.

Performance records are an important part of their operation in the buying and selling process. Accurate performance records are essential when buying bulls. Likewise, complete records are kept on all of their calves and make available to customers.

Artificial insemination use percentages vary from year to year, but usually from 60-80% of their cows are artificially inseminated and all of their heifers are.

Jack recently served two terms as president of the Beef Improvement Federation and the Red Angus Association of America, while Gini served on the board of directors of the Red Angus Association of America.

Nominated by Wyoming Beef Cattle Improvement Association

Bill & Steve Florschuetz
Florschuetz Angus
Sublette, Illinois

The father and son team Bill and Steve Florschuetz own and operate a farm that has been in the cattle business for 43 year s and in the seedstock business for 32 years.

They have Angus, Simmental and Charolais in their 31 cow seedstock, 60 cow commercial operation.

Calving ease, heavy weaning and yearling weights, fertility and cutability are all important criteria in the selection process for their seedstock herd.

Improvements made in their herd since they began keeping performance records 19 years ago include an increase of 184 lbs. in weaning weights from 396 lbs. to 580 lbs. Yearling weights have increased by 227 lbs. for bulls and 52 lbs. for heifers.

Nominated by Cooperative Extension Service

Ann Upchurch
Grey Rocks Ranch
Selma, Alabama

Ann Upchurch has been breeding Santa Gertrudis cattle since 1964. She has 303 cows in her seedstock herd and 102 cows in her commercial herd.

Ann maintains extensive production records on all of her beef cattle, and she has kept individual performance records on all cows and calves for more than 26 years. She developed her own computer program that best suits the management needs of her ranch.

She makes extensive use of EPDs in selecting herd sires and replacement females.

Since she has been keeping records she has noted several improvements in her herd. The calf crop percentage has increased 26%, with 5% of that within the last five years. Weaning weights have increased 34 lbs. over a five year span while yearling weights have increased 13 lbs.

Ann has served as president and secretary of the Alabama Santa Gertrudis Association and is a member of the Alabama Cattlemen's Association and the Alabama Purebred Beef Breeds Council.

Nominated by Alabama Beef Cattle Improvement Association

Nick Wehrmann & Richard McClung
Wehrmann Angus
New Market, Virginia

Nick Wehrmann and Richard McClung have 300 cows in their Angus seedstock herd. The herd was moved to New Market in 1986 after being in Cairo, Georgia for 11 years.

Artificial insemination is used on 87% of their cows. Herd sires that are selected for both AI and cleanup bulls are selected primarily based on their EPDs.

Wehrmann and McClung give a high priority to produce balanced trait cattle. They want moderate birth weight and high weaning and yearling weights as long as the cows are able to rebreed and not get too big at maturity.

Improvements have been made in the herd since the move to Virginia. Weaning weights have increased 130 lbs., and yearling weights have increased 100 lbs. The calf crop percentage has stabilized at 95%.

Richard has served on the board of directors of the Virginia Angus Association and the Virginia Beef Improvement Association.

Nominated by Virginia Beef Cattle Improvement Association

James O'Neill
O'Neill Angus Farm
Logan, Iowa

James O'Neill and his son have an Angus cattle operation with 165 cows and 60 commercial cows.

Their goal, when beginning their operation, was to produce the type of cattle that is capable of making money for all segments of the beef cattle industry. This goal has been met by retaining the best females, purchasing the best affordable bulls and building a valuable commercial trade, then a purebred trade.

In the past 20 years weaning weights have increased an average of 195 lbs. for bulls and 180 lbs. for heifers. Yearling weights have also increase with an average of almost 400 lbs. for bulls and 220 lbs. for heifers. The calf crop percentage has increased 4% from 92% to 96%.

James is a member of the American Angus Association and the Iowa Angus Association.

Nominated by Iowa's Cattlemen's Association

Rob Brown
R. A. Brown Ranch
Throckmorton, Texas

Rob Brown is the owner of a ranch that has been in his family for 87 years. Around the turn of the century his grandfather bought 4500 acres and had one of the state's first registered Herefords herds.

Today Rob is the owner of more than 112,000 acres with five purebred herds: Simmental, Simbrah, Red Angus, Senepol and Angus. He has 1350 cows in his purebred herds and 1680 in his commercial herd.

Calving ease, balanced EPDs and moderate frame bulls are important criteria emphasized in the selection process for his seedstock herd.

Artificial insemination is used on 70% of his cows, and embryo transfer has produced over 500 pregnancies in top progeny proven cows.

During the last 20 years of keeping performance records, weaning and yearling adjusted weights have been continually increasing, and the percentage of two year old heifers assisted has dropped from more than 50% to less than 10%.

Rob serves as director of the National Cattlemen's Association and the American International Senepol Association and has served in several executive positions in the American Simmental Association.

Nominated by Texas Agricultural Extension Service

John Bruner
Bruner Limousin
Winfred, South Dakota

For eighteen years, John Bruner has had a seedstock Limousin herd.

John's goal in his 200-cow herd breeding program is to produce red meat on the basis of pounds per unit of input instead of on the basis of pound per cow. His definition of performance goes beyond weaning and yearling weights to include conception and pregnancy rates, mature weight as it relates to carrying capacity and calving ease. By selecting cattle with a moderate mature size, it maximizes the number of cow units on a given land base.

Artificial insemination is used on 90% of his cows.

Birth weight and yearling weight and the relationship of the two expressed in EPDs is an important consideration in the selection for the seedstock herd. Also, matings are made to keep milking ability EPDs positive.

John is a member of the National Cattlemen's Association and has served as president of the South Dakota Limousin Association.

Nominated by North American Limousin Foundation

Jim Taylor
Taylor's Black Simmental
Winona, Kansas

Jim Taylor owns and operates an 8400 acre farm and ranch with 385 black Simmental cows in his seedstock herd and 25 cows in his commercial herd.

Jim's goal is to eventually develop a line of Simmental cattle that is homozygous black incorporating calving ease, performance positive maternal characteristics and carcass quality as key selection criteria. These standards will allow him to produce easy calving, fast growing bulls for the commercial breeder.

His objective is to produce purebred Simmentals that are not only homozygous black but ones that are also polled. He continuously selects for polled cattle. All herd bulls used are polled but not homozygous polled.

Improvements made in the herd since he began his seedstock Simmental herd 12 years ago include an increase in calf crop percentage due to a more thorough health program and more detailed management. Also, the adjusted 205-day weights of commercial calves increased almost 100 lbs. -- from 416 lbs. to 600 lbs.

Nominated by Kansas Livestock Association

Rob & Gloria Thomas
Thomas Angus Ranch
Baker, Oregon

Forty-four years ago Rob and Gloria Thomas started an Angus seedstock operation. Today is has expanded into a three-family operation to include both of their children's families. They have 600 cows in their herd.

Artificial insemination is used on 95% of their cows.

Because the Thomas's have a diverse market, the herd is divided into two groups. One group of cows is bred for moderate birth weights and high maternal traits. The other group of cows is bred with emphasis placed on calving ease and growth.

Improvements made in the 17 years of keeping performance records include a shortening in calving season and an increased conception rate. Also, weaning weights have increased 145 lbs.--from 538 lbs. to 683 lbs. in bulls and 131 lbs.--from 457 lbs. to 588 lbs. in heifers. Yearling weights have also increase 149 lbs. for bulls and 115 lbs. for heifers.

Bob is on the board of directors of the American Angus Association and is the director of the Oregon Angus Association. Gloria is a member of the American Angus Auxiliary Membership Committee.

Nominated by Oregon Cattlemen's Association

Fred Johnson
Summitcrest Farms
Summitville, Ohio

Fred Johnson has been a registered Angus breeder since 1949. He owns one of the largest Angus seedstock operations in the country with operations in Ohio, Iowa and Nebraska--more than 17000 acres with 1150 seedstock cows and 200 commercial cows.

Artificial insemination is used on about 95% of the cows so about 80% of the calf crop is produced by AI.

Fred uses a well ordered farm records system and the Angus Herd Improvement Record program to keep individual performance records on all cattle. Performance records dictate the entire spectrum for this Angus seedstock operation that has seen the use of his herd bulls in forty-five state, seven Canadian provinces, as well as three South American Countries, Australia, New Zealand, and Zimbabwe.

For the selection of the seedstock herd, he focuses on a balanced trait selection scheme with emphasis on moderate birth weight EPDs and high yearling weight EPDs. Emphasis is also placed on positive EPDs for carcass traits including marbling, ribeye area and average carcass weights.

Fred is a member of the Ohio Cattlemen's Association, a director on the Ohio Beef Council, and committee chairman of the National Beef Board.

Nominated by Buckeye Improvement Federation

Larry Wakefield
Wakefield Farms
New Richland, Minnesota

Larry Wakefield has between 60 and 65 Charolais and Salers cows in his seedstock herd. Larry lists performance as the most important criteria in the selection for his seedstock herd along with disposition, birth weight and soundness with emphasis on fertility and milking ability.

About 40% of his bulls are placed in central test stations at weaning. He has placed bulls in central tests in Iowa, Minnesota as well as the Wisconsin-Minnesota test.

Improvements made in his herd during the 19 years of keeping performance records include a consistent increase in calf crop percentage from 90% in 1964 to 99% in 1989. Increases have also occurred in 205-day weights -- from 524 lbs. to 685 (161 lbs.) as well as in weaning weights -- from 798 lbs. to 1100 lbs. (302 lbs.)

Larry is a founder and charter member of the Minnesota Charolais Association, as well as a director, and the Minnesota Salers Association where he serves as president and is a member of the National Charolais Association.

Nominated by Minnesota Beef Cattle Improvement Association

Tom Sonderup
Sonderup Charolais Ranch
Fullerton, Nebraska

Tom Sonderup has been involved with Charolais cattle for 19 years. He now has 360 cows in his seedstock herd. Tom has been selecting, producing and marketing his herd on performance records since he has been in the beef cattle business.

Artificial insemination is used on all of his replacement heifers and 100 cows. In order to achieve a uniform calf crop, he selects bulls that will complement each cow's weak trait. Embryo transfer is also used to produce additional daughters or to try to either produce or replace a herd sire out of older, proven cows.

In 14 years of keeping performance records, the bulls average weaning weights have increased 280 lbs. from 398 lbs. to 678 lbs. Yearling weights have increased 311 lbs. from 911 lbs. to 1222 lbs.

Tom is on the board of directors of the American Charolais Association, has served several executive positions on the Nebraska Charolais Association, and is member of the American International Charolais Association and the Nebraska Cattlemen's Association.

Nominated by American International Charolais Association

JOHNSON NAMED TOP SEEDSTOCK PRODUCER OF THE YEAR

Angus breeder Fred Johnson of Summitcrest Farms, Summitville, Ohio, has been recognized as seedstock producer of the year by the Beef Improvement Federation. An Angus breeder since 1949, Johnson owns one of the largest Angus seedstock operations in the United States. His farms in Ohio, Iowa and Nebraska include more than 17,000 acres, 1,150 registered cows and 200 commercial cows.

Johnson maintains complete individual performance records on all of his cattle, and he strives for balanced trait selection that emphasizes moderate birth weight EPDs and high yearling weight carcass traits, including marbling, ribeye area and average carcass weights.

Artificial insemination plays a major role in Johnson's program. Approximately 95 percent of the cows are bred artificially, producing about 80 percent of his calf crop.

Pictured left to right: Henry Bergfeld, Betty Johnson, Fred Johnson and Jack Chase

NOMINEES FOR COMMERCIAL PRODUCER OF THE YEAR

Craig Utesch
Triple U Ranch Inc.
Correctionville, Iowa

Craig Utesch owns a ranch along with his father and three brothers with 165-175 cows and 3350 stockers.

His breeding program is diversified into three breeds -- Simmental, Gelbvieh and Salers -- of registered cows and several crosses of commercial cows. This diversity is obtained by extensive artificial insemination and by "spreading" cows over six pastures to allow a different breed of bull in any one pasture.

The registered cows are artificially inseminated to bulls of their own breed. Selected commercial cows are artificially inseminated to Red Angus, Chianina, Maine Anjou, Simmental or Angus bulls to produce club calves, commercial replacements or terminal cross feeder cattle.

Genetics and environment are the two biggest improvements in the management of his herd. Genetics has improved by production testing the herd and by using genetically superior bulls. He improved environment by reseeding and fertilizing pastures, rotational grazing of these pastures, providing cheap quality roughages during winter grazing and calving on rye to keep calves out of the mud.

Craig is a member of the American Simmental, American Gelbvieh and American Salers associations.

Nominated by Iowa Cattlemen's Association

Robert & Tom Nixon
Glenmary Farm
Orange, Virginia

Robert and Tom Nixon own a father-son cattle operation: 202 commercial cows, 700 stockers and 40 finished cattle.

Their crossbred herd is bred by artificial insemination to progeny-proven bulls and by natural service to performance testing bulls. Angus and Simmental bulls are primarily used. Most often the first-calf heifers are bred by AI to Angus bulls with EPD accuracy for low birth weight and high milk. This results in reduced calving difficulty and calves with good weaning and yearling weights. All cows are bred by natural service to bulls that are selected based on individual performance and EPDs emphasizing calving ease, weaning and yearling weights and maternal milk.

Improvements made in their herd include a 10% increase in the last five years in weaning weights, which are now over 550 lbs., and a maintained 95% calf crop percentage.

Nominated by Virginia Beef Cattle Improvement Association

Reuben & Connee Quinn
Quinn Cow Company
Chadron, Nebraska

Reuben and Connee Quinn own a cattle operation of 550 commercial cows (Angus, Simmental, and most recently, Polled Hereford) and 50 stockers.

The cows are used in a two-breed rotation to create a maternal oriented crossbred cow capable of functioning profitably in a semi-arid range.

For the past five years, replacement heifers have been estrous synchronized and artificially inseminated to bulls with stacked pedigrees for calving ease and high accuracy EPDs. Replacement heifers are selected based on weaning and yearling weight ratios, pelvic area, disposition and frame size.

During the past 10 years, careful attention to performance records have increased weaning weights by about 175 lbs. and yearling weights by about 250 lbs.

Reuben and Connee are members of the South Dakota and Nebraska Stockgrowers Association and participate in local, stat e and national activities and committee of the Integrated Resource Management.

Nominated by South Dakota Beef Cattle Improvement Association

Kenneth Stielow
Bar S Ranch
Paradise, Kansas

Kenneth Stielow and his father own and operate an 8000 acre ranch with 400 cows and 1500 stockers.

Their cows herd is primarily Angus cows, with some Amerifax. One hundred are registered.

The introduction of artificial insemination and heat synchronization -- along with the availability of high accuracy EPD-AI sires -- was the biggest improvement of their herd.

By developing a workable AI program and having a group of homogeneous commercial cows, they moved into the area of sire group carcass testing. Ken feels that it is an area that the industry must pursue to find out exactly where they are before they can make progress in filling the different areas of consumer demand in the future.

Nominated by Kansas Livestock Association

Dave and Sandy Umbarger
Umbarger Ranches
Pendleton, Oregon

Dave and Sandy Umbarger own a ranch established 62 years ago of 2700 acres of mountain pasture, 2075 acres of cropland and 780 commercial cows.

The herd was originally a purebred Hereford; they've added Angus. They use Simmental bulls to increase growth and milk. They prefer 1/4 Simmental, 3/4 Angus cows that are efficient, easy flushing and produce calves that finish and grade at a younger age.

The Umbargers provide a classic example of profitability through performance principles. In the past five years, with performance influencing their management decisions, weaning weights have increased 138 lbs., yearling weights have increased 192 lbs. and calf crop percentage has increased 24.2%. In addition, they have been able to use this performance advantage in the feedlot through higher gains.

Nominated by Oregon Cattlemen's Association

Pat Hardy
Cloverleaf Farm
Madison, Georgia

Pat Hardy is the owner of a diversified farming operation: 70 British breed crossbred cows, 24000 breeder hens and 50 Suffolk ewes.

He uses estrous synchronization on the cows and heifers. About 50% of the cows are artificially inseminated to high performance Gelbvieh or Limousin bulls. The number of heifers artificially inseminated varies from year to year.

Artificial insemination has improved the quality of calves being produced. Weaning weights have increased an average of 100 lbs., and more uniform calves are being weaned. Also, the calving season has been reduced from 120 days to 60 days with 90% of the calving occurring in the first 45 days.

Nominated by Georgia Cattlemen's Association Bull Test Committee

James Hauff
Hauff Ranch
Lehr, North Dakota

James Hauff began using Simmental bulls with his Hereford cows in 1983. Today his herd of 85 cows is 80% Simmental.

All cows are artificially inseminated with semen purchased from AI services because it simplifies selecting the bulls and works well with heat synchronization in shortening the breeding and calving seasons.

In selecting these bulls, James concentrates on specific traits such as calving ease, growth traits or maternal traits to complement his cows's traits.

He relies on performance records to select herd sires, replacement heifers as well as culling. James' understanding and application of performance data has led to a herd that excels in reproduction and growth traits.

James is a member of the North Dakota Beef Cattle Improvement Association and the American Simmental Association.

Nominated by North Dakota Beef Cattle Improvement Association

Charles and Clyde Henderson
Vienna, Missouri

Charles and Clyde Henderson own a diversified livestock operation: 360 commercial cows, 175 stockers and 200 finished cattle.

They have an Angus\Hereford\Charolais crossbreeding program designed to produce moderately sized, easy keeping cows with the ability to produce fast growing, lean muscled calves.

Using performance records and performance tested bulls for 25 years has greatly improved their operation. In 1970 calves were born throughout the season; today 85% of the calves are born in the first 20 days of the 90 day calving season. Also, the average slaughter age of finished calves was 34 months; in 1989 the average slaughter age was 20 months.

Nominated by Missouri Beef Cattle Improvement Association

Russ Green
Purdy Ranch
Buffalo, Wyoming

Russ Green became the manager of Purdy Ranch in 1981, after working there for three years in the 1970s.

The most profitable improvement in the management of the herd 300-cow herd has been using artificial insemination with heat synchronization and proven bulls. The results was better quality replacement heifers.

All cows three years of age or older are bred by Gelbvieh bulls for higher weaning weights. Two-year-old cows are bred by artificial insemination and natural service based on calving ease. Red Angus bulls are used with first-calf heifers.

Improvements made in the herd in the last 10 years include an increase in conception rates from 90% to 95%, and an increase in weaning weights from 585 lbs. to 688 lbs.

Nominated by Wyoming Beef Cattle Improvement Association

John Hanson
Willow Creek Ranch
Susanville, California

John Hanson is the manager and part-owner of a cow-calf operation with 600 commercial cows and 300 stockers.

Most of the cows are Simmental-cross and are bred to Angus and Salers bulls.

Fertility, mothering ability, size and conformation and disposition are all important criteria in selecting the cow herd. Replacement heifers are evaluated at least three times -- at weaning, long yearling and breeding -- and are evaluated on conformation, disposition, performance and conception.

Improvements during the past 10 years include an increase in weaning weights by more than 100 lbs. and an increase in yearling weights by 125 lbs. Conception rate has also improved primarily because of better management of disease and nutrition.

The overall performance of the herd has improved mostly because of a shorter calving season, higher conception rate and higher percentage of calves being weaned.

Jack is the director of the California Cattlemen's Association.

Nominated by California Beef Cattle Improvement Association

Murray Greaves
Green Valley Farms
Barrie, Ontario

Murray Greaves and his family started farming in 1964 and added a cow herd in the early 1980s. The original cows were mostly Charolais\Hereford-cross and Simmental\Hereford-cross with some purebred Simmental and Charolais added later, using performance tested Charolais and Limousin bulls.

The Greaves' also own and manage an Ontario Bull Evaluation Center evaluating about 300 young sires annually.

All cattle are either sold as finished cattle or retained for breeding purposes.

Improvements made over the last six years include an increase in the average adjusted 200-day weight of 183 lbs. They have also increased in the carcass quality.

Murray has served as executive director of the Ontario Cattlemen's Association.

Nominated by Ontario Beef Cattle Performance Association

J. R. Anderson
Anderson Cattle Company
Dodgeville, Wisconsin

J. R. Anderson is the owner of a grain and livestock farm with 80 commercial cows, 40 acres of corn and 100 acres of alfalfa hay.

J. R.'s herd is primarily Angus-crossed cows artificially inseminated by either Maine Anjou or Simmental bulls. The results in the crossbreeding of these breeds include medium to large framed, heavy muscled calves with good growth potential.

His goals for the herd include weaning a 100% calf crop and producing as many pounds of beef possible at the least cost. Therefore, reproduction is the most important consideration in the selection process for his herd. Also, structural soundness, adjusted weaning weight ratios and yearling weights are used in selecting replacement heifers.

Since his start in 1976, calf crop percentages have increased each year. Weaning weights have increased over 250 lbs -- from 350 lbs. to over 600 lbs.

J. R. served as director of the Wisconsin Beef Improvement Association.

Nominated by Wisconsin Beef Improvement Association

Ed and Rich Blair
Blair Brothers
Vale, South Dakota

Ed and Rich Blair own a 10000 acre farm and ranch where they have 500 Angus/Hereford-cross cows, 1000 stockers and 150 finished cattle.

They credit crossbreeding as being the biggest improvement and artificial insemination as the next biggest improvement in the management of their herd.

First-calf heifers are artificially inseminated by Angus bulls, and second-calf heifers are bred naturally by Angus bulls. The young cows are bred to produced replacement females. Older cows are bred to Charolais bulls in a terminal sire system.

All bulls are selected based on EPDs and individual performance records.

Improvements made while keeping performance records include a consistent calf crop percentage of 92%. Weaning weights have increased over 170 lbs., and yearling weights have gone from 850 lbs. at 18 months of age to the same weight at 12 months of age.

Nominated by Wisconsin Beef Improvement Association

Walt, JoAn, Mary Ellen and Mark Bollmann
Bollmann Farms
Ava, Illinois

The Bollmanns -- Walter and JoAn are in partnership with their son and daughter-in-law, Mark and Mary Ellen. Walter and Mark have full-time jobs off the farm; so their cattle operation of 60 commercial cows and 55 stockers is part-time.

Simmental, Angus and Polled Hereford are used in rotation. They started crossbreeding using performance tested bulls in 1982.

In 1988, the Bollmanns helped pioneer the Illinois Intensive Grazing Management Demonstration project that was designed by the Illinois Cooperation Extension Service. In this project the Bollmanns first-calf heifers rebreeding percentage improved from about 65% to 92%. Also, weaning weights increased 61 lbs. from the previous year.

Nominated by the university of Illinois Cooperative Extension Service

James Theek
Mayfair Ranch
Brenham, Texas

James Theek manages a 6115 acre ranch with 1574 commercial cows and more than 500 stockers.

Almost one-half of the cows are Brahman/Hereford-cross while the others are Hereford, Brahman, Santa Gertrudis and Santa Gertrudis/Hereford-cross. These cows are bred to Santa Gertrudis, Brahman, Hereford or Gelbvieh bulls. All replacement heifers are bred to Red Poll bulls for calving ease.

The whole operation is built around the concept of using breeds strong in maternal traits to produce exceptional replacement heifers.

In the 24 years that James has been managing the ranch, it has expanded from 150 to 1574 cows. Average pregnancy rates have gone from 63% to 96%, and weaning weights have increased by more than 175 lbs.

Accurate records are the foundation for his rigid culling program.

Nominated by Texas Agricultural Extension Service

OREGON RANCHERS HONORED AS BIF 1991 COMMERCIAL CATTLE PRODUCER OF THE YEAR

Dave and Sandy Umbarger of Umbarger Ranches, Pendleton, Oregon, were named the Beef Improvement Federation's commercial producers of the year at the BIF's annual meeting recently in San Antonio, Texas.

The Umbarger ranch, which has been in operation for 62 years, consists of 2,700 acres of mountain pasture, 2,075 acres of cropland and 780 commercial cows. The cowherd was originally Hereford, but now Angus cows and Simmental bulls have been incorporated to achieve efficient, easy fleshing cows that produce calves to finish and grade at a young age.

Over the past five years, weaning weights have increased 138 pounds, yearling weights have climbed 192 pounds and the calf crop percentage has increased 24.2 percent. The performance advantage has carried through to the feedlot where Umbarger calves typically register higher gains.

Pictured left to right: Dave Umbarger, Sandy Umbarger and Jack Chase

DR. BOB LONG WINS 1991 BIF PIONEER AWARD

Dr. Bob Long, chairman of the Texas Tech Animal Science Department, has been named as a Pioneer Award winner by the Beef Improvement Federation (BIF). Long was presented the Pioneer Award May 16 at the annual BIF meeting in San Antonio, Texas.

Selecting Long as a recipient was consistent with the goals of the award in recognizing members of the animal science community for innovative contributions to the beef industry.

Long has spent his professional life in the pursuit of a better beef industry through both teaching and the private sector.

With a practical background from the family farm in Jackson County, Ohio, and a focus on nutrition, Long entered the teaching world in 1948 armed with a B.S. from The Ohio State University, and a M.S. and Ph.D. from Oklahoma State University.

Except for seven years spent as Executive Vice-president and Chief Operating Officer for Ankony Angus Corporation, Long has spent his career teaching at the university level, first at Oklahoma State University, then the University of Kentucky, the University of Georgia, where he was also chairman of the animal science department, and now at Texas Tech.

The years, travels and research led Long to publish a long list of articles aimed at beef nutrition and carcass composition among others. His insights have been demanded globally as he has lectured on beef cattle production, performance testing and carcass evaluation before audiences throughout the U.S., Canada, New Zealand, Argentina, Brazil, Costa Rica and Mexico.

At every level Long has helped lead the charge for holistic improvement of the beef industry, approaching the industry with an eye on total improvement rather than advancement of specific industry segments.

Pictured left to right: Jack Chase, Mrs. Long, Bob Long and Wayne Vanderwert

BILL TURNER PRESENTED PIONEER AWARD
BY BEEF IMPROVEMENT FEDERATION

Bill Turner is Leader of the Beef Cattle Science Section with a 70% appointment in the College of Agriculture and Life Sciences (COALS) for teaching, 15% assignment with the Texas Agricultural Experiment Station for research, 10% appointment with the Texas Agricultural Extension Service and a 5% assignment as the COALS representative for the San Antonio Livestock Exposition (S.A.L.E.). He earned the B.S. in Animal Husbandry from Texas Technological College, the M.S. and Ph.D. degrees from Oklahoma State University in Animal Science with emphasis in animal breeding and experimental statistics.

Dr. Turner is responsible for the undergraduate courses entitled Beef Cattle Production and Management and Management of Stocker and Feedlot Cattle. Additionally, he teaches a graduate course in cow-calf production concepts for the beef industry and jointly teaches a graduate course concerning the stocker and feedlot industries with responsibility relating to stocker cattle and forage utilization. As a member of the graduate faculty, he directs graduate programs relating to beef cattle production and management of beef cattle.

Dr. Turner is the recent recipient of the 1990 Texas Beef Expo Outstanding Agri-Beef Businessman of Texas Award, the 1991 Saddle and Sirloin Excellence in Teaching Award and the 1991 Pioneer Award from the Beef Improvement Federation. He is active in the American Society of Animal Science and a past regional officer and national director. He serves on the breed improvement committees for several beef breed associations. He is also chairman for the planning and development of the Animal Science Teaching, Research and Extension Complex and chairman for the Institutional Agricultural Animal Care and Use Committee that oversees agricultural animal use in teaching, research and extension.

Pictured above: Bill Turner

JOHN CROUCH PRESENTED CONTINUING SERVICE AWARD BY BEEF IMPROVEMENT FEDERATION

John Crouch of the American Angus Association in St. Joseph, Missouri, has been named winner of the Beef Improvement Federation (BIF) Continuing Service Award. The Continuing Service Award was presented to Crouch at the annual BIF meeting May 16 in San Antonio, Texas.

The Continuing Service Award is presented each year in recognition of outstanding achievement and ongoing service in behalf of beef industry improvement.

As Director of Performance Records for the Angus Association since 1981, Crouch has been responsible for the Angus Herd Improvement Records (AHIR) program and the genetic evaluation programs for Angus Sire Evaluation.

Moveover, his performance testing and research in behalf of a single breed have helped motivate the rest of the beef industry to evaluate performance genetics and work toward beef improvement.

Perhaps, Crouch's success in the arenas of performance testing and genetic evaluation stem from his practical background, managing his family's Tennessee purebred Angus operation as well as other registered beef cattle operations before joining the Angus Association 17 years ago.

BIF and the beef industry have benefitted from Crouch's expertise and efforts over the years. Crouch has served as a BIF Director for six years and as chairman of the BIF Live Animal and Carcass Evaluation Committee.

Pictured: John Crouch

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