UNIVERSITY OF CALIFORNIA
Agriculture & Natural Resources

Sierra Foothill Research & Extension Center

Beef & Range Field Day

APRIL 15, 2004

Browns Valley, California

UNIVERSITY OF CALIFORNIA
AGRICULTURE & NATURAL RESOURCES

SIERRA FOOTHILL RESEARCH & EXTENSION CENTER

Presents:

Annual Beef & Range Field Day

APRIL 15, 2004

Cosponsored By:
University of California Cooperative Extension
Department of Animal Science, U.C. Davis
School of Veterinary Medicine, U.C. Davis
California Beef Cattle Improvement Association (CBCIA)

UC BEEF & RANGE FIELD DAY
Sierra Foothill Research & Extension Center

APRIL 15, 2004

AGENDA

	Master of Ceremonies for the morning session: Roger Ingram, Livestock and Natural Resources Farm Advisor, Nevada-Placer Counties
9:30am	Welcome – Mike Connor, Superintendent, UC-SFREC
9:45	Use of DNA markers in beef breeding – what producers need to know. Alison Van Eenennaam, Animal Biotechnology and Genomics Extension Specialist, Dept. of Animal Science, UC Davis
10:10	Residual Feed Intake. Bob Sainz, Assoc. Professor, Dept. of Animal Science, UC Davis
10:35	Cattle diseases. Bruce Hoar, Asst. Professor, School of Vet. Med., UC Davis
11:00	BSE Update. John Maas, Extension Veterinarian, School of Vet. Med., UC Davis
11:30	Heparin binding protein as an indicator of bull potency. Roy Ax, Professor of Animal Science, University of Arizona
12:00 noon	Tri-tip BBQ Lunch – Served by the Yuba-Sutter Cowbelles and SFREC Staff
12:45 pm	California Cattlemen's Association Officers - Industry Update
	Master of Ceremonies for the afternoon session: Morgan Doran, Livestock and Natural Resources Farm Advisor, Solano County
1:15	Short walk to irrigated pasture site
1:30	Runoff Water from Ag Lands and Update on the Agricultural Discharge Waiver. Ken Tate, CE Rangeland Watershed Specialist, Agronomy & Range Science Dept., UC Davis
1:55	The Oak Woodland Conservation Act: How ranchers can get funded for conservation easements on their woodland properties. Doug McCreary, Natural Resources Specialist & Program Manager, Integrated Hardwood Range Management Program, University of California, Berkeley
2:15	Update on Rancher's Beef Cooperative. Roger Ingram
2:30	Chute-side demonstration: Heat synchronization with CIDR's. Cindy Daley, Assoc. Professor, CSU-Chico
3:00	Return to HQ and adjourn

Annual Beef & Range Field Day Proceedings
April 15, 2004

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MARKER-ASSISTED SELECTION BACKGROUNDER

Alison Van Eenennaam, PhD
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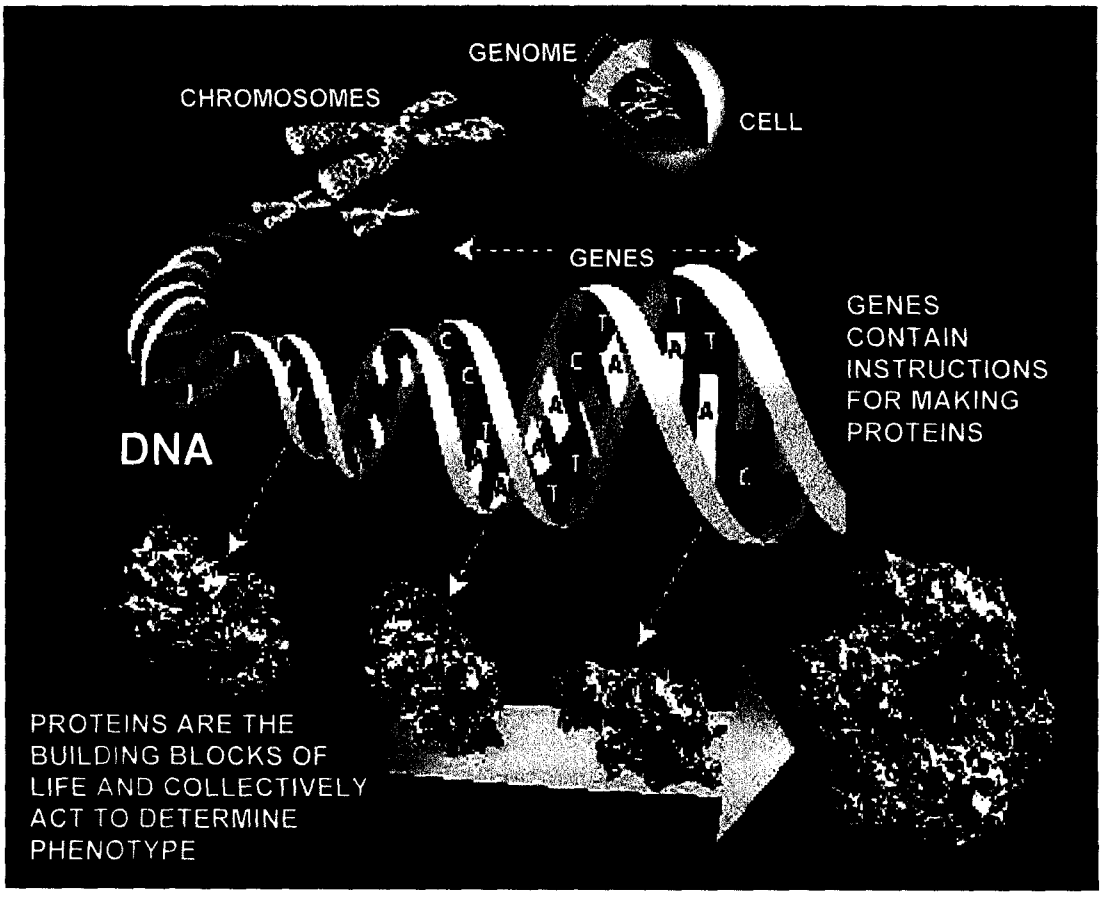
DNA (deoxyribonucleic acid) is a molecule that is shaped like a double helix and made up of pairs of **nucleotides**. DNA transmits genetic information. DNA is packaged into chromosomes which are located within the nucleus of all cells. Every cell in the body contains all of the chromosomes that collectively make up the **genome** of that organism. DNA codes for **amino acids** which are linked together to make **proteins.** A **gene** is a stretch of DNA that specifies all of the amino acids that make up a single protein. Proteins are the building blocks of life. There are thousands of proteins in the body (encoded by thousands of genes). The interaction and structure of proteins determines the visible characteristics or **phenotype** of an organism, while the **genotype** refers to the genetic makeup.



The sequence of nucleotides that encode a gene can differ between individuals. These differences are called **genetic variants.** As a result of these nucleotide differences, genetic variants or **alleles** may differ in the amino acid sequence of the protein they encode, or they may regulate the production of different quantities of the encoded protein. These differences can have an effect on phenotype.

All individuals receive one copy (allele) of each gene from their mother, and one from their father. The DNA sequence of a gene inherited from each parent may be identical in which case the individual is said to be **homozygous** for that gene, or the sequence of a gene inherited from each parent may vary in which case the individual is said to be **heterozygous**. Genetic variants often differ from each other by the sequence of a single base pair. These differences are called single nucleotide polymorphisms **SNPs** (pronounced "snips"). **Genotyping** means using laboratory methods to determine the sequence of nucleotides in the DNA from an individual, usually at one particular gene or piece of a gene. SNPs are commonly the basis of genotyping tests. Genetic tests based on SNPs analyze DNA derived from an individual to determine the genetic variants that are present at one specific location (nucleotide pair) in the midst of the approximately 3 billion nucleotide pairs that make up the genome.

Historically we have not known which genes contribute to performance characteristics (**traits**), and so we have used performance records and **EPDs** (expected progeny differences) to infer the genetic merit of animals. This method has been very successful at improving certain traits. Research has shown that some genetic variants of specific genes are associated in a positive way with a given trait. It is therefore possible to genotype an animal using a DNA-based genotyping test and select individuals carrying the preferred genetic variant. **Marker-assisted selection** is the process of using the results of DNA testing to assist in the selection of individuals to become parents in the next generation. The word "assisted" implies that the selection is also influenced by other sources of information, such as animal's observed performance and EPDs. The genotypic information provided by DNA testing should help to improve the accuracy of selection and increase the rate of genetic progress by identifying animals carrying desirable genetic variants for a given trait at an earlier age.

It is not known which specific genes contribute to an EPD – the genes are anonymous. **Complex traits**, including most of the economically relevant traits for cattle production (birth weight, weaning weight, growth, reproduction, milk production, carcass quality) are controlled by many genes, and they are also greatly affected by the environment (e.g. feed conditions). Although complex traits are influenced by a number of genes – each one of these genes is still inherited in the same way. An animal inherits one copy of each gene from its sire, and one copy of each gene from its dam. These copies may differ from each other, and these differences may have either a positive or negative effect on the trait that the gene controls or influences. When an animal has a positive EPD for a certain trait, what that is effectively saying is that based on its pedigree and phenotype, it has inherited a greater than average number of "good" genetic variants of each gene affecting that particular trait.

It is important to combine DNA results (which look at single genes) with other criteria, such as EPDs (which look at numerous genes) and the animal's actual phenotype for the trait (if available), to ensure that selection is distributed over all the genes that contribute towards the trait of interest. Don't ignore animals that have good EPDs for a given trait and yet are not carrying the favorable form of a gene for that trait. These animals are likely to be a source of good alleles for the many other genes that contribute towards that trait. Ideally the information from genetic tests should be integrated into a genetic evaluation system that weighs all the information about an animal. Combining information from both EPDs and genetic tests into a selection decision will be superior to selection on either EPDs or markers alone. The challenge will be to determine the weight that should be given to the marker information in this decision-making process. The magnitude of the effect of a genetic variant of a gene on the trait may vary among the different breeds, production systems and environments.

MARKER-ASSISTED SELECTION IN BEEF CATTLE

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Marker-assisted selection allows for the accurate selection of specific DNA variations that have been associated with a measurable difference or effect on complex traits. It is important to realize that markers for complex traits like marbling are associated with only one of the many genes that contribute towards that trait. The presence or absence of the numerous other "unmarked" genes and the production environment will determine whether an animal actually displays the desired phenotype (e.g. large weaning weight, increased marbling). When making selection decisions Expected Progeny Differences (EPDs) should be considered, even in the presence of marker data, as they estimate the breeding value of all the "unmarked" genes that contribute to a given trait. **Marker assisted selection should be seen as a tool to assist with, and not as a replacement for, traditional selection techniques.**

Potential benefits from marker assisted selection are greatest for traits that

1) have low heritability (traits with observed or measured values that are a poor predictor of breeding value).
2) are difficult or expensive to measure (disease resistance).
3) cannot be measured until after the animal has already contributed to the next generation (carcass data) .
4) are currently not selected for as they are not routinely measured (tenderness).
5) are phenotypically (observed value) but not genetically correlated with a trait that you do not want to increase (e.g. selection for marbling markers does not select for increased backfat thickness despite the fact that on the animal these two traits tend to increase in unison).

In order of greatest to least degree of benefit, the following categories of traits are likely to benefit the most from marker-assisted selection:

1) disease resistance,
2) carcass quality and palatability attributes,
3) fertility and reproductive efficiency,
4) carcass quantity and yield,
5) milk production and maternal ability, and
6) growth performance.

This ranking is due to a combination of considerations including: 1) relative difficulty in collecting performance data, 2) relative magnitude of the heritability and phenotypic variation observed in the traits, 3) current amount of performance information available, and 4) when performance data becomes available in the life cycle.

Recently genetic tests for DNA markers associated with marbling and tenderness have become commercially available. These markers are associated with only one of the genes that contribute towards marbling or tenderness. Other "unmarked" genes, in conjunction with the production setting, will determine whether an animal marbles or has tender meat. Cattle can be genotyped for the desirable form of the marker by analyzing DNA collected from hair, tissue, blood, or semen samples.

Marker information can be used to increase the frequency of the marker that is positively associated with the trait of interest by selecting for animals carrying two copies of that marker, and against those carrying no copies of the marker. In a typical herd, use of sires carrying two copies of the marker (homozygous) will probably be the most rapid way to increase the frequency of the marker in the herd. All of the offspring from a homozygous parent will inherit a single copy of the marker from that parent. Continuous use of homozygous sires for 4 generations will result in about 90 percent of the herd carrying two copies of the marker. Validation studies and the effect of these markers in commercial herds should be evaluated to determine the cost:benefit ratio of these tests, and the emphasis that should be placed on these markers versus all of the other "unmarked" genes that contribute towards marbling or tenderness. In the future it is likely that EPDs and marker loci will be combined into a selection index for the trait of interest, and this will be superior to selection on EPDs or markers alone. The challenge will be to ensure that the cost of obtaining marker data for marbling and tenderness, or any other trait, is in line with the expected long-term return based on the accelerated cumulative and permanent genetic improvement of the herd.

The commercially available markers for carcass quality traits and related websites are as follows:
GeneSTAR® Marbling (Genetic Solutions) is a marker that has been associated with increased marbling. The DNA variation is in the 5' leader sequence of the thyroglobulin gene. This enzyme is involved in the pathway that creates fat cells within muscle fibers as energy stores. A certain form of this marker (*) has been associated with increased marbling in company trials and this finding was validated by National Beef Cattle Evaluation Consortium (NBCEC) on Simmental x Angus fed cattle. They found an insignificant increase in marbling score but a significant (18%) increase in 2-star (as compared to 0-star) fed steers grading US choice (R. L Quaas, pers. comm.). More information about this test can be found at: http:/www.geneticsolutions.com.au

Igenity™-L (Merial) is a marker that has been associated with increased marbling and appetite. The DNA variation is in the coding region of the hormone leptin, encoded by the obese gene. Leptin helps regulate appetite and energy metabolism and is an important component in the long term regulation of body weight. A certain form of this marker (T) has been associated with increased marbling in beef cattle (http://skyway.usask.ca/~schmutz/meat.html#leptin). However, unpublished studies performed by the NBCEC did not find that the different variants of this marker were related to marbling score in Simmental x Angus fed steers (R. L Quaas, pers. comm.). More information about this test can be found at: http://www.igenity.com

***Tender*GENE™** (Fontier Beef Systems) is actually two markers that have been associated with increased tenderness by the U.S. Meat Animal Research Center. The DNA variations are located at two different places in the coding region of the μ-Calpain gene. This gene produces an enzyme which weakens muscle fibers thus increasing tenderness during the post-mortem aging process. Certain forms of these markers (SNP 316 "C" and SNP 530 "G") have been associated with increased tenderness in beef cattle. Validation studies by the NBCEC found an association between these two markers and a Warner-Bratzler shear force (WBSF) which is measure of muscle tenderness. The most extreme genotypes (which occur at low frequencies) differed by about 1.8 lb. of WBSF, while the range among the more common genotypes was slightly greater than 1 lb. (R. L Quaas, pers. comm.). This test is currently recommended for use only in cattle without Brahman influence. More information about this test can be found at http://www.frontierbeefsystems.com/

GeneSTAR® Tenderness (Genetic Solutions) is a marker that has been associated with increased tenderness. The DNA variation is in Calpastatin. This is a naturally occurring enzyme that inhibits the normal tenderizing of meat as it ages post-mortem through the regulation of Calpain. A certain form of the marker (*) has been associated with increased tenderness in company trials. No US validation studies have yet been performed on this marker. More information about this test can be found at: http://www.geneticsolutions.com.au

RESIDUAL FEED INTAKE

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Introduction

Low rates of return on investment for livestock operations are a fact of life. Producers have little impact on the market price for their cattle; therefore management must be focused on the things producers can actually do something about. For many years, genetic selection programs have focused on production (output) traits, with little attention given to production costs (inputs). Recently, this view has begun to change, and the efficiency of conversion of feed (i.e., the amount of product per unit of feed input) has been recognized as more important. Numerous studies have shown what cattlemen have always known: profitability in this business depends on keeping the costs of production to a minimum. Within any beef cattle operation, feed costs are undoubtedly the main concern, since they typically account for 60 – 65 % of the total costs of production. That's why greater feed efficiency has been targeted as a means of improving the profitability of the beef industry.

One estimate of feed efficiency is the feed conversion ratio. Traditionally, this was expressed as a feed:gain ratio, but this led to the confusing result that a higher ratio meant a lower efficiency. Today, feed conversions are often expressed as a gain:feed ratio to overcome this problem. Even so, results can be misleading, because these ratios are closely correlated to the intake and rate of gain of the animal (Carstens et al., 2004). So, two animals might have similar gain:feed and still be very different in their feed intakes and rates of gain. Conversely, the same animal at different intakes would certainly have different gain:feed ratios, even though the genetics of the animal hadn't changed. Therefore, gain:feed has never taken off as a criterion for genetic selection.

Residual feed intake (RFI), defined as actual feed intake minus the expected feed intake of each animal, was first proposed as an alternate measure of feed efficiency by Koch et al. (1963). It can be defined, in other words, as the difference between actual feed intake and the expected feed requirements for maintenance of body weight and for weight gain. RFI has been adopted more intensively in other countries, such as Australia and Canada, but in the US more attention has been given to understand the biological issues around this concept. Genetic selection to reduce RFI can result in progeny that eat less without sacrificing growth performance (Herd et al. 1997; Richardson et al. 1998). In contrast to gain:feed, residual feed intake is independent of growth and maturity patterns. Therefore, RFI should be a more sensitive and precise measurement of feed utilization, since it is based on energy intake and energy requirements.

[†]Pedro Paulino was supported during his stay at UC Davis by a Fellowship from the Brazilian Ministry of Education – CAPES.

Methodology for measuring RFI

The residual feed intake is an individual record, taken in long term feeding trials (at least 70 to 84 days) where animals are housed either in individual or group pens, and accurate measurements are made of daily feed offered and refused, as well as average daily gain. Research has shown that there is considerable individual animal variation in feed intake above and below that expected or predicted on the basis of size and growth. That statement, along with the fact that individuals of the same body weight require rather widely different amounts of feed for the same level of production establishes the scientific base for measuring RFI in beef cattle.

In order to obtain RFI values, it is necessary to measure and record the daily feed intake for each animal, which can be accomplished by housing them in individual pens. Recent techniques employing electronic devices that identify each animal individually, opening specific feed bunks and measuring the feed intakes of individual animals kept in groups can also be adopted, although some difference has been observed when comparing these two types of housing. Therefore, obtaining RFI data is laborious and expensive, and this has limited its spread as a feed efficiency measurement.

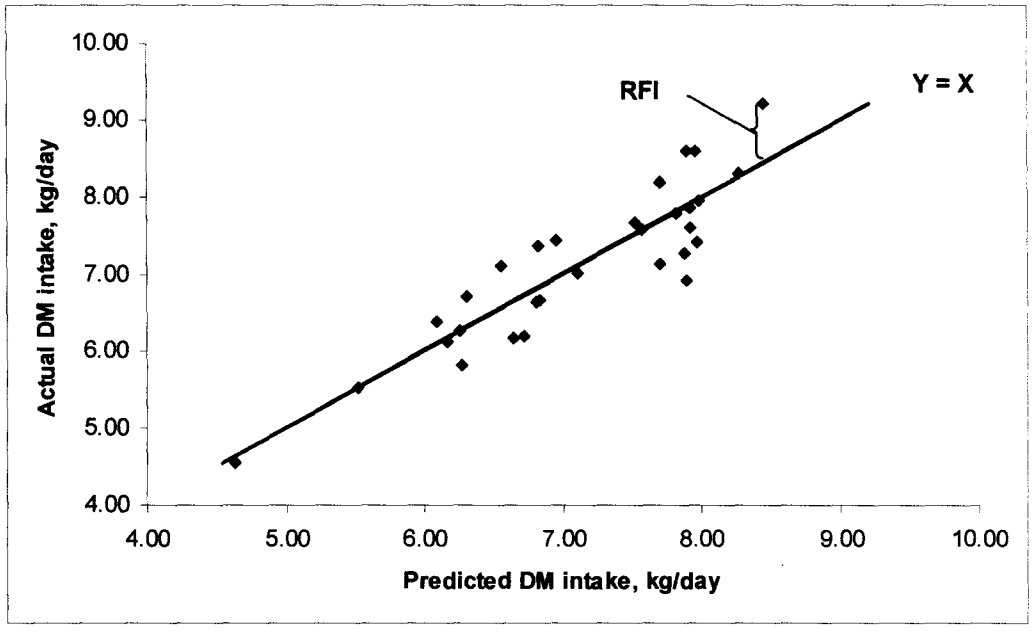

Figure 1. Actual and predicted dry matter (DM) intakes by fed steers. Residual feed intake (RFI) is the difference between actual and predicted DM intakes.

Once the trial is finished, the daily feed intake is calculated from the amounts of feed offered and refused, and the average daily gain and average body weight obtained for the same period. The expected feed (or dry matter) intake is obtained from linear regression of DMI on mid-test $BW^{.75}$ and average daily gain (ADG). The statistical model is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where Y is expected dry matter intake, β_0 is the equation intercept, β_1 and β_2 are the coefficients of the equation, X_1 is the mid-test metabolic body weight, X_2 is the average daily gain, and ε is the residual. The intercept of the equation is tested and if it is not significant a new equation is fitted without the intercept. Then, the predicted feed intake of each animal is estimated using the equation. This prediction may be thought of as the "average" or expected value for animals of similar weights and rates of gain. The actual feed intake minus the predicted feed intake corresponds to the residual feed intake (Figure 1).

Results and Discussion

Figure 2 shows the relationship between dry matter intake and average daily gain, obtained from 36 animals in a recent trial conducted at the UC Davis feedlot. These data show the general trend for increasing rates of gain with higher intakes, and also the variation around that trend. For example, two animals with identical intakes (7.43 kg) had more than 50% difference in average daily gain! Clearly, the more efficient animal would be much more profitable. Similarly, two animals with almost identical rates of gain (1.5 kg/day) had very different feed intakes (7.43 vs. 9.22 kg/day). Obviously, the animal with the same rate of gain and lower feed intake would be far more profitable.

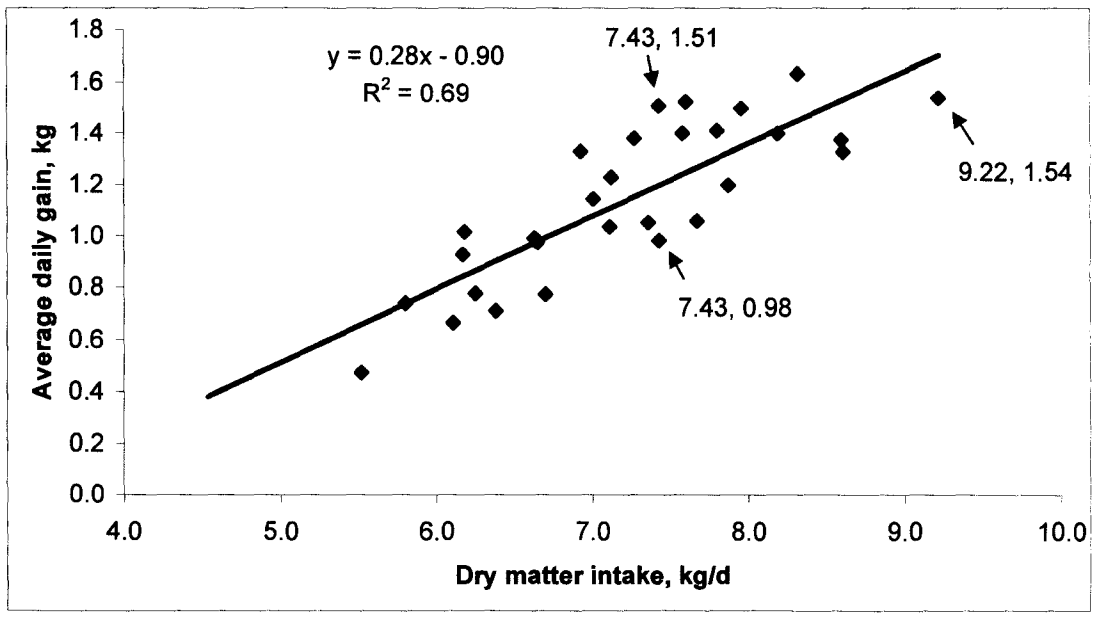

Figure 2. Relationship between dry matter intake and average daily gain in fed steers

For a trait to be used as a selection criterion it must present genetic variance and be heritable. Several studies have shown heritabilities for RFI ranging from 0.14 to 0.44 and genetic variances ranging from 0.149 to 0.267 (Fan et al., 1995; Archer et al., 1997; Arthur et al., 2001; Herd et al., 2003). From a practical point of view, this means that RFI is at least as heritable as early growth. The genetic variance is limited, but it is still enough to make substantial improvement. In that sense the development of an EPD for RFI seems practical. As observed by

Herd et al. (2003), selection against postweaning RFI in heifers has the potential to lead to a decrease in feed intake and improvement in feed efficiency of the breeding herd, since the correlation between post-weaning RFI and cow RFI is very high (0.98). This means that selection for lower RFI in growing animals will result in lower RFI in breeding females, thereby reducing the feed cost for the cow herd.

Conclusions

Profitability depends on keeping costs to a minimum without sacrificing production or quality. Feed represents about 2/3 of costs of beef production, so more efficient conversion of feed should be a priority. Residual feed intake is the best available measure of efficiency, because it is independent of level of production; moreover, RFI is moderately to highly heritable, and so will respond to genetic selection. Selection for reduced RFI in growing animals should reduce feed costs for beef cattle in all stages of life, including the cow herd.

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BOVINE VIRUS DIARRHEA (BVD)

Bruce R. Hoar, School of Veterinary Medicine, Department of Medicine and Epidemiology, University of California, Davis

Bovine virus diarrhea (BVD) is a complicated disease to discuss as it can result in a wide variety of disease problems from very mild to very severe. BVD can be one of the most devastating diseases cattle encounter and one of the hardest to get rid of when it attacks a herd. The viruses that cause BVD have been grouped into two *genotypes*, Type I and Type II. The disease syndrome caused by the two genotypes is basically the same, however disease caused by Type II infection is often more severe. The various disease syndromes noted in cattle infected with BVD virus are mainly attributed to the age of the animal when it became infected and to certain characteristics of the virus involved.

Diseases caused by BVD infection

Fetal BVD infections (infection of the unborn calf): The result of a fetal infection with the BVD virus is usually determined by the age of the fetus at the time of infection. The virus is capable of passing from an infected cow to the unborn fetus which is particularly vulnerable to the BVD virus during the first 6 months of pregnancy. Death of the fetus is common if the infection occurs during the first 120 days of pregnancy and the cow will lose the pregnancy. However, if the fetus survives an early infection, it will be born without a detectable antibody titer and be persistently infected (PI) with the BVD virus. During the first 120 days of gestation, the fetus has an underdeveloped immune system and does not recognize the BVD virus as foreign. The fetus does not mount an immune response against the virus, remains infected, and does not have a detectable anti-BVD titer. It is not uncommon for the surviving fetus to be malformed; blindness, skeletal abnormalities and under-developed brains are common defects noted in such calves. A BVD PI calf may appear normal, be weak at birth, grow poorly, be susceptible to respiratory diseases, and die before they can be weaned. They may also **grow normally, reach breeding age, and produce more persistently BVD infected calves** (The virus is passed from generation to generation). PI carriers can only be created by infection with BVD virus during the first 110-120 days of pregnancy. These animals shed billions of virus particles every day in their urine, feces, and saliva, and are a source of infection for other animals in the herd. If the fetus becomes infected after 120 days of pregnancy, there may be an abortion but usually, because this aged fetus has a more developed immune system and can elicit an immune response against the BVD virus, a healthy calf is born that has a good level of BVD antibody titer.

Subclinical BVD infections: Most animals that become infected with BVD never show signs of disease caused by the virus; however infection can lower the animal's resistance to other infections, which could result in illness. For example, in feedlot calves, BVD infection may go unnoticed, but the lungs become susceptible to infection with bacteria such as *Mannheimia haemolytica*

(previously called *Pasteurella haemolytica*) and other agents that cause "shipping fever". Some people believe that BVD is one of the most significant disease organisms involved with respiratory disease of cattle.

Severe acute BVD infections: This disease syndrome is usually (but not always) associated with Type II BVD virus infection. The affected animals will exhibit high fevers (107-110 F), occasional diarrhea, respiratory disease, and they will not eat. Peracute BVD can affect cattle of all ages and often results in death of the animal within 48 hours of disease onset regardless of age.

Acute BVD infections: The classic, acute form of BVD is characterized by a fever of 104-106 F, discharge from the nose and eyes, erosions of the muzzle and in the mouth, and diarrhea that may contain mucus and blood. Diarrhea is usually present in every herd that has an outbreak of acute BVD, but diarrhea is not present in every animal that has acute BVD. The percentage of the herd exhibiting clinical disease and dying can vary extremely; however, if "secondary infections" are controlled, most animals survive the acute disease. This syndrome usually occurs in cattle 6 to 24 months of age.

Acute Mucosal disease: An animal persistently infected with BVD virus is not able to mount any defense against becoming subsequently infected with a different BVD virus. When a BVD infection is superimposed on a PI animal, mucosal disease usually results. Acute mucosal disease is characterized by fever, profuse, watery diarrhea, erosions of the mouth, lack of appetite, discharge from the eyes and nose, and occasionally lameness. Secondary infections, such as pneumonia and mastitis, are common. Cattle with acute mucosal disease usually die within 3 to 10 days.

Chronic Mucosal disease: Some cattle that develop mucosal disease do not die as soon as expected but rather become chronically infected. Cattle with chronic mucosal disease are poor doers, and may have persistently loose stools or intermittent diarrhea, chronic bloat, decreased appetite, weight loss, erosions between the claws, or non-healing skin lesions. Discharge from the eyes and nose, bald spots due to loss of hair, and long-term lameness are also common. Cattle with chronic mucosal disease rarely survive beyond 18 months and ultimately die.

Treatment and Prevention of BVD infections

There is no effective treatment for infection with BVD, but most cases are subclinical and self-limiting. Antibiotics, fluid and supportive therapy may be indicated to control secondary infections. Offering highly palatable feed could tempt sick animals to eat needed nutrients. Vaccination of susceptible cattle has been the principal approach to the prevention and control of BVD. However, preventing the introduction of BVD into your herd and identifying and eliminating PI animals from your herd are important steps to take to control the disease.

Vaccinate calves: Calves should be vaccinated twice with a modified live virus (MLV) vaccine before leaving the herd of origin. Ideally, BVD vaccinations should be completed in the calves at least 30 days prior to weaning, but whatever program you initiate needs to fit with your management system. Check with your veterinarian for specific recommendations for your herd.

Vaccinate the cow herd: It is difficult to provide blanket recommendations for vaccinating the cow herd, but some general guidelines can be given. Unvaccinated heifers and cows should be properly vaccinated **before breeding** to ensure protection for the fetus. All bulls should be properly vaccinated before putting them out with the cows or heifers and new additions should be properly vaccinated **before adding** them to the herd. Modified live virus vaccines can be safely used in open cows (there are new MLV vaccines safe for pregnant cows if the cows have been previously vaccinated with certain products) and provide long-lasting protection. Killed vaccines are safe for all cattle, but usually don't provide as strong an immune response and may need more frequent booster vaccinations. Again, check with your veterinarian for specific recommendations.

Prevent introduction of BVD into your herd: BVD virus is shed from cattle in the feces and in secretions from the nose and mouth. BVD is also readily transmitted by aerosol droplets and direct contact. Avoiding contact with other cattle is therefore an important step to take to prevent infection from entering your herd. "Good fences make good neighbors". It is especially important to keep pregnant cows less than 120 days pregnant separated from other cattle. New introductions into your herd need to be tested for PI status.

Eliminate PI animals from your herd: Until recently, testing cattle for PI infection was prohibitively expensive but now there are tools available making it feasible to test for and eliminate these "typhoid Mary" animals from the herd. There are two types of test available, one using a skin sample and one using a blood sample:
Immunohistochemistry – for this test, a small notch of skin is taken from the edge of the ear, easily done using a pig ear-notching tool. The triangular piece of skin removed should be ¼ to ½ inches per side. Depending on the laboratory the sample will be sent to, the removed skin is placed either in a vial containing formalin or an individual plastic bag. All samples must be clearly labeled with the animals' identification number.
PCR – this test requires that a blood sample in a "purple top" tube be taken and submitted. Again, all samples must be clearly labeled with the individual animal ID.

Samples can be sent to a number of different laboratories; three are listed below. Be sure to contact the lab and talk to your veterinarian before taking and sending samples – if you take the wrong samples, all your work may be wasted. Be aware that it is possible to have "false positive" results – some animals may test positive when they are not truly persistently infected, and may need to be re-tested. Your veterinarian can help interpret the results of the testing. (Thank you to Dr. John Maas for the following information)

1. Tulare branch of the California Animal Health & Food Safety Laboratory (CAHFS)

CAHFS-Tulare
18830 Road 112
Tulare, CA 93274

Phone (559) 688-7543
Fax (559) 686-4231

Sample description: Ear notch (triangle notch ¼ to ½ inch per side) in zip lock bag (or whirl pack bag). Refrigerated—not frozen. Ship overnight (not for Saturday arrival).
Technique: Immunohistochemistry.
Cost: $16.50 per 1-5 samples, i.e. $33.00 for ten (10) samples and $33.00 for 6 samples. Additional one time accession fee is also charged.

2. University of Nebraska, Lincoln, NE

Veterinary Diagnostic Center
University of Nebraska
Fair Street and East Campus Loop
P. O. Box 82646
Lincoln, NE 68501-2646

Phone (402) 472-1434
Fax (402) 472-3094

Sample description: Ear notch (triangle notch ¼ to ½ inch per side) in neutral-buffered formalin. Leak proof tubes are mandatory for containers. Do not hold skin samples in formalin for more than 7 days prior to submission.
Technique: Immunohistochemistry.
Cost: Accession fee: $7.00 per each shipment (submission). First sample: $12.00. Two (2) to 6 samples: $20.00, multiples of 6: $20.00/six samples.

3. Davis branch of CAHFS.

CAHFS-Davis
University of California, Davis
West Health Sciences Drive
Davis, CA

Phone (530) 752-7578
Fax (530) 752-6253

Sample description: whole blood, refrigerated (not frozen). Ship in leak proof containers on ice bags (gel bags).
Technique: PCR.
Cost: $22.70 for the first sample, $5.65 per each sample after the first. Additional one time accession fee is also charged.

BSE Prevention Update: Comparing France and California

John Maas, DVM, MS Diplomate, ACVN & ACVIM
Extension Veterinarian
School of Veterinary Medicine—UC Davis

Over the past four months we have read and heard more about BSE (Bovine Spongiform Encephalopathy; Mad Cow Disease) than we may have ever wanted to know. The California Cattlemen's Association and other allied groups, particularly the NCBA have done a wonderful job in terms of getting out the facts about BSE and the message that beef is safe for consumers. The BSE issue is extremely complicated and I will compare some of what has been done in France with our situation in California.

What are the critical control points for preventing BSE in U.S. cattle?

The first step is to prevent the introduction of cattle into the U.S. that might be "incubating" the disease. This is the basis of our ban on the importation of any cattle from countries that are known or suspected of having BSE. For example, we banned the importation of cattle from Britain after 1986 and banned live cattle importation from Canada in May of 2003. Secondly, because this disease is transmitted by the feeding of contaminated meat and bone meal (MBM), the feed ban on feeding ruminant MBM to cattle was put into effect in 1997 in the U.S. Obviously, it is imperative that this feed ban be strictly enforced and this is the responsibility of the Food & Drug Administration (FDA). The third measure is to have an active surveillance program to be sure the other preventive measures are working correctly. The surveillance program must include potential clinical cases of BSE and must also include "at-risk cattle" (downer cattle are part of this "at-risk" group). Additionally, our veterinary diagnostic laboratories are excellent at detecting various diseases in cattle, especially diseases like BSE or rabies that have public health concerns. The monitoring of clinical cases of BSE has been actively occurring for almost 18 years. Secondly, the surveillance of "at-risk cattle" has also been an active area for a number of years. This is the part of the surveillance program that found the BSE-positive Canadian dairy cow in Washington state last year. In 2003, the USDA tested about 20,000 cattle for BSE. The USDA's surveillance of "at-risk cattle" had focused on downer cattle at slaughter houses. Because downer cattle can no longer be slaughtered for human consumption, the USDA will need to accomplish this part of the surveillance program by other methods. It is still extremely important to monitor this group of animals for BSE. In March, 2004 the USDA announced that BSE testing will be done on 286,000 or more cattle per year for the near future. Also, this testing will be accomplished by using the agency's network of 20 regional laboratories and by the use of the rapid test technology that allows negative results to be reported within 24 hours or less. Additionally, to satisfy our export markets (Japan, South Korea, etc); it may become necessary to test a percentage of healthy cattle over 30 months of age when they are slaughtered. Therefore, surveillance of cattle for BSE will continue to be an important part of our preventive measures.

An additional preventive measure in the future will be the development of cost effective tests that can be used on live animals. This would allow us to detect BSE "infected" cattle before slaughter. Sheep also have a transmissible spongiform encephalopathy called Scrapie and there is a test to detect this disease in the live animal. Also, some sheep are resistant to Scrapie and some are more susceptible. Currently, there are genetic tests available to detect this resistance or susceptibility. To prevent BSE it would be extremely helpful to have both live cattle tests and genetic susceptibility tests. Hopefully, these tests can be developed and implemented in the future.

What are the critical control points for food safety with regard to BSE?

The main food safety procedure is to prevent BSE in U.S. cattle in the first place. If healthy slaughtered cattle over 30 months of age are tested for BSE it is essential to have "test and hold" facilities at the plants. The carcasses will have to be held until the negative test results are reported. This would prevent the possibility of large scale meat recalls due to false positives. A very important procedure is to eliminate the "specified risk materials" (SRMs) from the human food chain. This process has already been initiated. The SRMs include the brain, eyes, skull, tonsils, spinal cord, spleen, small intestines, vertebral column (bones of the neck and back that surround the spinal canal), and thymus. For animals over 30 months of age, the SRMs will be removed from the carcass, segregated, and eliminated from the food supply.

How does France compare to California?

Both have very large agricultural bases. France is about 1.3 times the size of California. France has a population of 60 million and California has about 36 million people. If we count all the beef cattle, calves, dairy cattle, stockers, and feedlot cattle in California the number is probably less than 6 million, in France there are 20 million cattle. The average herd size in France is about 70 head and the average farm size is 140 acres. France is first in beef exports in the European Union (EU) and California is number one in agricultural exports in the U.S. France diagnosed their first case of BSE in 1991 and has had about 900 confirmed cases since that time. We have not seen a case of BSE in California and the U.S. has only had the one BSE case imported from Canada.

What does the BSE prevention program in France look like?

Many of the points covered in the first section are included in the French program. Their ban on feeding meat and bone meal started in 1990 and has been expanded several times in subsequent years. Currently, meat and bone meal from any source cannot be fed to any farmed animals (including poultry, swine, or sheep) in France. The ban on meat and bone meal feeding is the most important preventive measure in BSE control programs.

The surveillance program in France was also started in 1990 and focused on clinically sick cattle that might have BSE. In the year 2000, they begin to look at all "at risk cattle" and are currently testing over 270,000 cattle in this category per year. Additionally, beginning in 2001 all healthy cattle over 24 months of age at slaughter are

tested. The number of cattle in this last category is 3 million per year. Since 1991, there have been just less than 900 cases of BSE diagnosed in France. Twenty-three percent (23%) of these have been in clinical cases, 47% have been in "at risk cattle", and 30% have been in healthy slaughtered cattle. Additionally, the majority of BSE cases diagnosed were born after the 1990 feed ban. This is a very important point we need to remember.

What does the BSE prevention program in France cost?

During 2003 the French program for BSE prevention and surveillance cost them about 900 million dollars (750 million Euros). This amount was about 57% of the total animal health budget for France. Much of this cost is for the removal and disposal of the SRMs from slaughtered animals. Additionally, the animal identification program needed to track the animals from their farm of origin through slaughter is another cost to be considered.

Does BSE occur spontaneously in cattle?

The message that BSE occurs spontaneously in cattle has been repeated in the media several times. Where does this idea come from? There is a disease in humans called Creutzfeldt-Jakob Disease (CJD) which does occur spontaneously. It occurs at a rate of about 1-2 people per million population per year, worldwide. This is the so-called spontaneous CJD. Some have extrapolated this information to the cattle population, saying that BSE occurs spontaneously in cattle just as spontaneous CJD occurs in humans. Therefore, if we have about 100 million cattle in the U.S., we have 100-200 cases of BSE each year. This assumption is the basis for the argument that we should be testing every slaughtered animal for BSE. There is no basis in fact for this assumption, however. To the contrary, there is ample evidence that BSE is not occurring spontaneously. For example, we have been able to detect cattle diseases with public health significance that occurs at a much lower rate than 1 per million and one such disease is rabies. The diagnosis of rabies is dependent on a thorough examination of the brain of the animal. BSE diagnosis is also dependent on the complete examination and testing of the animal's brain. In California, cattle rabies is detected every year or so and almost every case is associated with significant human exposure. If we were unable to detect this central nervous system disease (rabies) one or more fatal cases of rabies in humans would occur. The fact is, we <u>are</u> able to routinely diagnose rabies and the same experts are more than capable of diagnosing BSE. Every veterinary diagnostic laboratory in every state is actively looking for BSE and has been since 1986. We are not missing the diagnosis of BSE in cattle in the U.S.

Those who are publicly concerned about spontaneous BSE in cattle and who advocate testing all slaughtered cattle are not at all concerned about beef products imported into the U.S. If BSE does spontaneously occur, it must do so world wide, thus imported beef products would carry the same or greater risk. We must insist on using the science as our guide in making policy regarding BSE.

HEPARIN-BINDING PROTEINS AS AN INDICATOR OF BULL POTENCY

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INTRODUCTION

Over 20 years ago, research was underway to develop methods for in vitro fertilization utilizing bovine sperm and eggs. Freshly ejaculated sperm cannot fertilize an egg. Those sperm must reside in the female reproductive tract for 6-8 h and become diluted from seminal fluid. That process is called capacitation because it allows sperm to acquire the "capacity" to fertilize an egg. The final change sperm cells undergo after capacitation involves a morphological remodeling with release of enzymes packaged in the tip of the sperm head's acrosome. This irreversible remodeling is known as the acrosome reaction. All of these events had to be controlled in the lab to successfully fertilize eggs from cows.

Proteins produced in the seminal vesicles, prostate, and Cowper's glands convey the capacitating effects of heparin, a carbohydrate, to bull sperm. Those proteins are collectively referred to a heparin-binding proteins because they function as "docking' molecules to allow heparin to physically attach to the sperm, causing capacitation. Heparin per se is not found in the female reproductive tract. However, several other heparin-like carbohydrates do exist, and heparin mimics their normal biological action.

One specific heparin binding protein has been named fertility-associated antigen (FAA). For the past 13 years, research has focused specifically on FAA, its identity, the ability to detect it in semen, and field trials comparing fertility of bulls classified as FAA-positive or FAA-negative. Trials included multiple-sire pastures with or without parentage of calves being confirmed by DNA testing. Herds have utilized A.I. in some instances, and serving capacity was also evaluated one year before bulls were allocated to pastures.

Field Trials Comparing Bulls Categorized as FAA-Positive or FAA-Negative

Since 1992, field trials have been conducted in Texas, Nebraska and California to compare prolificacy of bulls that produced semen classified as FAA-positive or FAA-negative.

Multiple-sire pastures: Table 1 contains data from 7 consecutive years of field trials at King Ranch. When bulls were 14-19 mo. of age, FAA status was determined after they passed a breeding soundness exam. All pastures contained 8-16 bulls for 60d at a constant ratio of 1 bull per 25 cows. Overall, FAA-positive bulls were 19 percentage points more fertile than their FAA-negative herdmates. FAA was quantified in the Ax lab at the University of Arizona.

Serving capacity and FAA: The ability of a bull to breed cows can be estimated as "serving

capacity." This is ordinarily evaluated by placing a group of virgin bulls with heifers that were synchronized to be in heat. Mounts with penetration are scored for each bull over a period of 20 min. Bulls are then ranked as "high" or "low" in that social setting.

FAA-positive bulls with high serving capacity impregnated 87% of cows exposed to them for a 60d breeding season. FAA positive bulls with low serving capacity only impregnated 69% of the exposed cows. Bulls with semen lacking FAA but with high serving capacity impregnated 78% of the cows pastured with them. Therefore, their libido was able to compensate for the absence of FAA, but they were inferior to herdmates with high serving capacity possessing seminal FAA (Table 2). FAA was measured in the University of Arizona Lab.

A.I. outcomes: With A.I., serving capacity is not an issue because cows are inseminated when they are in estrus. Holstein heifers and range beef cows were inseminated once with semen from mixed breeds of beef bulls designated as FAA-positive (n=18) or FAA-negative (n=7). Overall, there was a 16% higher fertility in females inseminated with FAA-positive semen (66% pregnancy rate) compared to FAA-negative semen (50% pregnancy rate, Table 3). The University of Arizona Lab analyzed semen for FAA content.

Efficiency of the cow herd: What does selection for FAA-positive bulls do for the cow herd? Research obtained from 1992 through 1998 at King Ranch indicated that the distribution of calves born during the calving season shifted to births occurring earlier (Table 4). In the nucleus herd, cows were initially bred only to FAA-positive bulls. Their replacement daughters were also only bred to FAA-positive bulls in subsequent generations. By 1998, 22% more calves were born in the first 20 days of the calving season from this FAA selection management practice (Table 4). Clearly, efficiency in the cow herd had improved.

DNA parentage of calves: In a collaboration with Drs. Dave and Cindy Daley and Harris Ranches, FAA status of bulls was determined using a newly developed chute-side cassette. Those bulls were in multiple-sire pastures with cows for a 60-day breeding season in 3 consecutive breeding years (2000, 2001, 2002). The trial was conducted to relate parentage of calves by DNA fingerprinting to growth and carcass traits of individual sires. Analysis of FAA status became a retrospective comparison to evaluate utility of the cassettes to analyze semen for FAA within 20 minutes.

Results from this study are being analyzed. Overall, 12 out of 62 total bulls were found to be FAA-negative. This was close to the incidence found in a population of 914 bulls screened in 6 states in April, 2003. In those bulls, 26% were FAA-negative using the same test cassette to quantify FAA in semen.

With the Harris Ranch bulls, complete DNA profiles were achieved with 47 of the 62 bulls. Overall, as bulls got older, they sired more calves per bull (1.1 as yearlings to 22.2 as 5-year old breeding bulls). Irrespective of age, FAA-positive bulls produced 5.9 more calves in the 3 years (1.9 calves/year) compared to FAA-negative herdmates. That translated into a 19% higher calf production for FAA-positive bulls for the 3-year duration of the trial (Table 5). There was clearly an age influence in terms of calf production in relation to FAA status of bulls. As yearlings and 5-year olds, FAA status did not factor into calf yield. However, between the ages of 2 and 4, each FAA-positive bull averaged 35.4 total calves, whereas his FAA-negative herdmates produced 27.3 total calves in that period of time. Therefore, the FAA-negative bulls were 77% as prolific as their FAA-positive contemporaries based upon those numbers.

From ages 1 through 3 years, a higher proportion of FAA-negative bulls were more likely to not sire any calves compared to FAA-positive bulls. In other words, sterility of a bull in a given year corresponded to FAA status of bulls 3 years old or younger.

CONCLUSION

FAA is a good thing! Fertility data support that regardless of years, pasture, or breed, the FAA positive bulls resulted in a higher percentage of cows pregnant compared to FAA negative herdmates. A conservative estimate places pregnancy rates 15% higher in heifers or cows bred to FAA positive bulls.

The calving season should also tighten up if daughters are retained from FAA positive bulls and are bred to known FAA positive bulls. In tern, daughters in subsequent generations need to be bred to FAA positive bulls, and that practice should continue.

FAA testing only takes 20 minutes and is based upon visible detection of a reddish-purple line on a plastic cassette that contains all the necessary chemicals to detect FAA if it is in a semen sample. The projected payback per cow in a herd from testing for FAA in bulls will be 16 to -25 fold if net profit per calf is $50.00. Obviously, if profit per cow exceeds $50.00, then the value of testing for FAA increases substantially.

For more information, pricing, and to order testing kits, contact:

ReproTec, Inc.
(520) 888-0401
(520)888-0297 (FAX)
www.reprotec.us

Table 1. Relationship of Sperm FAA Status to Fertility of Bulls Used For Natural Service.[a]

Sperm	No. Bulls	No. Cows Bred	No. Pregnant	Pregnant (%)
FAA Positive	242	5,317	4,497	85
FAA Negative	192	3,881	2,572	66
Total	434	9,198	7,069	19% Difference

[a]Adapted from Bellin et al., 1994;1996;1998.

Table 2. Impact of Serving Capacity and FAA Status on Fertility of Bulls.[a]

				20 d interval			Fertility	
FAA	**SC**	**Cows**	**BCS**	**1-20**	**21-40**	**41-60**	**%**	**Diff**
Pos	**High**	**270**	**4.2**	**50**	**19**	**18**	**87**	**-**
Neg	**High**	**143**	**4.8**	**45**	**13**	**20**	**78**	**9**
Pos	**Low**	**238**	**4.3**	**29**	**13**	**27**	**69**	**19**

[a]Adapted from Bellin et al., 1998.

Table 3. Relationship Between Sperm FAA Status and Actual First Service Pregnancy Outcomes From Artificial Insemination (AI). Adapted from Sprott et al., 2000.

Sperm	No. Bulls	No. Cows Bred	No. Pregnant	Pregnant (%)
FAA Positive	18	764	501	65.6
FAA Negative	7	386	192	49.7
Total	25	1,150	693	60.2

Table 4. Percentage of Calves Born During the Calving Season.[a]

Day of Calving Season	Births (%)		
	1991[b] 223 Head	1995 262 Head	1998 489 Head
1-30	61.4	66.0	83.8
1-45	83.4	85.1	93.4

[a]Daughters of FAA-positive bulls were retained and bred to FAA-positive bulls for the period of time indicated.
[b]Year Prior to FAA Testing.

Table 5. Calf production per year[a] in relation to age or FAA status of bulls used for multiple-sire breedings.[b]

Age (yrs)					FAA Status	
1	2	3	4	5	Positive	Negative
1.1	7.4	12.7	15.0	22.2	11.5	9.6

[a]Parentage determined by DNA fingerprinting
[b]1 bull per 25 cows for a 60-d breeding season

Suggested Readings

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5. McCauley, T.C., H.M. Zhang, M.E. Bellin and R.L. Ax. 1999. Purification and Characterization of Fertility-Associated Antigen (FAA) in Bovine Seminal Fluid. *Mol Reprod Dev* 54: 145-153.

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8. Sprott, L.R., M.D. Harris, D.W. Forrest, et al. 2000. Artificial Insemination Outcomes in Beef Females Using Bovine Sperm with a Detectable Fertility-Associated Antigen. *J Anim Sci* 78: 795-798.

Oak Woodland Conservation Act of 2001

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University of California

Background

In 2001, the California Legislature passed the California Oak Woodland Conservation Act. This Act grew out of concern that California's oak woodland habitats were threatened and that the State was continuing to lose oaks to development, firewood harvesting, and agricultural conversions. Such losses could critically impact a wide range of wildlife species that are so dependent on this habitat type since oak woodlands are home to more than 300 species of terrestrial vertebrates, as well thousands of invertebrates. In addition, woodlands moderate temperatures, reduce soil erosion, facilitate nutrient cycling, and sustain water quality. The Act recognized the importance of California's oak woodlands -- how they enhance the natural and scenic beauty of this great State, the critical role of the private landowner, and the importance of private land stewardship. The Act further acknowledged how oak woodlands increase the monetary and ecological value of real property and promote ecological balance.

As a result of the Act, the Oak Woodland Conservation Program was established. This Program, administered by the Wildlife Conservation Board (WCB), is designed to provide $10 million to help local jurisdictions protect and enhance their oak woodland resources. It offers landowners, conservation organizations, and cities and counties an opportunity to obtain funding for projects designed to conserve and restore California's oak woodlands. It authorizes the WCB to purchase oak woodland conservation easements and provide grants for land improvements and oak restoration efforts. While the Program is statewide in nature, it is designed to address oak woodland issues on a regional priority basis. Most importantly, this Program provides a mechanism to bring ranchers and conservationists together in a manner that simultaneously allows both to achieve that which is so valued -- sustainable ranch and farming operations, along with healthy oak woodlands.

The Legislature created the Oak Woodlands Conservation Program with the expressed intent to accomplish the following:

- Support and encourage voluntary, long-term private stewardship and conservation of California oak woodlands by offering landowners financial incentives to protect and promote biologically functional oak woodlands;

- Provide incentives to protect and encourage farming and ranching operations that are operated in a manner that protect and promote healthy oak woodlands;

- Provide incentives for the protection of oak trees, providing superior wildlife values on private land, and;

- Encourage planning that is consistent with oak woodland preservation.

The WCB is authorized to award cost-share incentive payments to private landowners who enter into long-term agreements. Such agreements will be structured to include management practices that benefit oak woodlands and promote the economic sustainability of the farming or ranching operations. The Act requires that at least 80 percent of the money be used for grants for the purchase of easements, for restoration activities, or for enhancement projects. In addition, the funds may be used for grants that provide cost-share incentive payments and long-term agreements.

The remaining 20 percent of the funds may be used for public education and outreach efforts by local governments, park and open space districts, resource conservation districts, and nonprofit organizations. Within this 20 percent category, funds may also be used for grants designed to provide technical assistance and to develop and implement oak conservation elements in local general plans.

In order to qualify for funding, the county or city where applicants are applying for funding from, must have an *Oak Woodland Management Plan*. Once the city or county has demonstrated that an *Oak Woodland Management Plan* exists, landowners are eligible to participate in the Program.

The *Oak Woodlands Management Plan*

The Act requires that Plans include a description of all native oak species located within the County's or city's jurisdiction. To assist with the preparation of the Plan, the Act allows nonprofit organizations, park or open space districts, resources conservation districts, or other local government entities to apply to the Wildlife Conservation Board for funds to develop an *Oak Woodlands Management Plan* for a county or city. However, the county or city shall maintain ultimate authority to approve the *Oak Woodlands Management Pla*n. If two or more entities seek grant funding from the WCB to prepare an *Oak Woodlands Management Plan* for the same jurisdiction, the county or city shall designate which entity shall lead the efforts to prepare the necessary document.

To participate in the Oak Woodlands Conservation Program, a county or city shall adopt an *Oak Woodlands Management Plan* in the form of a Resolution. The Resolution does not have to be part of the General Plan. If a county or city currently has a plan in place that meets the minimum requirements of the *Oak Woodlands Management Plan*, a resolution by the governing body certifying such compliance is sufficient.

The Resolution adopted by the local jurisdiction shall contain at least the following elements:

- The county or city agrees to adopt a Resolution to offer private landowners the opportunity to participate in the Oak Woodlands Conservation Program. The *Oak Woodlands Management Plan* and Resolution is adopted pursuant to the requirements of California Fish and Game Code Section 1366 (a). Previously adopted resolutions are acceptable if they meet the minimum requirements of the Resolution.

- The county or city shall prepare statements that describe the status of oak woodlands in their jurisdiction. Such statements shall include a description of all native oak species, estimates of the current and historical distribution of oak woodlands, existing threats, status of natural regeneration and growth trends. To the extent possible, local jurisdictions shall prepare maps displaying the current distribution of oak woodlands.

- The county or city shall prepare statements recognizing the economic value of oak woodlands to landowners and the community at large. These statements shall encourages and support farming, ranching, and grazing operations that are compatible with oak woodland conservation.

- The county or city shall prepare statements recognizing the natural resource values of oak woodlands, including the critical role oak woodlands play relative to the health and function of local watersheds, soil and water retention, wildlife habitat, open space, and the reproduction or reduction of fuel loads.

- The county or city shall prepare statements recognizing that the loss of oak woodlands has serious effects on wildlife habitat, retention of soil and water and that planning decisions for oak woodlands should take into account potential effects of fragmentation of oak woodlands.

- The county or city shall prepare statements expressing support for landowners that participate in the Oak Woodlands Conservation Program. To qualify for funding consideration by the Wildlife Conservation Board, the county or city agree, pursuant to Section 1366 (f) of the Act, to certify that individual proposals are consistent with the county or city *Oak Woodlands Management Plan.*

- The county or city shall prepare statements that support and encourage education and outreach efforts designed to demonstrate the economic, social, and ecological values associated with oak woodlands.

- The county or city shall review and update as necessary, the *Oak Woodlands Management Plan.*

Eligible Participants

The Oak Woodlands Conservation Program is designed to consider grant proposals from the following participants: private landowners, local government entities, park and open space districts, resource conservation districts, and nonprofit organizations. Participants are encouraged to develop partnerships with interested individuals or organizations that are designed to leverage available technical and financial resources.

In addition, the county or city shall certify that proposed grant requests are consistent with the *Oak Woodlands Management Plan* of the county or city. As such, eligible participants must consult with the local county or city and obtain a certification that the proposal is consistent.

Applicants are encouraged to seek input from the local Fish and Game Biologist or other resource professionals when developing proposals that request funding for conservation easements, development of management plans, or long-term agreements.

To learn more about this Program, or to download an application package, please visit the WCB web site at http://www.dfg.ca.gov/wcb/, or contact Marilyn Cundiff, the Program Administrator, at email: MCundiff@dfg.ca.gov., or phone: (916) 445-1079.

High Sierra Beef Progress Update

Roger Ingram
UCCE Livestock and Natural Resources Advisor – Placer & Nevada Counties

Research similar efforts in other regions

Research was completed on similar efforts in other regions. There are over 300 grass-fed beef marketing operations across the United States. Here in California, there are approximately 10. Most are selling approximately 50-60 head per year. This appears to be a marketing limit for those who produce, process, market and distribute on their own. Additional labor and space requirements for marketing, storage for dry-aging, and distribution appear to be the biggest barriers to increasing market share for producers working individually.

The largest grass-fed beef company in California is marketing around 1000 head annually primarily to Bay Area restaurants. Branded beef consultant Allen Williams has noted the grass-fed beef market still has plenty of room to expand and that price is not a limiting factor. Ervin's Beef in Arizona has noted that you can market all you can produce. One Bay Area restaurant is wanting grass-fed beef and is willing to work with other restaurants and independent retail outlets to help move the entire carcass and insure the company they are working with will be able to grow large enough to insure they stay a viable business.

Producer Survey Results

Based on a response rate of 27 percent (out of 466 surveys mailed), there is adequate supply to initially meet market demand. On average, ranchers in the HSB project area have 30 years of ranching experience. The average age of ranchers in the project area reflects statewide trends, with 79.1 percent of the respondents being over 45 years of age (opposed to only 5.6 percent under the age of 35). Most producers (81.7 percent) are in the cow-calf business, while seedstock producers (24.6 percent), stocker operators (17.5 percent) and feedlots (4.8 percent) are also represented. Most producers use English breeds – 67 percent of the bulls owned by those who responded were Angus. Cows were predominately Angus and Hereford.

Total cattle numbers for survey respondents are summarized below:

Class	*Total*	*Average*
Bulls	663	7.1
Cows	11,327	106.9
Heifers	3,578	37.3
Steers	2,374	32.5

Seasonal supply of cattle does not appear to be a problem as shown in the following table, which reflects number of cattle sold per season by respondents:

Class	*Spring*	*Summer*	*Fall*	*Winter*
Cows	204	338	840	230
Heifers	706	1662	279	728
Steers	665	1755	909	739
Bulls	36	36	100	67

More than 40 percent of respondents have participated in quality assurance programs, and nearly 55 percent keep herd health records. Only 5.6 percent indicated that they feed antibiotics to their cattle, and just 10.3 percent use implants. These elements may become critical in marketing a niche product.

Those who responded run cattle on 84,695 acres of owned land and 63,847 acres of leased land. Respondents include small, medium and large producers. Many are involved in conservation programs, as well; this could be used as a marketing message (see the table below):

Program	*Number of Ranches*	*Acreage*
Williamson Act	54	50,955
Super Williamson Act	2	6,350
Environmental Quality Incentives Program	7	6,350
Wildlife Habitat Incentives Program	2	250
Conservation Easements	11	21,213

Consumer, Restaurant and Retail Surveys

Three product samplings were conducted with 700 consumers at events in Placer and Nevada counties. During the samplings, surveys were distributed. Survey respondents ranked the same beef attributes on the same 5 point scale as the restaurant and store market survey conducted in March 2003. A total of 142 surveys were returned. The restaurant and market surveys were conducted with 29 establishments in the six-county area.

Results from the consumer surveys and how they compared with the March 2003 survey were as follows (1 = not at all important and 5= very important):

Attributes	Consumer Avg	Restaurant and Retail Store Avg
Flavor	4.7	4.7
Tenderness	4.7	4.7
Food Safety Assurances	4.7	4.8
Quality Assurance Certified	4.7	4.1
Consistent Quality	4.6	4.9
Nutritional Value	4.6	3.6
Antibiotic Free	4.4	3.7
Hormone Free	4.4	3.7
Dry Aged (14 to 21 Days)	4.3	3.3
Locally Produced On a Family Ranch	4.0	3.2
Grass-fed	4.0	2.8
Recipes & Other Product Information	3.5	2.4
Breed	3.3	3

Most of the establishments surveyed purchase a range of beef products, from steaks and roasts to ground beef. Nearly all of the establishments expressed an interest in participating in product taste testing with HSB.

Results from the consumer surveys were similar in some aspects with the March 2003 Restaurant and Retail Store survey. Both surveys were in agreement on the top 5 attributes, although not in the same exact order. These attributes were:

- Consistent Quality
- Food Safety Assurances
- Flavor
- Tenderness
- Quality Assurance Certified

Consumers also placed a higher score on nutritional value, antibiotic-free, hormone-free, dry-aged, locally produced, and grass-fed. Anecdotal comments from the product samplings seemed to indicate that locally grown and grass-fed are important. Interviews with two Bay area restaurants indicate that grass-fed and locally grown are important marketing attributes.

Processing Results

High Sierra Beef purchased a five-year old cow and a two-year old heifer. These were processed at Johansen's Meat in August. The cow's carcass weights yielded 897 pounds for the cow and 512 pounds for the heifer. The majority of the meat was ground into hamburger. The tenderloins

and tri-tip was pulled from both carcasses to sample some premium cuts of beef. The ribeye on the heifer was also pulled.

The cow's fat was yellow due to her age and time grazing on irrigated pasture and annual rangeland. The heifer's fat was more of a cream color due to her younger age. The ground beef from the cow was formulated into 13% fat. To test value-added opportunities, 50 pounds of the cow was made into a beef stick. The yield on the beef stick was 33 pounds.

Current Work

High Sierra Beef is currently working on completing a financial model and selecting a business model. Work is continuing on finalizing protocols and grazing strategies to ensure a consistent product. The Executive Committee will review business plan development in May to determine whether to proceed with forming a business. If that decision is affirmative, product testing and development would occur throughout the summer and fall of 2004. Product would be available to sell in spring 2005.

High Sierra Beef
Fact Sheet

- The High Sierra Beef (HSB) project was initiated by ranching families in El Dorado, Nevada, Placer, Plumas, Sierra and Yuba Counties with support from the University of California Cooperative Extension, the Sierra College Small Business Development Center and the High Sierra Resource Conservation and Development Council.

- HSB's Vision: ***High Sierra Beef is a producer-controlled business that markets beef products of consistent quality in order to sustain family ranchers.***

- The project was initiated in response to declining ranch income, loss of land from agriculture, and unmet demand for grassfed beef.

- The project has been awarded $136,600 in grant funding from USDA Rural Development, the California Department of Food and Agriculture and the US Forest Service. These cash grants have been matched by more than $55,000 in in-kind contributions from UC Cooperative Extension, High Sierra RC&D, and the ranching families involved in the Steering Committee.

- On September 27, 2003, the HSB Steering Committee approved the findings of the feasibility study, which indicated that significant opportunities exist for marketing grassfed beef that is produced within the High Sierra region. In supporting the feasibility study, the Steering Committee directed its project team to complete a business plan for High Sierra Beef.

- High Sierra Beef will market grassfed, natural beef products (e.g., cattle will never receive grain or grain byproducts, nor will they be implanted with growth hormones or fed antibiotics).

- Cattle will be pre-qualified for the HSB program at weaning using state-of-the-art ultrasound and computer imaging technology. Pre-qualified cattle will be re-evaluated just prior to harvest to ensure quality and consistency.

- All High Sierra Beef products will be source-verified from calf birth to marketing using electronic identification technology.

- Participating ranches will follow specific cattle health and management criteria designed to ensure product quality, safety and consistency.

- Since High Sierra Beef will finish cattle exclusively on a high quality forage diet, its products will be seasonal initially.

- Through genetic improvement and ultrasound technology, High Sierra Beef will assist member-producers in producing animals that will grade USDA Choice or better.

- Cattle will be finished exclusively on high quality forage and subject to specific management protocols.

- High Sierra Beef products will be marketed through upscale restaurants, specialty retailers, high-end institutional markets and the internet.

- Products will include steaks, roasts, premium ground beef, and a variety of value added products.

- High Sierra Beef's initial marketing region will include the greater Bay Area, the Sacramento region, the High Sierra project area, and the Reno/Tahoe area.

- High Sierra Beef will partner with existing processors, fabricators and distributors.

High Sierra Beef Project Team

Dan Macon, High Sierra Resource Conservation and Development Council, brings a lifetime of experience in the cattle industry. He formerly worked for the California Cattlemen's Association and California Rangeland Trust. His extensive rancher contacts in HSB's 6-county project region provide the team with industry connections. Dan also coordinates the team's grant writing efforts, securing over $190,000 in grants and in-kind contributions to complete HSB's feasibility study and business plan.

Roger Ingram, University of California Cooperative Extension, has 18 years experience working with ranchers in Placer and Nevada Counties. He has taught over 400 ranchers intensive grazing techniques over the last 12 years through a Grazing Academy. These techniques will be necessary to insure product consistency on grass. Roger's UC connection will enable research to be conducted on grassfed beef finishing systems. He has also secured $40,000 in UC funding to support development of the feasibility study and business plan.

Terry Jochim, High Sierra Beef Project Manager, currently serves as Vice-President of the California Beef Cattle Improvement Association and has been in the cattle business since 1992. Terry has served as the Chief of the Material Management Center at McClellan Air Force Base. He planned, organized, and directed the operations of a 155,000 sq ft warehouse and distribution center. Terry was responsible for business and marketing planning, marketing to potential customers, and evaluating new business opportunities through a cost-benefit analysis. In this capacity, he was responsible for a $1.3 million annual operating budget.

Doug Freeman, Sierra College Small Business Development Center, has worked in the business world and served as a business consultant for over 25 years (and for the last five years at the Sierra College Small Business Development Center).His experiences in working with clients on developing business plans has enabled High Sierra Beef to retain an emphasis on developing markets as opposed to focusing strictly on production. Doug asks the tough questions in relation to the business plan that must be answered fro HSB to become a sustainable business.

High Sierra Beef Executive Committee

David Gallino, Chair
Nevada/Sierra County Rancher

Jenny Brown, Vice Chair
Yuba County Rancher

Gretchen Fretter
El Dorado County Rancher

Tim Nielsen
El Dorado County Rancher

Sean Avera
Nevada County Rancher

Danny Casillas
Nevada County Rancher

Anna Reynolds Trabucco
Nevada County Ranchland Owner

Bart Cremers
Wildlands Inc. Cattle Manager

Lyndell Grey
Placer County Rancher

Rick Leonhardt
Plumas County Rancher

Cindy Noble
Plumas County Ranchland Owner

Carol Edwards
Yuba County Rancher

John Waskiewicz
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