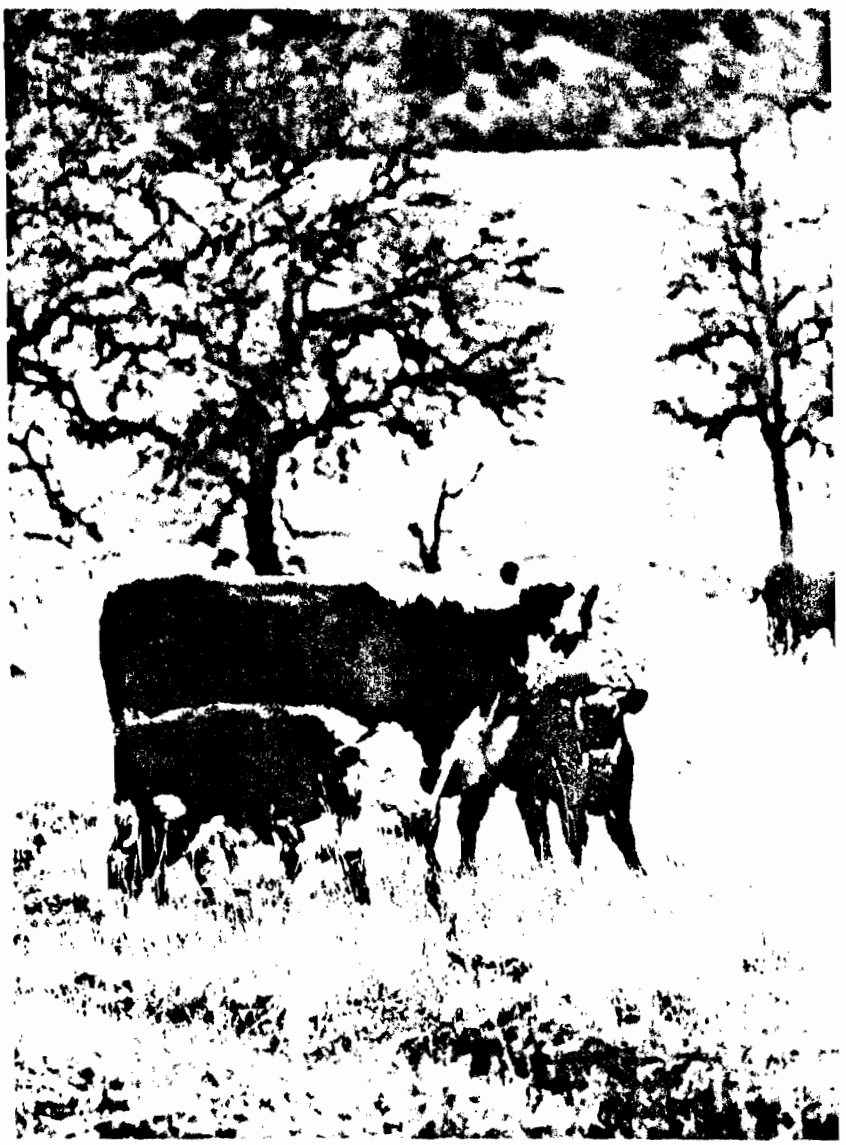
Mike Connor

UNIVERSITY OF CALIFORNIA
BEEF CATTLE DAY



Department of Animal Science
and Cooperative Extension
September 15, 22, and 29, 1984

DEPARTMENT OF ANIMAL SCIENCE
AND COOPERATIVE EXTENSION

University of California Beef Cattle Day
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PARTICIPATING SPEAKERS

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BREED'EM YOUNG, BREED'EM RIGHT

Reuben Albaugh, Emeritus

Calving difficulty still remains one of the most important problems on many livestock ranches. This is especially true where heifers are bred to calve at two years of age. Emphasis on growth rate and the use of large exotic breeds has compounded this problem. The following causes and effects of dystocia were developed at the Clay Center Station.

1. Age of cow
2. Birth weight of calf
3. Calving difficulty increased 1% for each increasing pound of calf birth weight
4. Calf mortality was 4% higher with difficult calving
5. Conception rate on subsequent calf was 18% lower for cows with dystocia

Since few cattle producers can afford the luxury to not breed their heifers to calve at two years of age, little can be done about the age of the cow. On the other hand much can be accomplished by using bulls that are known to sire small calves at birth. To avoid calving problems on two-year-old heifers, calf birth weights should not exceed 75 lbs. In early studies on the proper management of yearling heifers, small, light-boned Angus bulls were recommended. The reason was that the gestation period was shorter and the birth weights were smaller when compared to Herefords. This data was developed at the Ohio Experiment Station.

TABLE 1

Ohio Study (8 years) - FEMALE CALVES

	From Angus Cows				From Hereford Cows			
	Purebred Angus		Crossbred Hereford-Angus		Purebred Hereford		Crossbred Angus-Hereford	
Gestation, days	(48)	275.7	(42)	281.1	(53)	285.2	(54)	283.5
Birth wt., lbs.	(48)	56.1	(42)	62.7	(54)	67.8	(54)	62.6

Numbers in parenthesis represent the number of calves used in calculations.

TABLE 2

Ohio Study (8 yrs.) - MALE CALVES

	From Angus Cows				From Hereford Cows			
	Purebred Angus		Crossbred Hereford-Angus		Purebred Hereford		Crossbred Angus-Hereford	
Gestation, days	(53)	277.2	(52)	282.7	(47)	287.5	(48)	283.1
Birth wt., lbs.	(53)	62.4	(52)	65.9	(50)	69.2	(48)	67.0

Numbers in parenthesis represent the number of calves used in calculations.

More recently Longhorn and Jersey bulls have been found to sire small calves at birth. The following data has been secured from the Tejon and Snedden Ranches.

TABLE 3

TEJON RANCH DATA

877 Yearling heifers bred to 43 Longhorn bulls
492 Herefords
200 Black Brangus Hereford crossbreds
185 Red Brangus Hereford crossbreds
644 Calves weaned (73%), 1 calf pulled

WEANING WEIGHTS

Longhorn heifers	-	488
Longhorn steers	-	483
Straight Hereford heifers	-	469
Straight Hereford steers	-	513

TABLE 4

B. J. SNEDDEN RANCH DATA (8 YEARS)

557 HEIFERS BRED TO ANGUS BULLS:

348 Calves weaned
29 Calves were pulled
8 Heifers died calving

349 HEIFERS BRED TO JERSEY BULLS:

261 Calves weaned
10 Calves were pulled
0 Heifers died and no significant calving difficulties

BELOW IS A COMPARISON OF THE WEANING WEIGHTS OF HEREFORD-JERSEY CROSSES AND STRAIGHT HEREFORDS:

Hereford-Jersey Crosses:			Straightbred Herefords:		
Weaning weight	-	Heifers 464	Weaning weight	-	Heifers 508
Weaning weight	-	Steers 500	Weaning weight	-	Steers 547

Birth weights and gestation lengths on purebred Longhorns on the Tejon Ranch were: heifers 40 lbs. and steers 45 lbs. with gestation length at 281 days. For the Jersey crossbred cattle at Clay Center Meat Animal Research Center, the gestation period was 281 days and the birth weights were 71 lbs.

The feedlot performance and carcass quality plus tenderness score on crossbred Longhorn-Herefords, crossbred Jersey-Herefords, and straight Herefords were examined at U.C. Davis two years ago. This experiment was conducted by Dr. William Garrett, Professor of Animal Science at U.C. Davis. In this study 30 head of each of these breeds were purchased and brought to Davis. The Jersey-Longhorn crosses were out of two-year-old heifers. Most of these heifers were straight Herefords, but some were two way crosses so a few of these steers were three way crosses. The Hereford steers were out of mature Hereford cows and were of high quality. All of these animals were approximately the same age, being born during October, November and December of 1978. At the beginning of this experiment the majority of these cattle contracted pneumonia. UCD veterinarians treated the animals for this malady. In spite of the treatment, two of the crossbred Jerseys died and one of the Herefords died. One Longhorn had to be destroyed because it became paralyzed possibly due to an injury during the treatment for pneumonia. These animals were all individually fed a high concentrate ration. They were processed at the Armour Company in Dixon, California. A portion of the ribeye was removed from each carcass to determine the tenderness by the use of the Bratzler and Kramer Shear Tests. The following table gives the results of this test.

TABLE 5

ITEM	JERSEY CROSSBRED	LONGHORN CROSSBRED	HEREFORD
Average Days on Feed	203	203	203
Number of Animals	22	23	23
Initial Weight (lbs)	414	460	518
Final Weight (lbs)	883	921	978
Lb of Feed/Hd/Day	15.15	15.23	15.63
Av. Daily Gain (lbs)	2.33	2.29	2.28
Lb of Feed/Lb of Gain	6.52^{ab}	6.70^{bc}	6.93^{c}
Carcass Data			
Dressing %	62.07^{a}	63.07^{b}	63.40^{b}
Fat %	31.22	31.02	30.62
Carcass Grade	10.68^{a}	10.82^{a}	9.74^{b}
Yield Grade	2.27^{a}	2.87^{b}	3.13^{b}
Rib Eye Area, Sq. In.	10.78^{b}	10.21^{a}	10.88^{b}
Fat Thickness, In.	$.345^{a}$	$.452^{b}$	$.683^{c}$

TABLE 6

Breeds	No. of animals	W-B shear value kg/core*	Kramer shear value kg/20 g meat*
Jersey	22	6.2 ± 1.1^{a}	136.3 ± 31.6^{c}
Longhorn	22	$6.7 \pm 1.2^{a,b}$	$150.2 \pm 29.0^{c,d}$

*Mean + S.D.
a,b,c,d Means with different superscripts in the same column are different significantly ($p < 0.05$).

SUMMARY:

Dr. Garrett had the following summary to report: "Daily gains favored the Jerseys over the Herefords, and the Longhorns were in an intermediate position. However, dressing percent was the highest for the Herefords and the Longhorns. Therefore, adjusting the feed conversion ratio for differences in dressing percent removed all significant breed differences noted in the feed per gain ratio. The Jerseys and Longhorns racked up the best carcass grades although all breeds averaged about 31% carcass fat. Fat thickness was in favor of the Jerseys and Longhorns, breeds which also had less subcutaneous fat than the Herefords. Carcass yield grade was the best for the Jerseys. Ribeye area favored the Jerseys and Herefords on a carcaszs weight basis. The Jersey-cross steers had the largest ribeye area. No difference existed between the Herefords and Longhorns."

In summary it can be said that the performance of these three groups of cattle were very similar and that price discrimination against the Longhorn-Jersey crosses may not be justified. This experiment was financially supported by Mrs. Walter Rosenberg, cattle producer of San Ardo, Monterey County, California.

Another experiment was carried on at Texas A&M University where the performance of straight Herefords was compared to Longhorn-Herefords. These cattle were all out of two-year-old heifers. The following table gives the results of this test which indicates that the Herefords out-gained the Longhorns and they also were more efficient in their feed utilization. However, the cost and net profit favored the Longhorns.

TABLE 7

AVERAGE FEEDLOT PERFORMANCE OF STEERS
DURING FINISHING PERIODS

	NO. OF STEERS	BREED TYPE HEREFORD	TEXAS LONGHORN X HEREFORD
LIVE WEIGHT, LB.			
Initially	80	685.9	699.3
Final Weight	76	1160.7	1113.7
AVERAGE DAILY GAIN			
From 0 to 172 days	76	2.39	2.18
AVG. FEED DRY MATTER CONSUMPTION PER HEAD PER DAY			
From 0 to 172 days	76	23.2	22.8
FEED CONVERSION			
From 0 to 172 days	76	10.37	10.61
CUMULATIVE FEEDLOT COST PER HEAD, $			
From 0 to 172 days	76	322.50	318.05

Clay Center researchers have studied the performance of the crossbred Jersey to the crossbred Hereford and Angus crossbred. Weaning weights at 200 days favored the Hereford and Angus crosses at 428 lbs. compared to 404 lbs. for the Jerseys. At 405 days, the Herefords weighted 948 lbs. compared to 899 lbs. for Jersey crosses. The Jersey crosses hung up the winning number with 200-day calf weaning weights of 490 pounds compared to 472 pounds for the crossbred Herefords and Angus.

Recommendations for managing the breeding of yearling heifers (15 months):

1. Breed only wellgrown healthy heifers 30 days before the main herd.
   A. Minimum weight at breeding time:
      600 lbs for British breeds
      700 lbs for larger breeds
2. Use only bulls that are known to produce small calves at birth.
3. Breed twice the number heifers needed for replacement.
4. At the end of the 45 days breeding period, remove bulls and keep only those heifers that are pregnant.
5. Have heifers gaining weight 30 days before calving and continue to gain until they have conceived for second calf.
6. Cull heifers that have difficulty in calving.
7. Consider the use of prostaglandins to bring heifers into heat in order to calf heifers by appointment.

THE EFFECTS OF DYSTOCIA ON FUTURE REPRODUCTION AND CALF SURVIVAL

S. L. Berry

Calving difficulty (dystocia) is a major cause of reduced reproductive efficiency in beef cattle. Dystocia results in increased cow mortality, decreased future reproductive performance, increased veterinary expenses, increased labor costs for owner or hired hands and increased calf mortality.

The most insidious and least visible of these effects of dystocia is the decrease in future reproductive performance. In various studies which compared reproductive performance of cows experiencing normal birth to those having dystocia, it was found that subsequent pregnancy rates were decreased by 5-20 percent in cows where the calf was pulled manually and by 30-40 percent in cows that had cesarean sections.

Another result of dystocia which is not often fully appreciated is the increase in calf mortality from birth to weaning. Cows experiencing dystocia will wean about 5-15 percent fewer calves than those calving normally.

Many of the factors responsible for dystocia are determined by the time a heifer is bred, so reducing dystocia in heifers should increase reproductive efficiency. One of the most important factors is the growth rate of the heifer. Heifers need a high plane of nutrition from weaning to breeding. Another factor associated with dystocia is pelvic size. Although some of the evidence is contradictory, generally, within a group of heifers those with larger pelvic diameters will have fewer calving problems.

Selection of sires can have a dramatic effect on the incidence of dystocia. If AI is being used, then selection of a sire based on calving ease scores will decrease calving problems. In a study conducted in Montana, heifers were bred AI to Angus bulls selected for calving ease or to unselected Longhorn bulls. There was no difference in dystocia scores for the two groups, but calves from heifers bred to the Angus bulls were 38 pounds heavier at weaning than those bred to the Longhorn bulls. If natural breeding is being used and supervision of heifers at calving is difficult, then breeding to Longhorn bulls is a viable option. If heifers can be watched closely at calving and growth rate of calves is more important, then low birthweight bulls can be purchased from breeders keeping good records.

A practice which some people may use to decrease birthweighs of calves is to lower the plane of nutrition of the cows or heifers during late gestation. Most studies show that decreased nutrition decreases birth weights of calves; however, no decrease in incidence of dystocia is found. The cows on the lower plane of nutrition have a tendency to have longer postpartum to estrus intervals and lower subsequent conception rates than those fed a higher plane of nutrition.

If dystocia occurs, then the length of time that a heifer or cow is in labor before assistance is given can be an important factor in future reproductive performance. One study indicated that timely assistance improved subsequent performance. Heifers assisted early in labor had a pregnancy rate of 88 percent versus 69 percent for those assisted later. The pregnancy rates for cows were 91 percent and 82 percent, respectively. While these findings were statistically nonsignificant, their tendency was in the right direction and they indicate the need for more study.

Once dystocia is apparent, it is important to handle it systematically and promptly. Calving facilities should be as hygeinic as possible and

equipment should be clean and readily accessible. Clean water and soap should be available. Follow a definite, logical order in determining the action taken (Fig. 1). It is important to know at what point to call a veterinarian, and that point will vary under different circumstances. Too often the veterinarian is called as a last resort after the damage is already done. One piece of equipment which should always be available and in good working order is a fetal extractor (calf jack) which will allow the operator to work with the cow and to apply pressure in a direction that is much less likely to result in a hiplocked calf than would a fence stretcher or come-along. Good obstetrics requires patience and experience to achieve desirable results.

In summary, there is much evidence that dystocia can and does decrease reproductive efficiency, and that prompt attention when dystocia does occur can alleviate some of the losses. Management decisions regarding sire selection and nutrition prior to breeding will influence the level of dystocia that occurs.

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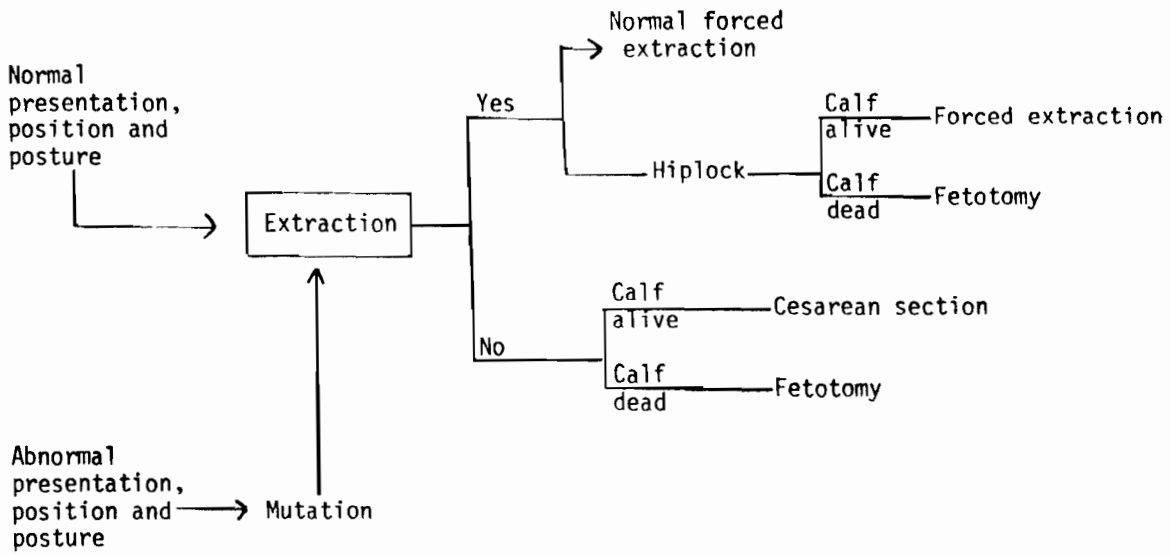

Fig. 1. Flow pattern for parturition once dystocia is diagnosed. (Adapted from Schuijt and Ball, 1980.)

CHANGE CREATES DEMAND

JANE ANDERSON

The beef industry is part of a maturing meat market, one that has grown with the American population. The meat market's growth is due to the simple truth that people have to eat and, in bountiful America, meat has traditionally been a food staple. The market is changing, though, and those of us in the meat industry are going to see, and have seen, a different consumer outlook toward meat and its role in our diet.

Although beef remains the most popular meat food, that fact is no cause for celebration. Beef's share of the total meat market has decreased in the last 20 years. Poultry trails beef in per capita consumption, however while the American public ate about 20 percent more beef in 1980 than two decades before, annual consumption of poultry increased more than 80 percent in that same time period. Beef's role within a meal has changed as well. Since 1967, beef's role as a meal component, rather than as a main dish, has increased from 56 percent of all serving occasions to 73 percent. Beef's popularity has been maintained on the lower priced, most convenient form of beef - ground beef. It accounts for over 80 percent of all usings.

The beef industry has the opportunity to take advantage of these market changes -- if we also change. The marketplace is not static, but our marketing strategy has been. In the past, our way to sell beef, handed down from cattle producer to son, was simply to produce beef, and to assume the consumers would buy it. That strategy is inadequate for today's marketplace.

In our industry, we can no longer think of ourselves as cattle producers. The American public does not buy cattle. The public buys beef, and we must adjust our thinking accordingly. We must view ourselves as beef producers, with a product that needs to be merchandised.

No one can continue to presume that beef is the only national product able to survive without advertising, without promotion. We have seen what has happened without such action; we have seen a decline in beef's share of the marketplace. However, marketing tools alone can not improve the market for beef. Our product, beef, must maintain its quality perception in the minds of consumers and match the shopping and dining needs of the beef consumers. Marketing and product quality are inseparable.

At the California Beef Council, we have begun putting plans into action to meet the many and varied needs of beef consumers. Our strategy -- based on continuing market research, program development, and evaluation of those programs -- is also simple, in theory. But, in practice, it addresses the demand of an everchanging marketplace.

To meet the marketing challenge, beef producers have several tools available ... beginning with research! Ongoing consumer research can identify the needs of beef consumers through product development, answering the question, "In what form do consumers like their beef?" Research can also define market segments, answering the question, "Who are the beef consumers?" And, through market positioning, answer the questions of why consumers purchase beef. What message influences the decision?

Step two is test marketing to a target group of consumers, of a new advertising campaign, a new product, or an old product in a new form - another tool available to the beef industry. Although over 90 percent of American households serve beef more than five times in a two-week period, beef is not all things to all people. Market research has revealed that there are light, medium and heavy beef users, and each of those groups has a different attitude toward, and a different need for, our product.

After research and testing, the actual marketing begins. In 1982, the Beef Industry Council developed a marketing plan based on the concept that, "Somehow, nothing satisfies like beef," directed toward the heavy beef

users. However, research discovered that heavy and medium beef users, who consume almost 65 percent of our product, consists of only about 40 percent of the consumer population. Research also showed that "satisfaction" was not a universally accepted quality for beef.

In such situations, the tool of program evaluation demonstrates its value. The "Somehow" campaign was replaced by the new, "Beef Gives Strength," marketing plan. The new message that "beef is the ideal food for the way we live and work today" is targeted to the light beef user, but is also acceptable to medium and heavy users. Research done this July confirms the right direction of the newest campaign.

Evaluation is necessary. The beef industry does not get a one-to-one return on the dollars it invests in marketing; too many variables are involved. As beef travels from producer to consumer, weather, outside investors, confidence in the marketplace and general economic health are just some of the factors influencing return on dollars invested in the beef industry. But, by taking the right product, with the right message, and by using publicity and sales efforts to tie everything together, the beef industry can meet the needs of the marketplace and promote demand. Evaluation of individual programs then is the best way to measure success for the CBC's efforts.

The job of positioning beef as a desirable food is not finished with one successful campaign, though. It never will be, because consumers' lifestyles and needs are dynamic. In the last few decades, the life of the cattle producer has changed, but not as much as the life of the urbanite. We must direct our marketing to the new consumer segments.

The new market segments include people who are convenience-oriented, often from two-paycheck families. More men are shopping these days. America's palate has become more sophisticated, variety is the spice of life, exhibited by the largest trend toward ethnic cookery. The beef industry needs to reach customers directly, as well as the food thoughtleaders, the retailers, the foodservice purveyors -- they are the customers who reach our consumers.

Marketing formulas have no shortcuts. Through research, targeting, programming and evaluation, we can gain control in the marketplace, but two factors are essential. First, the new marketing strategy needs time; it is a long-term process because many, changing variables act on our goal. Second, the plan's success depends on the cooperation, including financial support and positive sentiment, of everyone involved in the beef industry.

At the California Beef Council, we have been surveying the market situation and are in the process of developing beef merchandising programs to match several major consumer groups. Using the mandated marketing areas of promotion, research, education and public information, the beef council is working to capitalize on the increased opportunities for beef promotion afforded by these groups.

One group of consumers, the Hispanic market, belongs to the heavy user category. Beef is a food staple of this group, due to its convenience, versatility and perceived value for its price. Hispanic consumers are using more beef today than they did five years ago, and the Hispanic share of market will continue to grow. The beef attitudes of Hispanic shoppers justify to the beef council a new advertising strategy via Spanish-speaking television and radio, and at the retail level.

The California Beef Council is also working at the international level to market its product, as the Pacific Rim countries open up to beef exports. Information collated by the council indicates that by the year 1990, two billion more mouths will need to be fed in the Pacific Rim, and the Gross National Product of most of those nations should continue to grow. Thus, a beef promotion plan is necessary for the Pacific Rim market. This year, the CBC has increased its support of the U.S. Meat Export Federation and will underwrite an access study of the Japanese market.

The state's health-care professionals and nutritionists' members (in addition to buying beef) are food trendsetters for other consumers and are another target group of the council. A marketing plan, "Light Cooking With Beef," has been developed for that group to update their information about beef. Nutritional myths about the hazards of red meat are being dispelled as the professionals read, often for the first time, the lastest research about our product's contribution to good health. The new information is

based on research conducted through dollars contributed by California's beef industry. The new position for beef is positive. Beef can fit the dietary recommenations of major health associations, using the recipes and nutrition information compiled for this program.

The California Beef Council has already begun altering the promotional strategy of the state's beef industry, to meet the demands of a market that is not static. As long as the cattle industry continues to look at the changing marketplace as a threat, however, beef's survival is in jeopardy.

By using the marketing tools to take advantage of the new marketplace opportunities, we can position our product with strength and consumer desirability. Most importantly, we must keep in mind that the market will never stand still long enough for us to lay down those tools; consumer lifestyles are dynamic, and the beef industry must follow suit.

SELECTING BEEF CATTLE FOR MAXIMUM PROFIT

C. Richard Benson, University of California, Davis

Maximum profit or minimum loss from a beef cattle enterprise has not necessarily resulted from maximum performance of individual animals, either from their genetic potential or from management and resource inputs. Optimum has become the keyword for cost effectiveness. While maximum or minimum performance of the individual animal is not precluded as optimal, it does not appear likely in most cases. This message, based on systems evaluation, has become increasingly clear during the past decade.

In this program I will summarize results from systems research as I see it, and discuss how that has influenced my recommendations for commercial breeding programs and selection objectives. Finally we will use performance records to rank a group of cattle for their effect on herd profit.

In contrast to traditional thought, genetic superiority in a systems evaluation of ranch profit usually is not equal to maximum or minimum genetic potential in each trait. Therefore genetic improvement cannot be stated simply as a continual increase or decrease in genetic capability. That is because a change in performance per animal frequently is associated with a change in resource use per animal, or it may have a negative affect on some other trait that affects profit. For example, increased growth rate requires increased feed per animal which decreases the number of animals that can be carried. Likewise, it may affect the number of live calves because of the relationship between size at birth and death loss associated with calving difficulty. Therefore increased growth rate, or change in any characteristic, is neither desirable nor undesirable when considered alone. The banker does not care whether the same net profit is generated from a few large animals consuming more resource and returning more income per animal, or from more small animals consuming less resource and producing less income per animal.

A systems evaluation of ranch profit is based on the number of animals, performance per animal, resource use per animal and dollars. It is yearly output (i.e. total sale weight x price per unit weight) of all market animals and the resource use, including capital, of all animals required to produce them. Cattle are useful because people cannot eat grass. The cattle, management program and marketing are the system that converts land, labor and capital into human edible output.

Optimal performance is determined by market requirement for the meat product and efficiency of production. Our breeding and management must produce the carcass weight, yield grade and quality grade specifications the market wants, unless efficiency of production offsets the market discount for slaughter cattle that produce a carcass characteristics outside the acceptable range for weight, yield grade and quality grade.

Industry prefers yield grade 2 and 3 cattle with carcass weight ranging from 550 pounds to 850 pounds, or roughly 900 pounds to 1350 pounds liveweight. That is a frame three to low frame seven steer. The cow size that will produce the highest percentage of steer and heifer carcass that meet market requirements depends upon the breeding program, particularly the effect of terminal crosses for growth or calving ease. Commercial cow herds that average high frame four to low frame five with most cows in the frame four and five categories probably are most versatile. A general weight range for cows of that size is probably 1050 pounds to 1250 pounds, although that will vary considerably depending upon feed conditions and lactation. Therefore, from the standpoint of meeting carcass requirements, you do not need to select larger cows or bulls if your cow herd falls within the acceptable weight range.

However are larger cattle economically more efficient? The recent Beef Cow Efficiency Forum at Colorado State and Michigan State Universities

discussed the impact of genetic difference in size, milk, and functional efficiency on herd profit. Notter (1984) and Brinks & Bourden (1984) concluded from their work and a survey of other computer simulation experiments that there are theorectical advantages to larger size. However, Notter mentioned that accumulating information on breed differences at the U. S. Meat Animal Research Center may alter some of the theoretical assumptions that computer simulation models are based on which give advantage to the larger size. We will have to wait and see what affect that will have on the results.

Notter (1984) also reported that an intermediate level of milk production was optimal based on his computer simulation results. He found that the optimal range of milk production in a sparse nutritional environment was narrower and at a lower level than the optimal range in a good nutritional environment. There must be enough milk to provide adequate nutrition for the calf, but not so much that it interferes with ability to rebreed under normal range nutrition.

The optimal level of milk may be less than Notter suggests when apparent differences in efficiency of feed used for maintenance due to level of milk production, reported by Jenkins (1984), are accounted for. Jenkins says that cattle with the genetic potential for high milk yield may use feed less efficiently for maintenance than cattle with less genetic capability for milk production. That has been a bombshell. If those results hold they probably will have a major impact on breeding recommendations.

The best cattle and level of performance for a particular ranch depends upon how well the cattle fit that environment in addition to their ability to produce the right kind of carcass and the general influence of traits like size and milk. In the past many of us became comfortable justifying the increased feed and management requirements of cattle with high levels of performance by saying that cattle needed to be fed according to their production potential. For example, that advice was given when increased milk production required more supplemental feed in order to attain satisfactory reproductive performance. But some producers felt the combination of high milk-high feed and perhaps high growth-high feed was not always cost effective. Systems scientists agree with them. As "Doc" Hatfield, and Oregon rancher said in a recent interview, "It isn't the ranch's job to produce what the cow needs to perform; it's the cow's job to perform on what the ranch produces" (Hatfield 1984). That does not support laissez faire or sloppy management; it does mean that the type of cattle and their level of performance must be compatible and cost effective with the ranch environment and management inputs.

I use reproductive success to determine how well different cattle fit the ranch. Look at the difference in pregnancy rate among breed types. Weighing open females may be helpful also, particularly open replacement heifers. If open females are larger than bred females that may indicate too much size for the environment. Finally look at the condition of open cows who weaned a calf versus pregnant cows who weaned a calf. Even though many commercial herds can economically benefit from more milk production, it is possible to get more milk than needed so that rebreeding performance is hurt. When that happens the open cows probably will be thinner. Then you either back off on milking ability or increase supplemental feeding. Commercial producers and purebred breeders who record calving dates can evaluate reproductive success more accurately with a calving distribution table (figure 1).

We are giving producers the wrong signals about genetic improvement as I evaluate systems research information. I do not imply that recent changes in size and milk production have been inappropriate. Rather, I am concerned that we are giving producers the message that if a little change is good, more is better. Our goal should be to identify the optimal range for size, milk production and other traits after considering the market and fitting cattle to the environment. The message we send to producers should be clear that once the average performance of their herd is within the optimal range for a trait, like size or milk, it is good management not to change it.

Therefore we need to change the way we discuss performance data. Instead of identifying cattle as best for a trait because they have the highest (e.g. growth, milk) or lowest (e.g. calving difficulty) breeding value, simply discuss the level of performance without labeling the animal

BEEF CATTLE PERFORMANCE EVALUATION

ITEM DESCRIPTION	DISCUSSION
Age of dam is age at calving	Age of dam is a useful [illegible] in evaluating aspects of reproduction such as calving regularity.
Most probable producing ability (MPPA) is an estimate of the weaning weight of future calves. It is influenced by milk production and growth potential. It is expressed as a ratio. When MPPA is greater than 100 calf weaning weight is expected to be greater than 100 and vice versa when MPPA is less than 100.	Many herds of cattle can benefit by increasing their milking ability. However, an intermediate level of milk production is usually best for beef cattle. Too little milk can inhibit calf growth and too much milk may be determinental to reproduction and feed efficiency.
Adjusted birth weight represents actual birth weight taken within 24 hours of birth, adjusted for age of dam. It is expressed in pounds.	The general rule is to select animals with the best combination of low birth weight and high yearling weight. In general, calving difficulty and death loss tends to increase as birth weight tends to increase as yearling weight and other indicators of size increases.
Yearling weight ratio represents the animal's adusted yearling weight as a percent of herd average. For example a ratio of 112 means the animal was 12 percent heavier than average while a ratio of 88 means the animal was 12 percent lighter than average.	Most commercial cow herds will benefit from increased size. However, it is possible to get cattle too big for the market or the production environment.
Hip height or frame score represents height of an animal. It usually is measured in inches at the hip. Sometimes the measurement in inches is converted to a frame score. The original scale went from 1 (smallest) to 7 (largest). Now some animals are taller than frame 7.	Frame score was developed to indicate the approximate weight of a steer at a choice carcass grade. Cattle less than frame 4 or greater than frame 7 may have limited use in U.S. beef production. In general, larger frame animals weigh more than smaller frame animals at all ages, including birth.
Scrotal circumference (SC) of bulls is measured in centimeters.	At one year of age a scrotal circumference less than 30 cm is very undesirable. While a scrotal circumference of 38-40 cm is very desirable, it is not clear that an increase beyond that is valuable. Scrotal circumference most importantly is related to age at puberty and semen quality.

BRANGUS BULLS

← Dam's Record →					← Bull's Record →				
Bull ID	Dam ID	Age of Dam	Number[1] Calves	MPPA[2]	Adj. Birth Weight	Yearling Weight Ratio	Yearling Hip Height	Scrotal Size	Current Weight
5/3	100/0	9/17/80	2	102.0	88	112	52.6	33	1510
13/3	140/0	11/5/80	2	98.4	76	88	48.9	33	1275
16/3	145/9	9/22/79	3	104.9	76	114	50.7	39	1450
32/3	106/4	9/24/74	7[3]	96.4	104	109	52.7	29	1465

[1] include fall 1983 calving season

[2] does (does not) include record on fall 1983 calf

[3] open, fall 1984

best because of performance in a single trait.

We have just begun to quantitatively evaluate optimal performance. Today our performance records focus on the individual animal or average performance of a group without regard for resource cost. We have been stressing maximums and minimums. Tomorrow our records will focus on enterprise profit and the records will stress optimum performance.

TABLE I: Calving Distribution [1]

Age of Dam	No. Calves	Calving Period 1<-Day->21 1st %	22<-Day->42 2nd %	43<-Day-> 3rd %	Average Calf Interval
Early 2 year old	2	50	50	0	22
Late 2 year old	79	55	27	16	24
3 year old	62	29	43	27	33
4 year old	44	43	36	20	26
5 year old	27	66	22	11	19
6 year old	18	66	22	11	20
7 year old	9	66	0	33	28
8 year old	6	33	33	33	32
9 year old	5	40	40	20	24
10 year old	4	25	25	50	32
11 year old	1	100	0	0	17
12 + year old	0	0	0	0	0
TOTAL	257	48	31	20	26

Characteristics

MBV	101.6	100.4	100.7	101.0
Weight	1243	1234	1244	1240
Height	51.88	52.17	51.90	51.98
Wt/Ht	23.92	23.62	23.93	23.83
Condition	12.4	12.1	12.3	12.3

[1] Pedretti, El Nido, California

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SUPPLEMENTARY FEEDING BREEDING COWS ON RANGE. IS IT PROFITABLE?

James G. Morris

The objective of providing supplementary feed to breeding cows on range is to supply essential nutrients limited in the diet; hence increase productivity of the cow and financial returns to the rancher. Therefore, for supplementary feeding to be cost effective, the increase in returns from giving the supplement must more than offset the costs involved in providing the supplement. Stated another way, increase in income $ must exceed output $ for the supplementary feed.

The experiments of Wagnon, Guilbert and Hart (1942) conducted at the San Joaquin Experimental Range Station in (1935-1940) demonstrated that supplementation of range cows could increase the number and weight of calves weaned per cow. While these experiments were valuable in establishing a principle, they did not address the question, "What is the optimal level of supplementation?" We may intuitively suspect that an inadequate level of supplementation would mean that cows were not producing at their potential and possibly net returns were less than optimal. However, from other studies we know that excessive levels of supplementation of grazing cows with conserved forage or concentrates can result in substitution of relatively inexpensive range forage in the diet by the costly supplement. This substitution phenomena does not occur with mineral or vitamin supplements (a topic to be discussed later) which are generally additive to the nonsupplmented range diet.

As there appeared to be no data to assist the rancher in deciding the optimal economic level of supplementation, the following experiment was conducted.

Experimental

Five groups each of about 40 grade Hereford cows were selected at the Sierra Foothill Range Station. The groups were initially balanced for age, as the individual cows in each group ranged from first calf heifers to 7 yr old cows. Five levels of supplementation were used corresponded to 0, 0.5, 1.0, 1.5 and 2.5 times a basal level of about 400 kg alfalfa cubes per cow per year. Supplementation commenced at a low level in late August and increased to a higher level in November following calving. Supplementation was discontinued about the end of February when adequate green feed was available. Cows remained in the treatment group until the end of the experiment or were eliminated for age or health reasons, (e.g., broken teeth or defective udders), or after a second consecutive season in which conception did not occur. Replacements were made at weaning each year.

As an insurance against possible mineral deficiencies, all cows were given a 50:50 trace mineralized salt-dicalcium phosphate mixture ad lib. However, we have good evidence that cows on this station do not require supplementary salt and have no clinical evidence to suggest the occurrence of mineral deficiencies other than possibly selenium. Cows were rotated around the available fields during the period of supplementation to equalize differences between pastures. At other times all treatments were run as a herd. A creep was available to the calves from birth to the beginning of the green season.

Measurements on the cows included conception rate; body weight at critical periods, e.g., at calving, beginning of mating, and start of the green season; birth and weaning weights of the calves; and amounts of supplements and creep consumed by the cows and calves, respectively.

Results

Conception Rate. Conception rates in 1980 were low due to a high incidence of enzootic bovine abortion, and these data have been omitted for any of the treatment comparisons. The four year mean conception rate shows no response to supplementation; the unsupplemented cows had a conception rate of 90.3% versus 91.4% in cows receiving approximately a ton of alfalfa cubes per cow.

Considering individual years, no significant differences in conception rates occurred in 1979, 1981 and 1982. However, there were significant differences at $P<0.05$ level in 1983, and with the exception of the 1.0 level conception rate increased with level of supplementation.

Weaning Weight of Calf. The weaning weights of the calves for each of the five years according to treatments, are presented in Table 2. The 5 year mean weaning weight shows a positive relationship with level of supplementation; there being a difference of 25 kg between the calves from unsupplemented cows and those receiving the highest level of supplementation. However, in terms of relative costs and returns, the market value of each unit of additional body weight gain of the supplemented weaner would have to exceed 30 times the cost of one unit of alfalfa cubes in order to break even. Today's ratio is approximately one-third of the above.

A comparison of the body weights of calves at various ages up to weaning showed that birth weight was not significantly effected by supplementation of the cows. However, differences in body weights of the calves according to treatment established at the beginning of the green season was similar to that at weaning. Therefore, the effect of the supplement on body weight of the calf appeared to be mediated through higher milk production of the dam in the period preceeding green feed season. Once the green feed was available, all calves made similar gains.

Effect of Level of Supplementation on Body Weight of Cows.

The body weight of the cows tended to be positively related to level of supplementation at calving and at start of breeding (Jan. 1). The mean difference between the unsupplemented cows and those receiving the 2.5 X level being 20-50 kg/cow. However, in most years, the body weights of the cows in the different treatments tended to be reduced to about half the above value by weaning time and to approach a common mean by fall when supplementation recommenced. Thus, the unsupplemented cows restored their body weight in the green season to a greater extent than the supplemented cows.

Application of Results

These results agree with other measurements we have made (Sanchez and Morris, 1984) of energy expenditure of breeding cows on range and demonostrate the ability of the cow to adjust her energy expenditure to variable feed conditions.

During periods of low feed (energy) intake, the cow reduces her energy expenditure, additional supplementary feed goes toward an increase in body weight and energy expenditure. When range forage is of good quality (March - May at the Sierra Field Station) energy reserves of cows are restored to similar levels, largely independent of previous levels of supplementation.

The results of this experiment to date indicate that when cows are conservatively stocked on cleared foothill range in most years, supplementary feeding is unlikely to be profitable. As the study is still in progress, these conclusions may have to be modified when further results are available. In addition, other studies we have done at the Sierra

Foothill Range Field Station on the necessity of providing common salt (sodium chloride) and additional vitamin A indicate that these supplements are unlikely to be cost effective.

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TABLE 1

Pregnancy Rate† of Cows Given Five Levels of Supplementation

	Level of Supplementation				
Year	0	0.5	1.0	1.5	2.5
1979	93.7	96.8	90.3	88.2	80.6
1980*	57.6	45.2	75.0	84.8	60.0
1981	93.5	93.9	86.7	84.4	96.6
1982	97.0	91.4	90.6	90.9	93.5
1983	76.9	81.4	70.0	85.4	94.9
Mean*	90.3	90.9	84.4	87.2	91.4

*A high incidence of enzootic bovine abortion reduced conception rate in 1980 and these results were eliminated in calculating the mean.

†From palpation at weaning of calves.

TABLE 2

Weaning Weight (kg) of Calves From Cows Given Five Levels of Supplementation

	Level of Supplementation				
Year	0	0.5	1.0	1.5	2.5
1979	180	193	187	205	198
1980	133	142	152	170	180
1981	185	185	186	184	201
1982	181	187	192	192	197
1983	169	184	175	204	200
Mean ± SD for 5 yrs	170 ±21	178 ±21	178 ±16	191 ±15	195 ± 9

FUTURE IMPLICATIONS OF BEEF CATTLE EMBRYO MANIPULATION

Gary B. Anderson

Introduction

In order to appreciate the benefits that beef producers can derive from new technology related to manipulation of early embryos, an appreciation for and knowledge of embryo transfer procedures are required. It was the establishment of embryo transfer in the breeding programs of cattle producers that provided the impetus for development of methods for manipulation of embryos *in vitro*. Achievements in embryo transfer procedures made to date have been phenomenal, and progress continues to be made through the development of sophisticated technology for manipulating embryos. Breeders with animals of sufficient economic value to justify the expense of embryo transfer may effectively utilize this new technology. Even producers who do not use embryo transfer may, in the future, benefit indirectly through improvements in the overall genetic quality of beef cattle. This paper provides a brief description of the importance of embryo transfer and a discussion of new embryo technology, of which some procedures are available today and others are likely to be available in the future.

Embryo Transfer

The term embryo transfer is often used to describe collectively a variety of techniques such as superovulation of the donor, synchronization of estrus in the donor and recipient, and various manipulations of the embryo *in vitro*, in addition to physical transfer of an embryo. The first successful embryo transfer was performed with rabbits in 1891. It was not until 1951 that the procedure was successfully carried out in cattle. Only early in the 1970's was the demand for reliable embryo transfer procedures great enough in the U.S. to stimulate the establishment of commercial bovine embryo transfer. The primary stimulus for this increased demand was the so-called exotic boom. Inflated cattle prices resulting from introduction of European breeds of beef cattle provided the incentive to use embryo transfer as a method of reproducing more rapidly the few imported purebred "exotics" and to hasten upgrading of crossbreds from artificial insemination of North American cattle with imported semen. As the demand for exotics lessened and beef cattle markets entered a slump during the mid-1970's, development of reliable procedures for nonsurgical embryo collection extended application of embryo transfer to dairy cattle and the industry continued to grow. Improvement of nonsurgical transfer procedures allowed embryo transfer to move from commercial facilities to the farm. Embryo transfer is now carried out through many large and small companies, as well as private individuals including veterinarians. The costs are such that it remains available primarily to breeders of purebred stock. Economic value rather than genetic merit is the primary criterion for selection of donors for superovulation and embryo transfer.

Applications of Embryo Transfer to Beef Cattle

Together, superovulation and embryo transfer offer the opportunity to produce more offspring from a donor female than she is capable of producing naturally. Reports in popular magazines of individual donors producing large litters of calves have often left the mistaken impression that this is the rule rather than the exception. Analysis of data from large numbers of donors from commerical embryo transfer units indicates that, on the average, 3.5 pregnancies per superovulation treatment may be expected from normal, healthy cows. Poorer success is expected from cows that are reproductively unsound. Slightly higher values may result from applying newer technology such as embryo-splitting, which will be discussed later. It should be remembered that, even with superovulation, the reproductive

potential of a cow is less than that of a bull, and her genetic value more difficult to determine. The amount of genetic progress that can be expected from embryo transfer is, therefore, substantially less than what can be achieved with the use of semen from genetically proven sires and artificial insemination.

Embryo transfer can be used also for production of calves from otherwise infertile cows. Failure of a cow to calve may occur in spite of production of fertile ova, normal fertilization and early preimplantation development. Embryos from infertile cows can be transferred to fertile cows for the remainder of pregnancy. Adequate data have yet to be collected to determine the ultimate effect of reproducing infertile females. Because some types of infertility have a genetic component, the wisdom of artificially reproducing these females may be open to some question.

Importation and exportation of breeding animals between countries have certain inherent problems, some of which may be overcome by using embryo transfer. Importation of embryos may facilitate introduction of new bloodlines. Embryos can be transported more cheaply than animals and there is some evidence that the threat of disease transmission is less. The advantages of importing embryos rather than livestock can in most cases still be accomplished satisfactorily by importation of semen from genetically superior males.

Embryo transfer continues to be a useful research tool. For example, embryo transfer can be used to induce twins in cattle and to test for undesirable recessive genes.

Manipulation of Embryos In Vitro

Storage of Embryos. After embryos have been flushed from the reproductive tract of the donor and until they have been transferred to recipients, they must be maintained *in vitro* under conditions that will ensure that viability is maintained. Bovine embryos may be kept viable for up to several days at body, room, or refrigeration temperatures. Embryos can also be frozen in liquid nitrogen and stored for years, although optimum survival of frozen/thawed embryos has not yet been achieved. Embryos are usually frozen in plastic straws similar to those used for storage of frozen semen. Until recently it was necessary to remove the embryo from the straw after thawing to dilute the cryoprotectants prior to transfer to a recipient. Recently a simplified procedure was developed that allows a frozen/thawed embryo to be transferred directly to the recipient. Even under ideal conditions some embryonic death can be expected in frozen/thawed embryos.

Sexing of Embryos. One uncertainty that remains with both embryo transfer and natural reproduction is the sex of the resulting calf or calves. Sex of the calf is determined by its sex chromosomes; a heifer has two X chromosomes (XX) and a bull has one X and one Y chromosome (XY). Analysis of sex chromosomes in placental tissue from an early embryo is possible, but overall success rate and embryo survival is not high. Encouraging results have been achieved recently with an immunological procedure that identifies a factor found only on male embryos. This procedure was developed with mouse embryos and then applied to cattle embryos. In each case an accuracy of approximately 85% was obtained without a significant effect on viability of the embryos. This procedure is not yet commercially available, but is likely to become available in the near future.

Embryo-splitting. A procedure that is gaining widespread use in beef cattle embryo transfer is one whereby an embryo is split into halves such that each half will develop into a calf. This technology offers a means for producing sets of identical twins. So successful is the procedure that more calves can be produced from a donor by splitting her embryos than if the individual embryos are transferred without splitting. Research is

underway to increase the number of calves that can be produced from a single embryo to more than two, but although some success has been achieved, results are much more variable than with procedures for producing identical twins.

In Vitro Fertilization. A great deal of publicity has been generated over the birth of human babies after fertilization of eggs in vitro and their transfer back to women for continued development. Because much of the technology used with embryo transfer in humans was originally developed in cattle, one may expect that in vitro fertilization is an important procedure in cattle also. Despite long-term research in the area, however, the cow egg has resisted efforts to achieve in vitro fertilization. To date, only a few calves have been born from bovine eggs that were fertilized in vitro. Interest and research continue because in vitro fertilization may provide a practical means for harvesting the large number of eggs that are never released from the ovaries during the lifetime of a cow.

"Genetic Engineering." A variety of other techniques remain under study and development for subsequent application to beef cattle. Among these procedures are those often classified as biotechnology or genetic engineering. For example, procedures for the production of clones, or many genetically identical copies of an animal, are actively being sought. In addition, improvement of the genetic quality of an animal by transfer of specific genes is also receiving much attention and research effort. Significant breakthroughs are required before these embryo manipulations will have any practical application to beef producers. It should be remembered, however, that no one could have predicted 15 years ago, when there was not yet an embryo transfer industry, that procedures then thought to be impossible or nearly so would be commonplace today.

SEX DISCRIMINATION IN THE BEEF CHAIN

John R. Dunbar and Audrey S. Jenkins

Talk about sex discrimination. It has been with the beef industry since the early days. Steers are the choice among cattle breeders, feeders, packers, and retailers while bulls and heifers receive discrimination. Regardless of how much cattle prices rise and decline, bulls and heifers continue to sell for less than steers.

Retail

Let's start at the consumer acceptance level and consider the true differences that exist between bulls, heifers, and steers when all are fed for the same length of time. There is no difference in the price of young bull, steer, or heifer beef at the retail level. It is, however, often reported that meat from young bulls is more variable in tenderness, texture, palatability, and fat distribution. Bull beef is darker in color and leaner than steer or heifer beef. In several studies bull beef was given a superior leanness rating by consumers.

While there is no difference in the price of bull, steer, or heifer beef at the retail level, wholesale prices portray a different picture. Wholesale carcass prices are ten to fifteen dollars per hundred pounds less for bulls than steers, and two to three dollars per hundred pounds less for heifers than steers in today's market. The bulk of scientific evidence suggests that bulls have less marbling, less subcutaneous fat, less kidney fat, and a lower quality grade than steers of the same age. Heifers on the other hand yield much fatter carcasses with a higher quality grade and lower cutability than steers of the same age.

Differences also exist at slaughter. Bull hides are usually thicker and more difficult to remove, making them worth less than the hides from heifers and steers. The result is increased processing costs and reduced acceptability of bull carcasses by the packer. Another serious disadvantage to the packer is the lower USDA quality grade and term Bullock assigned to bull carcasses as compared to the quality grades of steers or heifers. Lower prices are received by wholesalers for bull beef due to price constraints placed by retailers on bull carcasses with less than .24 of an inch of backfat or carcasses over 750 pounds.

A serious disadvantage of heifer carcasses to the packer and retailer is lower cutability and retail yield. One of the major problems associated with heifer beef is the weight and fatness constraints. Small or medium framed heifers slaughtered before they become excessively fat may fall below the minimum weight of 550 pounds. Lighter heifers cost more to slaughter per unit weight (see Tables 1 and 2). A heifer must weigh 950 to 1050 pounds at slaughter to meet the price constraints. It's difficult for heifers of many breeds to reach this weight without also becoming overly fat.

Another principal objection to slaughtering heifers is that they may be pregnant which adversely affects dressing percent. If ten percent of heifers are pregnant and close to calving at slaughter, there will be a two percent loss in dressing percent. It is not unusual to have 30 percent of heifers arriving at the slaughter plant at full-term pregnancy. This means a loss of six percent in dressing percentage.

Feedlot

There is no question that bulls gain more rapidly and efficiently, producing a leaner carcass than steers of the same age. Steers on the other hand grow more rapidly, use feed more efficiently, and yield leaner carcasses than do heifers of the same age. One disadvantage of feeding

bulls is their aggressive behavior. Once in a feedlot and until the time of slaughter, they should not be mixed with unfamilar animals.

For years prejudice against breeding-age heifers in the feedlot has existed because of the likelihood of pregnancy or the management problems caused by cycling heifers in heat. Neither pregnant nor estrous heifers are conducive to rapid and economical gains. Spaying heifers will prevent heat cycles and pregnancy, and will make heifers more adaptable to feedlot management. Spade heifers, however, do not gain as fast or as efficiently as intact heifers. This is expected since the ovaries produce hormones which stimulate growth and better feed conversion (the same is true for males--steers have slower and less efficient gains in comparison to bulls). It's possible to improve rate of gain and feed efficiency in spade or intact heifers by implanting sex hormones or using feed additives to produce more economical gains.

Cow/calf producer

What about the cow/calf producer? The discounts for bulls and heifers all back up to the cow/calf producer. A heifer will weigh 25 to 50 pounds less than a steer and will bring a lower price per pound. On the 11th of July, 1984, 525 lb. steer calves sold for approximately $62 per hundred pounds while a 500 lb. heifer calf brought $50 per hundred pounds. Using these price comparisons, a heifer calf in 1984 grossed $76 less than a steer calf. A bull calf will weigh 25 to 50 pounds more than a comparable aged steer and on today's market will bring $5 per hundred weight less. A cow with a bull calf in 1984 would gross $14 less than a cow with a steer calf.

To sum it up, the major disadvantages associated with the bull compared to the steer are price discounts because of lower quality grade, larger carcasses, and difficult hide removal. Meat from bulls is also darker in color and more variable in tenderness and palatability. It is also obvious there are some critical disadvantages to producing heifers for the beef trade. The major disadvantage of heifers is price discounts because of reduced rate of gain and feed efficiency, lighter carcass weight, and excessive fat if not marketed at the correct degree of finish.

Producing a Superior Carcass

Figure 1 illustrates the normal pattern of growth for the major tissues as a beef animal increases in size. Muscle relative to bone in a normal calf at birth may be in a ratio of 2:1. The same calf at slaughter weighing 1100 pounds may have a muscle to bone ratio of 5:1. Muscle tissue has a much faster relative growth rate than bone. The rate of fat deposition begins relatively slow and increases as the animal begins the finishing phase. Very fat cattle may have more fat than muscle in the carcass.

Figure 2 illustrates the influence of sex on tissue growth patterns. Heifers fatten earlier and faster relative to their live weight than do steers, and steers fatten earlier than bulls. To achieve a similar carcass composition from the three sex groups, it's necessary to market heifers at a lighter weight and younger age than steers, and steers should be marketed at a lighter weight and younger age than bulls.

At an equal grade endpoint, the three sexes do not differ materially in their ability to convert feed energy into body energy. The heifer, however, reaches a carcass grade of low choice at an earlier age than steers, and steers reach the low choice grade at an earlier age than bulls. Since the beef carcass represents an important endpoint in the economic production process, and its composition of muscle, fat, bone and weight largely determine carcass value, it is important to slaughter heifers, steers and bulls at the deserved finish rather than a time determined by days on feed. A carcass weighing 600 to 850 pounds, with a USDA quality grade of low choice, and a yield grade of 2, represents a carcass of superior merit.

What then, are some of the recommendations to increase bull and heifer profit potential?

1. Produce high quality animals that yield an optimum carcass weight, quality grade, and cutability.
2. Retain ownership further along the marketing chain.
3. Support research and educational programs on production of bull, heifer, and steer beef. Support the California Beef Council.

4. Revise and establish USDA carcass grading standards for young bulls which are interchangeable with those for steers and heifers.
5. Use growth implants and feed additives in the suckling, growing, and finishing phases of production.
6. Test heifers for pregnancy, and sell them on a guaranteed open basis. Abort heifers less than 100 days pregnant, sell those over 100 days. Consult your local veterinarian for additional advise.
7. Use the breed or breed cross that produces the right combination of carcass weight with the correct amount of muscle, bone and fat.

TABLE 1.

PREFERRED CARCASS WEIGHTS

CUSTOMER	CARCASS WT.
Retailer	550 - 750 LBS
Hotel, Restaurant Institution (HRI)	700 - 850 LBS
Boxed Beef Packers	700 - 750 LBS

SOURCE: R. Boling, Monfort of Colorado.

TABLE 2.

CARCASS SIZE vs. COSTS

	LARGE	MEDIUM	SMALL
Carcass weight	850	725	550
Kill & fabrication cost per head	$85	$85	$85
Kill & fabrication cost per cwt.	$10	$11.72	$15
Relative efficiency	0	-15%	-35%

SOURCE: R. Boling, Monfort of Colorado.

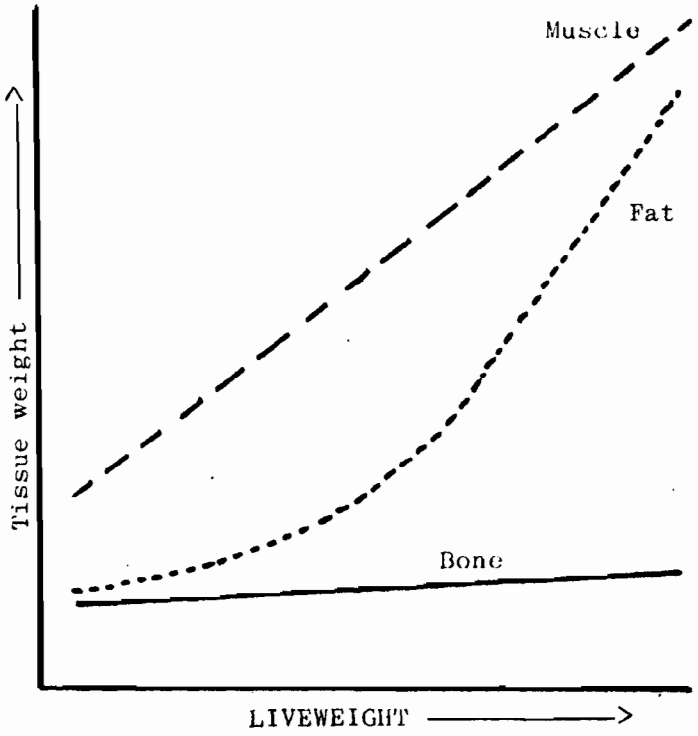

Figure 1. Tissue growth in the beef animal.

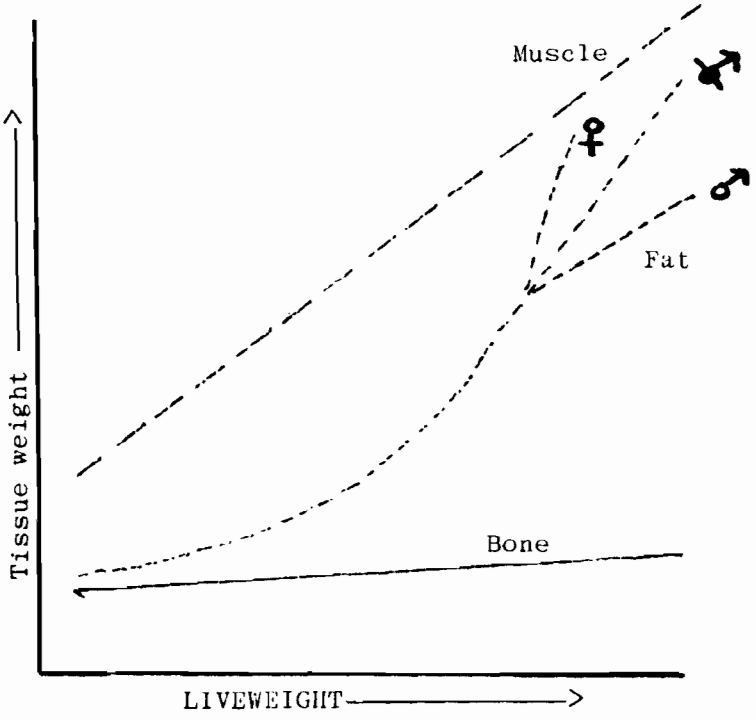

Figure 2. Sex effects on tissue growth.

CATTLE VACCINATION .....it depends.

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There are many vaccines for cattle, and the decision to use one depends on many factors, including:

1) the probability of the specific disease in the local area where you keep your livestock,
a) the more movement of animals in and out of the herd the greater the risk of "buying" or bringing in diseases,
b) the greater the traffic of visiting livestock people to your operation the higher the probability that someone will bring you their disease problems.
c) certain geographic locations have specific disease problems (anthrax, red water, anaplasmosis, etc. - see local veterinarian or Extension agent for specifics).

2) the age, nutrition and production status of the animals at risk,
a) younger animals are more at risk to scours and pneumonia,
b) animals on higher energy rations may experience more severe courses of some diseases,
c) sexually mature animals are more at risk to brucellosis, vibriosis, and other abortion causing diseases,
d) some vaccines should not be used in pregnant animals.

3) the financial danger to you if a disease outbreak occurs in your herd,
a) losing genetically superior animals that would be impossible to replace,
b) high debt load or overhead with fixed cashflow requirements,
c) your contractual obligations to supply specific animals at specific times,
d) little margin for problems (no credit).

4) your ability to find and handle sick animals,
a) no local corrals or facilities for rounding up and holding sick animals for treatment,
b) no competent help to find, isolate, and treat sick animals,
c) operation too spread out to see all animals at an interval short enough to detect and stop a disease outbreak.

5) the cost and quality of protection afforded by a specific vaccine,
a) some vaccines, such as for pateurellosis, colibacillosis, and salmonellosis, provide short-term or little measureable protection,
b) vaccines against anaplasmosis have problems, are relatively expensive, and should only be used to solve specific risk problems.

VACCINE RECOMMENDATIONS

It is not reasonable to attempt to give a set of vaccination recommendations that fit all conditions. Since some vaccines can cause problems themselves, all users should be well informed before planning their immunization program. Your local veterinarian can best advise you as to the specific diseases present in the area of your herd, and what vaccines may be used with good effect. Your Extension Advisor or Agent and local livestock people can tell you what programs others in the area are using.

Vaccines do not give 100% protection. They need your help to be effective. Exposure of your animals to infectious disease must be reduced. Early detection of sick animals, isolation of infectious cases, and appropriate treatment are important parts of disease control and prevention. Purchasing a bottle of vaccine and injecting it may not be enough. Good nutrition and management procedures are necessary for cattle to obtain protection from immunization programs. Some vaccines can harm your animals if not properly used. Consult your Veterinarian and your Livestock Farm Advisor or Extension Agent to help you make intelligent and economical decisions in fitting your vaccination schedule into an overall

management program for efficient production.

TYPES AND TIMING OF VACCINES

Vaccines can be divided into two types: 1) killed or inactivated, and (2) modified live organisms. They can also be divided into (a) monovalent (against one disease or one strain of organism), and (b) polyvalent (against several diseases or more than one strain of organism).

It can be very important to apply vaccines at specific times in the animal's life to establish protection before a disease is most likely to occur. Immunity from killed or inactivated vaccines is best a few weeks after application and most of these vaccines need to be reapplied on a 6 month to 1 year basis. Under some conditions, giving a vaccine 30 days before disease exposure can double its protective effect compared to giving it 6-12 months earlier.

Modified live vaccines generally need be given only once in the animal's lifetime. However, these living vaccines are more sensitive to poor management. Most must be kept refrigerated until use or they "die" and become ineffective. Once mixed for use they are sensitive to ultraviolet sunlight and needle disinfectants. Some may be partially inactivated by colostral antibody in young animals. Calves occasionally escape the chute at vaccination time and miss their once-in-a-lifetime injection. So...its not a bad idea to consider revaccination with modified live vaccines to valuable animals unless you are sure previous vaccinations were effective.

Common times that cattle are vaccinated depend on the disease and the vaccine: immediately after birth, at 2-3 months of age (marking time), at 7-8 months of age (weaning), at replacement heifer selection time, and once or twice a year thereafter (depending on the program and the vaccine).

Vaccines given under 6 months of age should be repeated at 6-8 months of age because of the immature immune system of the young calf and because of the possible interference of colostral antibody received from the mother at birth. If it fits your management program, the routine vaccines given at weaning should actually be given 30 to 45 days before weaning for best results.

Work in the Imperial Valley by the U.C. Stressed Calf Study Group indicates that when receiving light calves, it is better to vaccinate calves off the truck rather than wait 30 days after arrival. Vaccinating the calves as they were loaded was also better than waiting 30 days postdelivery.

The use of the names 2-way, 3-way, 5-way, and 8-way vaccines mean only that more than one disease or strain is included in the bottle (it is "polyvalent"). There are several 3-way vaccines that are all for very different diseases. Order your vaccines against specific diseases, by name. Generally it is OK to give several different vaccines on the same day (in different injection sites), as long as only ONE vaccine is a living product. Don't mix different vaccines in the same bottle or syringe, since the preservatives or pH (acidity) of one can damage the other. Since the real expense of vaccination can be the cost of gathering and working the cattle, don't let the cash vaccine costs fool you into buying less than you need.

Some vaccines are available in a one dose form or in a two dose form. The total cash vaccine cost is usually quite similar (because of market demands more than the cost of production). Giving only one injection of a two dose vaccine is foolish economy. The first shot sensitizes the animal for the second dose which provides the protection. If it says give two doses, do it or don't buy it.

PRECONDITIONING OF CALVES

Preconditioning can save calves, but it is difficult for the rancher to recover its cost unless ownership of the calves is kept through the stocker and/or feeding period. It is a special management program usually including vaccination (against organisms related to Shipping Fever pneumonia) a few weeks before weaning. Other factors are included to reduce stress related to weaning and shipment--such as training calves to eat and drink from bunks and tanks. It may include selenium and vitamin treatments. You should seek competent advice when putting together a custom preconditioning program for your

livestock operation. Especially important is how are you going to recover the added cost of the program if you don't plan to keep ownership of your calves after weaning.

PRECAUTIONS WHEN USING VACCINES

Vaccines occasionally cause death from allergic "shock" type reaction. Always have injectable epinephrine present at the chute when you vaccinate....you won't have time to go to the house or town for it under most conditions. A bottle will keep for several years if unopened and refrigerated between vaccination days.

Each and every time read the package insert instructions that come with the vaccine BEFORE purchasing and AGAIN before using. Vaccine recommendations can change and the package insert is your best source of information. Some vaccines can cause abortions and some can cause calf deaths if not used according to directions. Some vaccines require refrigeration and protection from sunlight to be effective. Also, when very small amounts of antiseptics or disinfectants are accidentally left on vaccination needles, it can destroy whole bottles of live vaccine at chute-site.

Live vaccines such as Brucellosis (Bang's), rabies, and some type of Anthrax products may cause disease in humans (or other animals) if improperly used. Some vaccines such as the Strain 19 Bang's vaccine are restricted to application by a veterinarian. This is for several reasons. It will cause brucellosis in humans if they are accidentally exposed, it can cause abortions in cows, and if improperly used it will cause false reactions to official blood tests.

EXPIRATION DATE AND SERIAL NUMBER

All vaccines have an Expiration date and a Serial Number. When you use a vaccine, keep that part of the vaccine box for your records that has the serial number and expiration date, note the number and kind of stock and the date it was injected. Later, if you suspect problems caused by vaccine failure, your veterinarian can help you check it out with a call to the Biologics unit of the USDA in Ames, Iowa. They keep a box of each serial until it is 6 months out-of-date.

SELENIUM DEFICIENCY

This problem is widespread in California, the Pacific Northwest, and many localized areas in western states. Heavy fertilization with sulfur can impede the uptake of selenium digestion. Inadequate uptake of selenium can impair the immune system's ability to respond to a vaccine. Check with your Veterinarian or Extension personnel for advice on how to make sure your cattle are selenium sufficient so the vaccines you buy can give the protection you need.

VIRUSES FOR WHICH THERE ARE VACCINES

CORONAVIRUS - a baby calf diarrhea occasionally seen in range cattle...oral vaccine in newborn calves...or vaccine of pregnant cows...may be combined with rotovirus.

PAPILLOMA - Warts generally seen in younger animals...injectable killed vaccine. An autogenous (made from warts off your cattle) vaccine may be required to have good effect.

PARAINFLUENZA - may be unapparent or may cause pneumonia of young animals...usually part of I.B.R. vaccine.

ROTOVIRUS - Newborn calf diarrhea...oral calf vaccine or vaccine of pregnant cows, may be combined with coronavirus.

VIRUS DIARRHEA - Diarrhea, nasal discharges, deaths of cattle of all ages...killed or live vaccine...nasal or by injection...some veterinarians use it orally...the vaccine is generally not given to pregnant animals...called B.V.D.

INFECTIOUS RHINOTRACHEITIS - Coughs, nasal discharge, pneumonic, viral pinkeye... called "RED NOSE" or I.B.R...killed or live vaccine...usually combined with B.V.D., lepto, and/or P13.

RABIES - Disease of the brain that can be transmitted to humans by the saliva of

nocturnal animals out at daytime - maybe rabies

infected cattle...fatal. Source is usually bites from skunks, foxes, dogs, and occasionally bats...sporadic disease for which cattle are vaccinated on under special conditions...a specific cattle vaccine is required...use of the dog vaccine can cause death of cattle. If you suspect rabies seek help immediately...highly fatal to humans.

AEROBIC BACTERIA FOR WHICH THERE ARE VACCINES

BACILLUS ANTHRACIS - Anthrax causes sudden death in cattle...Can kill humans also... lives in soil many decades...carcasses remain infected and must be burned or buried...some localized areas of California and western states have continuous anthrax problems and cattle must be vaccinated routinely...before you move into a new area check on the past history for this disease...if anthrax has been diagnosed, the organism is probably still there and you probably should vaccinate against it.

BRUCELLA ABORTUS - also called Bang's Disease, Infectious Abortion and brucellosis in cattle, and Undulant Fever in humans...live Strain 19 vaccine is available only through federally approved private veterinary practitioners and must be given only once to female calves less than 1 year old (age recommendations vary) and calves must be permanently identified as an "official vaccinate" by tattoo and eartag...caution, this vaccine can cause disease in humans...reduced dose vaccination and adult vaccination of problem infected herds are subjects to discuss with your veterinarian...calfhood vaccination will facilitate the interstate movement of calves.

CORYNEBACTERIUM PYOGENES - Sometimes causes pus pockets under the skin of numerous cattle in a herd...sometimes causes mastitis or metritis...general vaccines not usually helpful...some autogenous vaccines made from organisms isolated from your livestock can be of help...this bacterium doesn't generally make a good vaccine.

ESCHERICHIA COLI - usually seen in calf scours...sometimes causes fatal calf septisemia...sometimes causes fatal mastitis (blue bag)...vaccine against one strain won't protect against other strains...usually vaccinate dry cows so colostrum (first milk) will have protective antibodies...this bacterium doesn't usually make a good vaccine.

HAEMPHILUS SOMNUS - Shipping Fever pneumonia and/or brain fever (T.E.M.E.)...sudden death...this organism is hard to isolate from sick or dead animals...usually more commonly seen in feedlots.

LEPTOSPIROSIS -
L. Canicola - usual source, dogs and swine.
L. Gripotyphosa - usual source, wildlife.
L. Hardjo - usual source, cattle.
L. Icterohaemorrhagia - usual source, rats.
L. Pomona - usual source, cattle, swine and sometimes wildlife.

This group of organisms can cause numerous kinds of diseases, including death, mastitis, infertility, abortion storms, stillbirths, and pneumonia...cattle become carriers and spread the organisms for many months through infected urine...can infect humans...most common problems are abortions and calf deaths (L. Pomona), and hard breeding or infertility (L. Harjo).

MORAXELLA BOVUS - There are several commercial pinkeye vaccines being sold to prevent infectious keratitis...they are generally made from the pili (hair) of the bacteria... there are reports of anaphylactic shock (allergic shock) from these vaccines. There are several strains and there may be strain differences from area to area. If you use these vaccines make sure you have epinephrine and corticosteroids available and watch the calves for at least 6 hours after vaccination.

PASTEURELLA HAEMOLYTICA - Part of the Shipping Fever complex...usually given at weaning time...doesn't usually make a good vaccine.

PASTEURELLA MULTOCIDA - Part of the Shipping Fever pneumonia complex...doesn't usually make a good vaccine.

SALMONELLA DUBLIN - Diarrhea in young calves...can also cause sudden death in some calves...doesn't usually make a good vaccine.

SALMONELLA TYPHIMURIUM - Diarrhea in young calves similar to S. Dublin...there are many strains of salmonella...many carrier animals are around...usually causes disease when other stresses are present...doesn't usually make a good vaccine.

STAPHYLOCOCCUS AUREUS - Pus former...the most common method of transmission is by wound contamination with unsanitary instruments or environment...autogenous vaccine may help.

VIBRIO (CAMPYLOBACTER) Fetus - A venereal disease of cattle spread from infected to uninfected cattle by the breeding act...bulls may carry the disease over from season to season...bulls older than 3-4 years more commonly infected...cows eventually clean up... vaccine needs to be applied 30 to 45 days before bulls are turned in with cows for best protection...cattle should be revaccinated each year...some veterinarians suggest that bulls should be injected twice in two different sites 30 days apart for better immunity... giving only one dose of a two dose vaccine is not effective.

ANAEROBIC BACTERIA FOR WHICH THERE ARE VACCINES

CLOSTRIDIUM - (Enterotoxemia and sudden death):
Cl. Chauvoei - Blackleg.
Cl. Novyi Type B - Black's Disease (Necrotic Hepatitis).
Cl. Novyi Type D - Redwater Disease (hemoglobinuria).
Cl. Perfringens Type B - fetid calf diarrhea.
Cl. Perfringens Type C - bloody calf diarrhea.
Cl. Perfringens Type D - "overeating" sudden death.
Cl. Septicum - malignant edema, sudden death.
Cl. Sordelli - hemorrhagic edema of the neck, death.
Cl. Tetani - "lockjaw", tetanus.

All of the clostridial organisms can be deadly...they are widely found in nature including in the normal gut of normal cattle...the vaccines usually need to be repeated twice each year for best protection...with heavy exposure it may be necessary to repeat the vaccine at 2-3 month intervals...some commonly used vaccines have 2, 4, 7 or 8 of these organisms...an 8-way vaccine is usually more expensive than a 2-way, but you should consider using it anyway...sudden death and/or foul smelling (sometimes bloody) diarrheas are common observations...specific diagnosis of the causative organism can be very difficult and expensive...vaccination recommendations are usually made on the basis of clinical history and/or postmortem examination...some farm advisors have reported the 7-way vaccine useful in preventing outbreaks of fatal bloat in calves on extremely high quality alfalfa hay winter feeding programs.

When very young calves have clostridium problems it may be necessary to give them specific antitoxins...this is very expensive and should only be done with professionals advice...this temporary antitoxin (antiserum) lasts only a couple of weeks in the calf... also remember calves vaccinated under 2-3 months of age should usually be revaccinated after 6 months of age.

HEMATOPARASITE FOR WHICH THERE ARE VACCINATIONS

ANAPLASMA MARGINALE - An infectious anemia of cattle which is transmitted from carrier cattle and deer to susceptible cattle by ticks and biting flies, and by dirty hypodermic needles, dirty dehorning tools, knives, etc....it is found in many areas of California and the western states.

Animals under one year seldom die with anaplasmosis, but as animals become older they are more severely affected by the anemia. Recovered animals seldom have the disease again. Animals over 4 years old, animals in heavy lactation, and those in the last 1/3 of pregnancy are most severely affected. Animals on higher energy diets are more severely affected. Both vaccines have problems and are available only on veterinary prescription.

KILLED ANAPLASMA VACCINE - The USDA approved killed vaccine is safe for all classes of cattle to which it is normally given...it requires two doses a few weeks apart (see the package insert), repeated once 24 months later...If the vaccine causes antibodies to the calf's red cells, the mother's foremilk (colostrum) can destroy the calf's red cells when he first nurses. This is an "Rh factor" type problem called neonatal isoerythrolysis

and the calf may die in the first 2-7 days of life. This risk can be reduced by vaccinating open cows or cows only in the first 1/3 of pregnancy. It is a very rare occurrence on a herd basis, but when it occurs there may be severe calf losses. Neither cows nor bulls are adversely affected by the vaccine.

MODIFIED LIVE ANAPLASMA VACCINE - This live vaccine has a state license for use only in California on a prescription basis. It is best used on replacement heifers under 1 year of age. It will cause a 1/3 reduction in red cell count in these young animals. It only has to be applied once in the lifetime. The vaccine has very specific shipment and storage requirements and must be ordered on a herd-by-herd basis.

SPECIFIC DISEASES WITHOUT VACCINES

TRICHOMONIASIS - This is a protozoal venereal disease of beef cattle. It is spread by sexual contact. There are prescription drugs for treatment but no vaccines are available.

FOOTHILL ABORTION - This is a disease primarily of California herds. It is also called Epizootic Bovine Abortion (EBA). There is no vaccine available, but veterinary scientists at UCD continue to work on a vaccine for EBA.

BLUE TONGUE - This is primarily a sheep disease, but it occasionally causes "dummy" calves. There is a sheep vaccine but none for cattle. There are at least 4 separate strains of this virus in the western states.

WOODY TONGUE AND LUMPY JAW - These bacterial diseases cause abscesses in the soft and hard tissues and are spread by contact with drainage from open sores. There are no vaccines.

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