PRECONDITIONING SEMINAR

INTRODUCTION

In June, 1968, the National Preconditioning Coordinating Committee, the University of Wyoming and the Wyoming Veterinary Medical Association jointly, sponsored a conference on preconditioning calves for the feedlot. This national meeting was held to share with the livestock industry some of the latest information on the problems and scientific basis for a preconditioning program. The National Committee and Elanco Products Company, a Division of Eli Lilly and Company, have assembled into this proceedings the transcripts of the formal presentations made at the seminar.

It is hoped that the ideas in this proceedings will derve as a guide in the formulation of even more research and industry motivated programs aimed at improving the health and animal husbandry practices which are so essential to efficient beef production.

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"BACTERIAL DISEASES"

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The bacterial diseases encountered from birth through weaning may be grouped into a few categories. Umbilical infections, enteritis complex or scours, calf diptheria, pneumonia enterotoxemia, and other bacterial infections.

The greatest risk of death occurs within the first two weeks of life with an estimated loss of 8 - 25% of our total calf crop lost during this period. I will discuss briefly those conditions most common during this high risk period.

Navel ill

A condition of newborn calves caused by bacterial invasion of the umbilical cord at the time of birth and may be characterized by conditions ranging from a local abscess in the umbilical region to involvement of the liver bladder and often times causing a septic arthritis of the joints. This condition is most often associated with unsanitary conditions and may be prevented by proper treatment of the naval at birth.

Enteritis complex — Scours

Probably our number one calf killer. Various things may cause scours but the main condition is known as colibacillosis. This condition may be secondary to other stress factors or dietary upsets. Colibacillosis is manifest clinically in a variety of forms from the per acute in which death may occur within six hours to the acute form where the animal may develop the typical whitish or yellowish white scours and live for a few days before death. With extensive and expensive treatment many cases may recover from acute colibacillosis only to become unthrifty individuals.

Colibacillosis is usually considered a problem of dairy calves where sanitation is difficult due to crowded conditions. Colibacillosis may also be an acute problem with calves under range conditions. One rancher in our practice area lost 60% of this years calf crop due to colibacillosis. Prevention through management is the only successful control as there is no vaccine or drugs that are effective.

Salmonellosis and paratyphoid also causes enteritis in calves. This condition is not as predominate as colibacillosis but may be similar in clinical appearance with acute cases having a high fever, dehydration, weakness, and off feed. The feces frequently are watery and contain blood, in the less severe cases the stools may change to a pasty consistency and are whitish-yellow as in colibacillosis. Treatment is necessary as most untreated calves die.

Pneumo-enteritis complex is another condition affecting calves at an early age. This condition is typified by a pneumonia and a simultaneous enteritis. Most workers agree this is probably caused by a bacteria virus combination.

Entero toxemia or hemorrhagic enteritis is a condition affecting calves usually within the first two weeks. It is characterized by acute onset, severe hemorrhage into the lumen of the small intestine and early death.

The clinical signs displayed vary with the degree of intoxication. In many cases apparently healthy calves when observed a few hours later may be found dead. Early in the disease, infected calves become weak, listless, and quit nursing. Hemorrhagic diarrhea may or may not be observed. This condition has been observed throughout the beef producing areas and is usually associated with well managed herds. Prevention of this condition is best obtained by immunizing the dam thus protecting the calf via the colostrum.

Calf diptheria — Necrotic stomatitis or Necrotic laryngitis

This condition is caused by a bacteria which causes necrosis or death of the tissues in the mouth and upper respiratory tract. Calf diptheria may affect all ages of calves, from three weeks to yearlings, and is characterized by a stenosis of the larynx which results in a loud snoring type of breathing, gasping for breath, coughing and suffocation due to the air passage being shut off by the necrotic membranes. Necrotic laryngitis is often associated with crowded conditions and may be prevented through management practices.

Pneumonia

Pneumonia of calves is a highly infectious respiratory disease most prevalent in 2-6 month old animals. For many years, various bacteria were thought to be the sole cause of this condition. But recent work indicates that a virus is probably the primary cause.

Pneumonia in calves is characterized by a sudden onset of respiratory difficulty, high fever, salivation, nasal discharge, and open mouth breathing. Pneumonia is usually precipitated by stress factors such as shipping, weaning, adverse weather, changes in feed, etc. Prevention of this condition is certainly the economical choice as death loss may be low but loss efficiency extremely high.

In the last category, I will briefly mention a few of the more common bacterial diseases associated with calves.

Pink eye—Et. Bact. for virus—which is characterized by a conjunctivitis with profuse lacrimation and an animal that is extremely sensitive to light. Death from pink eye is rare although feed efficiency and rate of gain are greatly reduced.

Listeriosis is a condition of all ages of cattle and is characterized by a nervous disturbance in which the animal continues to circle in one direction and usually has a paralysis of one side of the face. This condition is sometimes associated with the feeding of ensilage.

Leptospirosis is another condition affecting all ages of cattle and other livestock as well as man. This condition is spread by urine contaminated feed and water and in calves leptospirosis is characterized by a fever, prostration, off feed, labored breathing, icterus, bloody urine, and anemia. Leptospirosis is usually associated with wet crowded conditions and may be prevented by any of the commercial vaccines.

Blackleg and malignant edema are common terms to all Western cattle men. These conditions are caused by related organisms that are picked up during grazing on pastures that have been contaminated with these resistant bacteria. These bacteria produce gas in the muscle. If the animal is observed before death, it may be very reluctant to move. If one palpates the skin of these animals, the skin will crackle like tissue paper due to the gas formation under the skin. These conditions are effectively prevented by vaccination.

There are other bacterial infections that may be encountered in localized areas such as Anthrax, Bacillary Hemoglobinuria, Black Disease and others.

PROBLEMS OF CALF PRODUCTION
CALFHOOD DISEASES
"PARASITES"

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Under ordinary range conditions, external and internal parasites do not greatly influence the health of the calf from birth to weaning. Cattle are scattered over large areas and the potential for parasite transmission is limited. Nutrition of the nursing calf is usually excellent and, as a result, the calf is well equipped to cope with light to moderate parasite loads. Under unusual conditions of management or local ecology, clinical parasitism may sometimes occur in suckling range calves. In most instances, the problem arises because of overcrowding. This may result from overstocking, but usually from voluntary congregation of cattle around marshy areas during drought or around feeding areas when supplements are fed. Infestations with ticks and various species of biting flies, gnats, mosquitoes, midges, etc., are an exception and are not related to cattle concentrations in most cases.

External Parasites

The most important of the external parasites are various species of lice, ticks and flying and biting insects. All of these parasites can be important causes of unthriftiness in livestock of all ages, because of the disruption in grazing activity that results from their attacks. During certain seasons, cattle may seek shelter in wooded areas during most of the daylight hours in order to escape biting insects, and do not graze. In addition to the torment caused by these pests, many of them are blood-suckers and are capable of transmitting certain infectious diseases, especially anaplasmosis. Sucking lice and ticks may actually cause death from blood-loss anemia when the infestations are unusually severe. Even relatively light infestations with certain species of ticks may cause a potentially fatal paralytic disease. Removal of the ticks effects a rapid recovery.

Of all the external parasites, lice are the easiest to control since they spend their entire life on the cattle where they are readily eliminated by periodic dipping or spraying with a variety of insecticides. It is best to treat lousy cattle twice at a 2 to 3 week interval, as the eggs (nits) are not killed by the initial treatment and a new crop of lice continues to hatch for about 2 weeks after the adult population is destroyed. When using any insecticide, the manufacturer's instructions should be carefully observed with respect to concentration, formulation, dosage, application, treatment intervals, cut-off date prior to slaughter, age of cattle to be treated, use on sick or stressed cattle, and combination with other chemotherapeutic agents.

Ticks and flying insects are less easily controlled than lice, since much of the time they are not present on the cattle, and the residual activity of the available insecticides on the skin of the cattle following treatment is not prolonged. Frequent gathering of range cattle for dipping or spraying is not practical because of the time and labor involved. Excellent control of most of these external parasites has been achieved by the use of burlap dust-bags charged with insecticides such as methoxychlor, toxaphene, ciodrin and coumaphos (Co-Ral). The bags are suspended so that they rub across the backs of the cattle as they walk under them. The bags should be arranged so that the cattle must walk under them as they go to feed, water or salt. Cattle soon learn to seek relief from biting insects by walking under the dust-bags.

Internal Parasites

The internal parasites that are most frequently associated with disease in range calves include liver flukes, lung worms, the gastrointestinal trichostrongylid roundworms and coccidia. With the exception of liver flukes, overcrowding is a prerequisite for clinical disease under range conditions. These parasites do cause disease when cattle are grazed on irrigated pastures, even when stocking rates are within acceptable limits. Whenever pastures become heavily contaminated with fecal droppings, and soil and climatic conditions are favorable for development and survival of the infectious stages of the parasites, disease is likely to result.

Liver flukes themselves are unlikely to be a direct cause of clinical disease in cattle unless a truly massive infection is present. The adult flukes reside in the major bile ducts of the liver, and do little harm other than cause condemnation of the liver at slaughter. The immature flukes tunnel through the liver, ingesting hepatic cells and tissue debris as they travel. If there are no spores of the bacterium *Clostridium hemolyticum* present in the liver, little or no harm results from their presence. In certain geographically restricted areas which have poorly-drained, alkaline soils, the surface soil may contain relatively large concentrations of *Cl. hemolyticum* spores. These spores are ingested by the grazing cattle and persist in the liver for a considerable period of time. When larval flukes invade such a liver, small necrotic areas (resulting from the migratory activity of the flukes) provide suitable anaerobic conditions for replication and toxin production by *Cl. hemolyticum*. The result is an extremely acute disease referred to as bacillary hemoglobinuria or "red-water". It is characterized by high fever, depression, rapid respirations, pale and sometimes yellow-tinged mucous membranes, port wine-colored urine, and rapid death. At autopsy, the liver contains a large pale area of necrosis, a lesion which is diagnostic. The disease can be prevented by annual vaccination.

Gastrointestinal trichostrongylid roundworms are not usually a problem in range calves, except when they are removed to irrigated pastures, or when cattle congregate around marshy areas to feed on green grass during periods of drought. Under these conditions, worms may cause poor growth or even frank disease with "bottle-jaw", chronic diarrhea, emaciation and death.

Calves can tolerate moderate numbers of these worms while nursing their dam, since a high plane of nutrition is at least partially protective against most parasites. When the calf is suddenly weaned and placed on relatively low-quality roughage such as dry pasture, with no supplement, signs of clinical parasitism may appear without any increase in the actual numbers of worms present. Trouble can be avoided by worming prior to weaning whenever post-weaning nutritional stress can be anticipated.

Lungworm infestations are favored by the same management and ecologic factors that favor roundworm infections. A lungworm outbreak is usually associated with a concurrent roundworm infestation, although the converse is not necessarily true. Lungworms cause varying degrees of bronchitis and pneumonia, the severity being related to the numbers of worms and the length of time over which they were acquired. Small numbers and gradual exposure favor subclinical infection. The disease is characterized by paroxysmal coughing attacks, exaggerated respiratory efforts, and loss of body weight. There is no response to antibiotic therapy, such as is effective against bacterial pneumonias. Diagnosis is based on the demonstration of the lungworm larvae in the feces or the adult worms in the air passages of the lungs on autopsy.

Treatment is expensive and the results are not always gratifying. Diethylcarbamazine (caricide) is only effective against the immature worms, and cyanacethydrazide is only effective against the adult worms. In field outbreaks, it is not always possible to know for certain which drug is likely to be most effective. Methyridine (promintic) has a broad spectrum of activity against all stages of the worms, but the efficiency against any one stage is not high. A new drug, L-tetramisole, may prove to be the treatment of choice since it appears to be highly effective against all stages. Fortunately, the disease is usually self-limiting, and most cattle develop immunity following infection and survive to become asymptomatic carriers. The cattle are often severely set back, however, and prevention is preferable to treatment.

In areas where lungworm disease is endemic, the incidence has been greatly reduced by treatment of older cattle with cyanacethydrazide prior to the pasture season, and all cattle prior to movement to clean pastures. Marshy areas in the pastures should be drained or fenced to exclude cattle. Overcrowding should be avoided. A vaccine made by treating infective lungworm larvae with x-rays has been highly effective in Great Britain, but is not available in this country.

Coccidiosis is an intestinal infection with certain species of protozoan parasites, that is characterized by varying degrees of diarrhea and weight loss. In severe cases, calves die from hemorrhage into the bowel. Coccidiosis can only occur when calves are overcrowded and when conditions of ambient temperature and soil moisture are suitable for survival and development of the infective stages on the ground. Dryness and extremes of heat and cold mitigate against the development of clinical infections. Disease may occur on dry pastures or even in pens or corrals when cattle are fed supplements on the ground in the same places every day. The disease is best controlled by management and sanitation.

"VITAMIN AND MINERAL DEFICIENCIES ASSOCIATED WITH BEEF CALF PRODUCTION"

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Preconditioning of calves is an important part of the overall program of improving efficiency of cattle production. Preconditioning, in a broad sense, begins before the calf is born. How adequately the dam is fed during gestation determines, to some extent, the vigor and livability of the calf when born. Vigorous, healthy calves at birth are more likely to wean at a heavier weight. It is well that this conference begins with a discussion of calf production and herd management problems.

We are concerned, in this country, with a great need to improve efficiency of cattle production. This can only come about through reduction and elimination of disease, improvement of nutrition, management, and possible changes in breeding programs. The general level of production today for the average cattleman is too low. Every breeding cow should produce a healthy living calf each year and this calf should be weaned at a heavy weaning weight. If the cowman is able to stay in business and make a profit, he must produce a high percent calf crop, wean calves at a heavier weight, produce calves which gain fast and efficiently in the feedlot and are the type demanded by the consumer.

Changes in methods of production and in type of cattle produced often come about slowly; however, rapid changes are being made today. It is likely that the average weaning weight of calves will be increased considerably in the next few years. The percent calf crop must also be improved.

Let us now consider factors which result in a lowered calf crop: cows do not become pregnant, calves die in the uterus during gestation, calves die at birth or they die from birth to weaning. There is a scarcity of information on the prenatal and postnatal mortality of calves. A National Research Council publication is being written on the subject. More research needs to be conducted.

The role of nutrition in preventing calf losses is complex. Although there are single nutritional deficiencies in cattle which can cause large losses, most single nutritional deficiencies are associated with deficiencies of other nutrients. Madsen (1942) stated that most of these deficiencies are not fatal but they cause large economic losses. The precise effect of most dietary deficiencies upon the growth and development of the bovine fetus is not known. Hignett (1960) stated that there is little reliable information concerning the influence of nutrition on the fertility of large animals. Robinson (1957) stated that the prenatal life of an animal is an extremely critical period. There are many interacting factors which determine whether or not the developing organism live or die and is aborted or resorbed. Prenatal influence does not cease with parturition. The ability of the young to survive and their dam to care for them is markedly influenced by factors such as the nutritional status of the dam during pregnancy and early post-partum period.

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The lack of total feed is probably the most common nutritional deficiency in beef cattle production. Although energy and protein deficiencies will be covered in the following paper, it is important to state now that this lack of sufficient feed causes general malnutrition and complex nutritional deficiencies. Malnutrition in young cattle affects the orderly growth of reproductive organs; malnutrition is a common cause of low fertility. Hignett (1960) stated that gross nutritional deficiencies depress ovulatory activity and often result in anestrus; however, when ovulation continues it is not always clear whether there is a lack of fertilization or an increase in prenatal mortality. Robinson stated that a cow in which the embryo has died may return to a normal estrus cycle without necessarily prolonging the cycle. Thus, the management of cattle prior to breeding has an effect on the ability of the cow to re-breed early and to produce a healthy living calf.

The purpose of this paper is to discuss vitamin and mineral deficiencies associated with calf production. Vitamin A is the principal vitamin with which the cattlemen need be greatly concerned. Vitamin A is essential for the general health of the body and for maintaining the epithelial cells. Vitamin A maintains mucous membranes in a healthy condition, thereby lowering the incidence of some infections by harmful bacteria and subsequent disease. Vitamin A deficiency occurs in cows during the last half of gestation and is characterized by abortion or birth of weak or dead calves. Calves may have diarrhea, be blind, or show muscular incoordination. Dystocia, retained placenta, and metritis are likely to occur in cows.

Vitamin A is formed in the animal's body from carotene found in plants. Carotene is transformed into vitamin A in the intestinal wall, Mattson *et al.* (1947). Vitamin A is stored principally in the liver; thus during the green grass season, animals are able to store in the liver amounts usually sufficient to carry them through the winter months when carotene content of range forage is low. Vitamin A deficiencies are most likely to occur after or during prolonged drought periods, (Guilbert and Hart 1934), or when cattle are fed low quality hay or low carotene feeds for long periods of time. Many ranchers who feed commercial protein supplements provide cows with 20,000 to 50,000 units of vitamin A per day during the latter part of gestation. The amount of vitamin A provided depends upon amount and quality of roughage available to the cow.

Vitamin A is stored in large amounts in the colostrum; therefore, it is extremely important that the calf have access to colostrum shortly after birth. Not only does a calf receive large amounts of vitamin A, but also antibodies which aid in prevention of some infections.

Calves are born with low liver vitamin A reserves, even though their dams are fed adequate amounts of vitamin A (Hart and Guilbert 1933). Colostrum provides protection to the newborn calf and is an excellent source of vitamin A. Colostrum contains 4 to 100 times more vitamin A than milk. This high level of vitamin A at parturition declines rapidly and is at a low level after a week.

A lack of vitamin A causes the transformation of normal epithelial to stratified keratinized epthelium. The mucosa of the respiratory tract and intestinal tract are affected in vitamin A-deficient calves. Structures thus affected are very susceptible to infection and, as a result, colds and pneumonia occur. Frequently convulsions are manifested in the advanced stages of the deficiency. Diarrhea, loss of appetite, and emaciation are common features of the disease at this time (King, 1961). Hanson *et al.* (1946) showed the needs of the newborn calf for 3,000 to 5,000 units per day. Calves showing symptoms of vitamin A deficiency can be given injectable vitamin A at the rate of 2,000 International Units per pound of body weight. Although several experiments have been conducted to determine the value of injecting vitamin A into calves at birth, the results have been somewhat inconclusive. Certainly if the calves are deficient at this time and the cows do not have sufficient vitamin A reserves, then injectable vitamin A may improve the health and general well-being.

Young range beef calves nursing their dams are not likely to become deficient in the B-complex vitamins or vitamins D or K. Calves born in some areas deficient in selenium are injected with both selenium and vitamin E to prevent white muscle disease.

Minerals

Many minerals generally recognized as essential for growth and reproduction have an indirect role in preventing calf losses. Although deficiencies of some minerals result in poor fertility, deficiencies of other minerals result in anemia, unthriftiness, debilitation, and emaciation, causing birth of weak calves or insufficient milk for the newborn. Iodine is essential for normal reproduction (Kalkus 1920) (Welch 1917 and 1928). They showed that iodine deficiency causes stillborn or weak calves which may subsequently die. Calves may be born with an enlarged thyroid gland. If these calves survive, the thyroid gland will usually regress in a few weeks. The iodine requirement of cows can be satisfied by feeding stabilized iodine salt containing 0.0076 percent potassium iodine during pregnancy.

Range cows grazed on native range or fed hay, particularly legume hay, will receive more calcium than meets the minimum requirements for reproduction. However, range forage is deficient in phosphorus in many areas. It is during the winter that the phosphorus level of forage declines and that pregnant cows need to replenish reserves depleted by previous lactation. The National Research Council, 1963, states that the ration fed beef cows should contain 0.15% phosphorus. Because the phosphorus level in range forage available to cows in many areas is below this level during much of the year, adequate supplementation should be provided. Phosphorus can be supplied to cattle by feeding natural feeds that have a sufficient quantity of phosphorus. Fertilizing hay meadows usually improves the content of hay. Phosphorus can be supplied in drinking water or by feeding a home-mixed or commercial mineral mixture. In some areas deficient in phosphorus, it is recommended that mineral mixtures contain from 6.5 to 10% phosphorus. In Montana, we recommend that mineral mixtures contain 10% or more of phosphorus. A cow receiving a normal intake of mineral can meet at least one-third of her daily requirements by being given mineral mixtures containing 10% or more phosphorus (Jacobsen and Thomas, 1963). Another method of providing phosphorus is by force-feeding phosphorus in protein supplements. Montana research has shown that the addition of phosphorus through a protein supplement has increased the birth weight of calves by 3 pounds and the weaning weight by 15 pounds (Thomas *et al.* 1960)

Asdell (1949) studied the relationship between nutrition and sterility and stated that phosphorus deficiency interferes with ovarian function, probably causing a lower estrogen secretion in the early stages. Follicular development is interferred with in more severe conditions. If pregnancy occurs, little effect is seen until the end of gestation when parturition may be difficult; calves may be born weak or dead. Because of wide spread deficiency of phosphorus in many areas of the world, the important role of phosphorus in reproduction should be studied in more detail. Recent work in Montana has shown that cattle receiving additional phosphorus in supplemental feed had greater numbers of calves born per cow bred and weaning weights were improved (Thomas *et al.* 1965)

A manganese deficiency has been associated with the high incidence of sterility due to delayed ovulation. Heifers raised on low manganese rations were slow to exhibit estrus (Hignett, 1941; Bentley and Phillips, 1951). Hignett (1959) showed there is a relationship among calcium, phosphorus, and manganese and he suggested that major minerals affect the utilization of manganese required for enzyme systems essential for establishing and maintaining pregnancy. Dyer (1961) suggested that calves born with congential deformities may be a result of manganese required for enzyme systems essential for establishing and maintaining pregnancy. Dyer (1961) suggested that calves born with congential deformities may be a result of manganese deficiency in the dam.

Cobalt deficiency is recognized as a serious problem in certain areas of the world. Underwood (1962) states that an animal with severe cobalt deficiency is emaciated and anemic. Calves born to these animals are weak at birth and do not survive long. Vitamin B injections can relieve cobalt deficiency.

Low fertility in cattle has been associated with a copper deficiency in some areas (Monroe 1957); however, the nature of the reproductive failure has not been investigated (Underwood 1962). Rusoff (1941) and Becker *et al.* (1965) stated that salt sick cows will produce a calf which is not salt-sick. Copper deficiencies can be prevented by adding 0.25 to 0.5% copper sulfate salt fed free-choice (NRC, 1963), except that larger amounts may be needed in areas where excess molybdenum is a problem.

Molybdenosis in cattle occurs in cattle grazing on forage containing over 20 ppm of moloybdenum. This condition is characterized by scouring and loss of weight and can be overcome by feeding 2 grams per day of copper sulfate (Underwood, 1962).

The copper-molybdenum relationship is also complicated by other minerals and is not fully understood. Very young calves nursing dams and suffering from molybdenosis may scour and become unthrifty (Dye and O'Hara, 1959).

An excessive intake of selenium has been shown to be toxic. Moxon (1937) reported that a diet containing more than 5 ppm prevented normal growth. Deficiency symptoms were characterized by dullness, lack of vitality, emaciation, atrophy, cirrhosis of the liver and anemia. Erosion of long bones often resulted in soreness and sloughing of hoofs. Calves are sometimes born with deformed hoofs. Beath *et al.* (1953) stated that permanent injury to the fetus of pregnant animals may occur with abortion resulting in some cases. In South Dakota work, Dinkel (1963) showed that early breeding of cattle in areas where selenium toxicity is a problem has improved breeding performance.

In recent years, selenium has been associated with white muscle disease, Alloway and Hodson (1964) conducted a survey which indicated that selenium content of forages may be an important factor in establishing the broad regional pattern and distribution of white muscle disease. All forage samples obtained from areas where white muscle disease was common contained less than 0.1 ppm selenium. This level seems to be the approximate dividing line between areas where white muscle disease exists and where it doesn't.

White muscle disease occurs in calves in apparently good nutritional condition at an age when they are mainly dependent upon milk for nourishment (Vawter and Records, 1947). Cows feed on legumes grown in certain areas may give birth to calves which develop white muscle disease. Some are stillborn (Muth, 1955). White muscle disease may result from a deficiency in selenium or an interference with its metabolism.

The nutritional problem of the young beef calf may be minor if the dam is properly fed during the gestation period. Proper nutrition of the dam at critical periods before calving and breeding can improve production efficiency.

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"PROBLEMS RELATING TO PROTEIN AND ENERGY NUTRITION OF THE WEANLING CALF"

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Most calves do not consume adequate amounts of protein and energy during the early weaning period. This results primarily from the calves refusal to eat or to eat enough during the first three or four days after weaning. This occurs when the calves are weaned on the ranch as well as when they are shipped directly off the cow and weaned enroute or in the growers lots.

With this being the rule rather than the exception, preweaning and weaning management that encourages increased feed consumption the first few days after the calf is off the cow has an important and major influence on the status of protein and energy nutrition of the weanling calf.

We can theorize at considerable length about the proper levels of protein and energy and the proper relationships of these two major nutrients needed in the ration. They are important in calf nutrition, yet they are of secondary importance the first few days after weaning as a result of the psychological and physiological disturbance that the calf goes through and the adjustment that he and his digestive system must make.

Protein and energy needs and relationships in the various phases of beef cattle production have been the subject of many studies. While these are not as refined for beef feeding as for poultry nutrition, we have workable recommendations in the NRC Nutrient Requirements Publication. These will be refined in the future as we refine our experimental methods. Yet, I see no reason to deviate substantially from NRC recommendations in feeding the calf during the weaning period.

Some recent work that points to the importance of protein and energy relationships in beef cattle feeding are shown in Tables 1 and 2 and Figure 1. Increasing supplemental energy

Table 1.

Daily supplements and average daily gains, pubertal age and carcass grades of the heifers in the Fort Robinson experiment (December 29, 1964-April 15, 1965).[a]

Supplemental Crude Protein/day, lb.	Supplemental megacalories digestible energy/day			
	0	3.2	5.6	8.0
0.0	0			
Winter gain, lb.[b]	-0.23			
0.4	at	2lb-20.3%	3.5lb-11.8%	5.0lb-8.9%
Winter gain, lb.		0.41	0.27	0.07
0.8		2lb-39.8%	3.5lb-23.5%	5.0lb-16.5%
Winter gain, lb.		0.60	0.74	0.80

a. 1966 Nebraska Beef Progress Report.
b. Grazed on Winter Range.

Table 2.

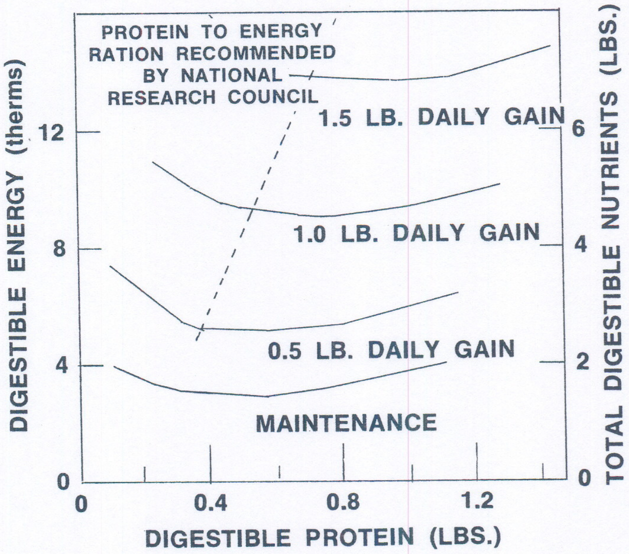
Performance of steers fed all concentrate and roughage containing rations.[a]

	15% roughage			All concentrate		
	11% protein	14% protein	Av.	11% protein	14% protein	Av.
No. head	49	50	99	50	50	100
Initial weight, lb.	692	699	696	693	696	694
Adj. daily gain, lb.[b]	3.10	2.98	3.04	2.95	3.15	3.05
Daily feed consumption, lb.	24.5	24.7	24.6	21.8	22.4	22.1
Feed required/ 100 lb. gain, lb.	779	832	805	751	724	737
Dressing %[c]	58.3	58.7	58.5	58.9	59.0	58.9
Carcass grade[d]	16.8	17.0	16.9	17.1	17.1	17.1
Condemned livers	7	7	14	28	28	56

a. 1968 Nebraska Progress Report.
b. Daily gain adjusted to equal dressing percent-fed 120 day.
c. Based on live weight at end of experiment.
d. 16 - high good, 17 - low choice.

Figure 1.

Daily protein and energy intake in relation to maintenance and weight gain — USDA Technical Bulletin 1364.



on winter range at Ft. Robinson (Table 1) resulted in reduced gains at the lower level of protein and increased gains at the higher level of protein.

An interaction between energy levels and protein content of fattening rations is indicated in Table 2. Cattle on 15% roughage showed no response or perhaps a negative response to 14% protein in the ration when compared with 11% protein. On the other hand, on the all concentrate ration cattle fed 14% protein gained more rapidly than those fed 11% crude protein.

Protein and energy relationships for the most efficient energy utilization as determined by Winchester are shown in Figure 1. Efficiency curves are shown for 0 to 1.5 lbs. daily gain. The intercept at the low point of each curve indicates the daily energy and protein needs for most efficient energy utilization for the rate of gain. Note that (1) these data indicate a rather wide range in protein intake where energy efficiency is good, (2) efficiency decreases as protein-energy ratios become narrower or wider than the optimum; and (3) published NCR Nutrient Requirements are fairly close to the optimums indicated in this detailed study.

Other basics that have a bearing on goals that we establish for protein and energy nutrition of the weanling calf are as follows:

1. Animals apparently cannot store protein reserves in the body unless the muscle tissue is considered a protein reserve.
2. High energy and/or high protein intake do not necessarily protect against disease.
3. Low energy and/or low protein intake do not necessarily predispose an animal to disease.
4. Starvation upsets rumen metabolism greatly and contributes to the stress of weaning.
5. Adaptation of rumen microorganisms to new feed stuffs requires time.
6. Cattle that have been on low levels of energy and protein make compensatory gains when fed more liberal rations i.e., gains are made with greater economy during the early part of the recovery phase.

As we summarize these facts, they point strongly to the importance of pre-weaning and post-weaning management in reducing stress, weight loss and low feed intake in the newly weaned calf. The fact that calves do make compensatory gains and in most cases must be grown before being finished minimizes the importance of striving for sizable gains during this period.

Let's look at some management practices that can be helpful to calf producers who:

1. Sell directly off the cows or
2. Wean and sell three to four weeks after weaning.

Management practices that offer potential in reducing the shock of weaning and should be considered by the producer who sells directly off the cow include: (1) Providing supplemental feed to acquaint calves with feeds other than milk, salt and grass; and (2) teaching cattle to eat from bunks or to drink from water tanks or troughs.

In a weaning study with Forrest Lee, Brownlee, Nebraska (Table 3), calves that were creep fed for three weeks prior to weaning gained more the first eight days after weaning than calves that had not had a creep ration. All calves in this test made good gains the first week after weaning. This was, of course, due to fill, but that is what we want during this early weaning period.

Table 3.

Treatment Effects on Weight Changes from Weaning to Seven or Eight Days Post-weaning.[1]

	1958		1959	
	No. of Calves	Avg. Gain (8 days)	No. of Calves	Avg. Gain (7 days)
Creep-fed	60	20.2		
Non-creep-fed	72	14.4		
Tranquilized	65	17.9	61	1
Non-tranquilized	67	16.2	61	-1

1. 48th Nebraska Progress Report 1960.
2. Significant increase in gain over the non-creep-fed calves.

Another factor that may have contributed to these good results was the fact that all the calves and their mothers had been fed some hay the last week before weaning. Similar hay was used in the weaning pens for feed and bedding. Calves were eating hay and laying down within minutes after being removed from their mothers without the usual chorus of bawling, milling and fence running.

In a recently reported Oklahoma study calves weaned on good quality bluestem pasture responded well during a 21 day post-weaning period (Table 4). Gains by weekly periods are shown in Figure 2. Although no control group was available for comparison, the data indicate that the calves responded well to the feeding program and psychological stress associated with weaning.

Table 4.

Changes in Weight, Grade and Condition of Beef Calves During A Three Week Period Following Weaning[1]

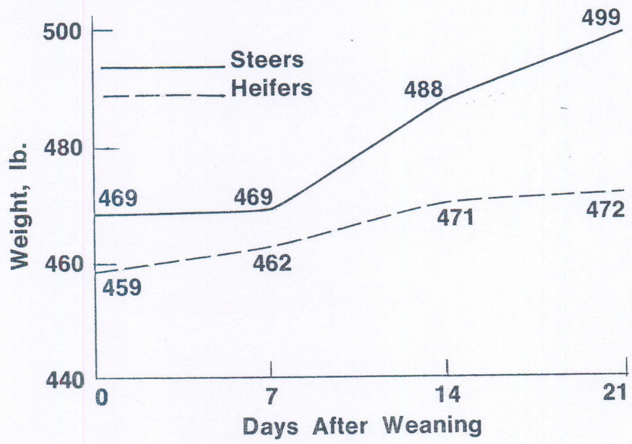
No. of Calves	Steers 115	Heifers 85	Avg.
Calf Performance, lbs.:			
Weaning weight (10-3-67)[2]	469	459	464
Total Gain (21 days)	30	13	21
Feed Consumption per calf (21 days) lbs.:[3]			
Ground Milo	8.9	8.9	8.5
Crimped Oats	7.4	7.5	7.4
Alfalfa Hay	35.8	33.3	34.5

1. Oklahoma Misc. Publication No. 80, 1968.
2. Weights are non shrunk weights after approximately one-quarter mile drive.
3. Grazed on good bluestem pasture.

Only a limited number of tests are available to emphasize the importance of exposing the nursing calf to feeds and equipment similar to those he'll come in contact with after weaning. Rancher experience, feeder experience and "bovine psychology" all attest that these practices do contribute to reduced stress at weaning. Costs of including one or more of these practices in the management program will vary from one calf producing unit to another. Returns too will vary depending on the subsequent environment and management following weaning. Before recommendations can be fairly specific we need more well-planned weaning studies than we have had to date.

Figure 2.

Weight change pattern of beef calves during a 3 week weaning period—Oklahoma Misc. Publicatio No. 80, 1968.



One other practice that will reduce the stress of weaning and contribute to net returns, as well, is to handle the calves as quietly as possible during sorting and weighing.

Management at and immediately following weaning is even more important in getting the calf off to a good start than pre-weaning management.

The calf producer who weans two to three weeks before selling has an opportunity to combine pre- and post-weaning management for a minimum of weaning stress, a minimum of disease and quick recovery from weight losses associated with weaning.

In addition to incorporating pre-weaning management practices that are practical he should:

(1) Have good quality roughage similar to the main pre-weaning roughage available as soon as possible after the calf is sorted from his mother.

(2) Put a few gentle animals with the calves for a quieting effect.

(3) Use small pens filled reasonably full with calves for a quieting effect rather than using large pens which are fairly empty. (If calves are weaned in dry lot.)

(4) If they are weaned in dry lot, hay the lots with good quality hay for feed as well as dust control.

(5) Add energy and/or protein supplement as soon as the calves quiet down and are eating well. The ration should provide 11 to 12% protein. A small amount of grain may increase gains slightly as indicated by studies at our Northeast Experiment Station. (Tables 5 or 6)

Table 5.

Performance of Calves on Prairie Hay.[ab]

Treatment	Gain/head	Daily feed consumption			
		HAY	CORN	SUPP.	WHEY
1. Prairie hay and soybean meal	21 lbs.	8.0	. . .	.95	. . .
2. Treatment 1 + mineral and Vitamin[c]	22 lbs.	8.0	. . .	1.02	. . .
3. Treatment 2 + corn	30 lbs.	7.5	1.3	1.02	. . .
4. Treatment 3 + Tylosin	28 lbs.	7.5	1.3	1.02	. . .
5. Treatment 3 + injected Vitamin A[d]	24 lbs.	7.5	1.3	1.02	. . .
6. Treatment 3 + whey	34 lbs.	8.0	1.3	1.02	.44

a. The test was conducted for a 31-day period and had 3 lots of 13 head on each treatment.
b. 1965 Nebraska Progress Report.
c. Calcium, phosphorus, salt, trace minerals and 10,000 IU Vitamin A per animal per day was added to the soybean meal.
d. The calves were injected with .5 million IU of Vitamin A on arrival at the lots.

Table 6.

Performance of Calves on Alfalfa Hay.[a b]

Treatment	Gain/head	Average daily feed			
		Hay	Corn	Whey	Molasses
1. Alfalfa hay only	37 lbs	7.3	. . .	. . .	. . .
2. Treatment 1 + corn	53 lbs.	7.6	1.36	. . .	. . .
3. Treatment 2 + ¼ lb. whey	40 lbs.	7.2	1.36	.25	. . .
4. Treatment 2 + ½ lb. whey	51 lbs.	7.7	1.36	.50	. . .
5. Treatment 2 + ½ lb. molasses	52 lbs.	7.5	1.36	. . .	.50
6. Treatment 1 + ½ lb. whey	56 lbs.	8.0	. . .	.50	. . .

a. The test was conducted for a 28 day period and had 3 lots of 10 calves on each treatment.
b. 1965 Nebraska Progress Report.

Feeding of substantial amounts of concentrates during a weaning period as short as 30 days does not appear appropriate from the standpoint of feeding and management problems or profit potentials.

In summary, problems of protein and energy nutrition at weaning are primarily the result of the calf's refusal to eat or to eat enough. This starvation adds to the stress of weaning and contributes to disease susceptibility. Pre-weaning and post-weaning management should be designed where feasable to encourage the calf to eat the first three or four days following weaning. Feed intake at this time appears to be more important in reducing disease susceptibility than refined ration formulation during the rest of the post-weaning period.

"NORTHWEST HERD MANAGEMENT PROBLEMS"

by
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The Northwest ranges have always been an area relatively free of livestock diseases. Due to geographic location, there has been little traffic in cattle enroute to other areas. Montana was at the end of the Texas trail, and for years imported nothing but steers from the Southwest and Old Mexico. Everything produced or grown was shipped out of the state. And, until the advent of truck transportation, there was little trade in cattle between individual ranches or areas within the state. Because of economic necessity, Northern cattlemen have been more concerned with preventing diseases rather than just treating sick animals. In the Northwestern states, especially Montana, stockmen have supported the continued operation of a strong and effective livestock sanitary board as the industry's official regulatory body on livestock disease prevention and control. More recently in Montana, the Montana Stockgrowers Association has created a Cattle Health Committee to advise with the State Livestock Sanitary Board, and the cattle industry as a whole, on all matters relating to cattle health. With about 40 percent of the state's annual calf crop of over 1 million head going to Iowa each year, this committee and the several thousand cowmen it represents have an obvious interest in the preconditioning of feeder calves.

In the Northwest, all calves have, for years, been castrated and vaccinated for blackleg and malignant edema at branding time. They are then 6 weeks to 2 months of age. More are being dehorned when branded if not sired by polled bulls. All this is of first importance for the rancher's own protection. A second shot in the fall for blackleg and malignant edema has so far been applied only to these calves being held over as yearlings. With the advent of newer diseases, such as IBR and leptospirosis, ranchers faced with these problems are starting to vaccinate. All this can then be classified as automatic preconditioning in that it is largely for the rancher's own protection. Perhaps a record of such operations and immunizations is all that will be needed to verify these treatments to the satisfaction of the feeder buyer.

Other preconditioning treatments, such as vaccinations for BVD, shipping fever, treatment for grubs and weaning prior shipment, do pose some problems for many Northwestern cattlemen. It is not a matter of unwillingness but one of inconvenience because of limited facilities for holding cattle once they are gathered and come off the range. Ranchers running on National forests and other public ranges are mostly without a means of holding calves for more than just overnight once they are cut off the cows. Even so, ranchers in some areas in Montana have been cooperating in voluntary informal groups with practicing veterinarians in administering certain preconditioning treatments to calves just before shipment. There will be more of this providing ranchers can see some compensation for doing so, either to their own direct benefit or through an increase in sale price. In the end, there is nothing the rancher will not do in the way of preconditioning, if necessary to maintain his competitive position in the feeder cattle market.

Although weaning is recognized as the greatest single shock to a feeder calf, weaning 3 weeks prior to shipment poses the greatest single problem for many ranchers. Some ranchers have said that if they have to hold their calves off the cows for 3 weeks prior to shipment they might just as well feed them until spring. Montana livestock market operators and feeder cattle order buyers have also said they do not want calves weaned just three weeks before shipping but prefer them either right off the cows with their "bloom" or on feed for at least 6 weeks.

A preliminary trial on preconditioning calves was conducted by the Montana Agricultural Experiment Station in the fall of 1967 which may point the way as to how this post-weaning phase of preconditioning might best be handled in the future. Here is a brief summary of this trial. Forty-eight Hereford steer calves produced at the Red Bluff Research Ranch were weaned on October 10, individually weighed at the ranch and hauled about 35 miles to the MSU Cattle Nutrition Center at Bozeman. Upon arrival they were again individually weighed and given grass hay and water. The next day one-half the calves were given vaccinations for the following—leptospirosis, IBR, BVD, PI-3, a booster for malignant edema and blackleg and were treated with Ruelene. The other half were given PI-3, malignant edema and blackleg and treated with Ruelene only. On October 24, the other vaccinations were given to this half of the calves. In traveling from ranch to feedlot the calves lost about 20 pounds per head or underwent a 5 percent shrink. An additional 2 percent loss in weight occurred between arrival and when the calves were weighed on October 12. They gained back their ranch weight in one week following.

During a 36-day feeding period, the calves were divided into four lots and fed various amounts of barley, beet pulp and protein supplement averaging from 3 to 4 lbs. of the concentrate mixture daily, plus approximately 8 lbs. per head of grass hay, free-choice. By November 16, the calves had gained from 36 to 59 lbs. per head. Feed costs of gain for all lots ranged from $11.54 to $21.29 cwt. Although blood analyses have not yet been reported on the antibody levels obtained from the immunizations, there did not appear to be any unfavorable physical effects on the calves given all injections at once as compared to those receiving the immunizations over a 12-day period. Complete details of this study are reported in the Proceedings of the 12th Annual Feeders' Day held at Montana State University, May 11, 1968 under the title "Weight Recovery of Calves From Ranch to Feedlot as Affected by Feed and Vaccination" by O. O. Thomas, J. E. Catlin and Jesse Armitage.[1]

In certain areas in Montana and perhaps other Northwestern states as well, the wintering of calves for resale in the spring to go to feedlot or grass is a growing practice. The calves are

[1]Professor Animal Science; Associate Professor, Veterinary Science; Graduate Assistant, Animal Science.

fed to gain from 1.0 to 1.25 lbs. per head daily for a period of 125-150 days. For some time this has proven to be a profitable venture in view of low cost corn silage, alfalfa hay and barley as well as a usual rise in price from fall to spring. In Montana, feeder calf prices since 1949 have been $1.14 per cwt. higher in April than the previous October. During 10 of the 17 years, since 1949, April prices have averaged $3.19 cwt. higher than the previous October prices.

Calves held on feed over winter also provide the maximum in preconditioning in that they have undergone all of the adjustments attendant to weaning and getting on feed. They will also have had time for any desired schedule of immunizations that may be necessary. These short yearlings, weighing around 500 pounds and sold in March or early April, may not precisely fit the Corn Belt feeder's demand for calves weighing 400 pounds in October or November but they can be classified as thoroughly preconditioned and ready to go to anybody's feedlot—Corn Belt or otherwise.

Much has been said concerning the bad features of repeated reselling feeder calves through Corn Belt Auction markets with the inference that anything but direct selling must be avoided. So far as Northwestern cattlemen are concerned, direct selling is often highly desirable but not always practical. The auction markets located in the range country provide a valuable service in feeder cattle marketing and are not necessarily focal points of disease contamination. Admitting that sudden changes in weather can often upset the health picture of any bunch of cattle, western markets, at least in Montana, are closely supervised by livestock sanitary officials so that the chance of the spread of communicable disease is cut to the minimum. No cattle showing evidence of disease are ever released for shipment from these markets. Futhermore, veterinary inspectors will not release direct shipments of feeder cattle of doubtful health status where the receiving state regulations require a health inspection.

If the midwestern sale barn is a problem in feeder cattle health, then it appears the responsibility for correcting this condition rests with the cattle feeders themselves and their respective livestock sanitary officials. Regardless, this is hardly a problem of the northwestern cattle producer as the original cost of western feeder calves is usually too great to allow much further speculation before they go to a feedlot.

"COW HERD MANAGEMENT AND PRECONDITIONING"

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As is typical of every other segment of the beef industry, the cow-calf operation is under severe pressure, with mounting costs of land, labor, taxes, feed, and all the other inputs that must be charged against the calf at weaning. The most effective way the producer can overcome this obstacle is through greater production per cow unit, plus an increased value for his product. In terms of increased market value, he must prepare or "package" his product, so to speak, to gain a premium.

Nothing has hit the beef industry with more impact in recent years than the prospect of preconditioning calves prior to their arrival at the feedlot. It has become a controversial topic among cowmen, and many are frankly unsure of what it really means, and how it might fit the normal cow herd operation. No one can deny that it focuses attention on a weak link in our production cycle from calf to carcass—the proper preparation and merchandising of the weaned calf to avoid needless stress and disease loss to the cattle feeder.

All in all, it's a healthy sign of our "growing up" in the cow-calf business. No longer can the cowman be content to merely truck his calves to the most convenient market, and risk years of improved breeding or months of feeding and management to the whims of the market, without the proper preparation so necessary to get the top dollar. In this age of "sales power," a reputation for good performance of his calves is gained through (a) evidence of performing ability from actual test data on the herd, and (b) soundness and health of his product. It is within the latter framework that preconditioning will become an integral part of tomorrow's beef cow operations. Also, since more and more ranchers are feeding out their own calves, preconditioning is a natural development in avoiding unnecessary stress and disease.

As cow-calf men become "specialists" similar to their feedlot counterparts, preconditioning will become a routine practice. In turn, the feeder is faced with ever-mounting costs of production, and cannot afford to gamble on green, fleshy calves of unknown history and vaccination—calves that shrink up to 12% before they start on feed, and death loss of over 2%.

Much depends on adapting the practices necessary for proper preconditioning to common herd management. Bear in mind, that in some instances (i. e., cow herds grazing in mountain areas, etc.) some of the practices which are simple in farm herds are virtually impossible. Nevertheless, history has shown repeatedly that the cow herd operator is a resourceful fellow, and will find new methods and "tricks of the trade" to overcome difficulties, providing the profit motive and incentive is evident.

Routine practices, such as castration, dehorning, vaccination for blackleg and malignant edema, are common in most herds during the first few months of a calf's life. However, it is surprising that so many calves appear on our markets which have never been "worked." More attention is being paid to internal parasites today, particularly in the Southern states, and new anthelmintics are now available. The possibility of feeding a range supplement or special premix containing sufficient worming agent for the cow or calf should be a real boost toward internal parasite control. Similarly, more ranchers are using the "pour on" method of grub control treatment, and when applied properly, it can virtually eliminate this parasite in the host before damage to the hide. Thus, we now have the "tools" we need to protect the calf against some of the more obvious parasites. BUT THE BIG PROBLEM IS GAIN WIDESPREAD USE OF THESE PRACTICES; adoption has been too slow in many herds, even those of the reputation variety.

Until the past year or so, there was little defense against some of the viral diseases that can cause havoc in newly-shipped, exhausted calves. Again, this can be prevented by proper pre-weaning and vaccination, using one or more of the new vaccines on the market. However, ranchers have been slow to practice this because of (1) cost, (2) lack of knowledge as to which vaccine to use and when to use it, and (3) uncertainty as to whether a premium will be forthcoming. Further, there is some feeling among ranchers that these are best used if they sell "direct" to the feeder, and can work out an acceptable vaccination program and proper charge for same. Another factor of considerable concern to the cowman is the necessity of a "double shot," with certain vaccines, with a month or six weeks between shots. This may be difficult to adapt to many range situations. Two possibilities come to mind: By working the calves a little later than normal, the first shot can be given at a time that requires little extra labor, with the second shot prior to shipping. A further possibility exists if the calves are pre-weaned for 4 weeks or more before shipment, so that the first dose can be given as they are separated from the cows.

The subject of pre-weaning has come in for more comment, pro and con, than any other practice associated with preconditioning. And rightly so, for the rancher is the one who must supply the labor, feed, facilities, and assume all the risk under most conditions. Pertinent questions arise such as: What kind of success will I have in weaning calves on the farm or ranch? How should I handle them for minimum loss and sickness? What kind of ration must I feed? How long should the pre-weaning period last for best recovery, efficient gains and proper preconditioning before shipment?

Obviously, answers to only a few of these questions are available. Further, the situation will vary from ranch to ranch, and herd to herd—even from one area of the country to the other. But again, resourceful ranchers will find a way, provided they are motivated by a desire to (1) protect their "reputation" for good-doing, sound and healthy calves, and (2) if there is sufficient premium involved.

Data from experiment station herds, while valuable as an indicator of expected results, may not be adaptable to the field since conditions often differ. Thus, they best serve as a guide to probable performance. Unfortunately, to date the design of station tests and inadequacy of data obtained do not tell the whole story. As the practice gains momentum, however, we can expect much useful information to become available.

Several stations have studied the problem and reported their results. The Utah station has reported results with three small groups of calves, representing samples from large range herds in that state.[1] Calves weighing 360 to 418 lbs., weaned 2 to 4 weeks, recovered from the stress of weaning and gained an additional 30 lbs. when fed alfalfa hay and a small amount of grain mixture. Aside from the $2.00 per cwt. premium which favored the pre-weaned calves in this experiment, the value of the added gain over feed cost was worth from $0.82 to $2.64 per head.

At Oklahoma, an analysis of records over several years by Gill[2] shows rather good rates of gain by calves weaned off range cows in the Experiment Station herd. Calves weaned from 14 to 44 days in small traps before being placed on feed, gained from 1.0 to 1.7 lbs. per head daily. The average results of two additional Oklahoma tests are shown in Table 1. Note that the results were somewhat variable: In one test, 115 steer calves gained 30 lb. each, and 85 heifer mates averaged 13 lb., when weaned in small pasture lots for 21 days, with limited alfalfa hay and less than 1.0 lb. per day of grain mixture.[3] In another test, 110 calves gained an average of only 3 lb. each during a 12-day weaning period.[4] Part of the calves, when shipped to market, shrunk 5%, while another group of steer calves shrunk 12% when shipped to the feedlot and placed on feed. In the latter instance, it required 37 days to recover the shrink in the feedlot. From most tests to date, it appears best to wean for at least 3 weeks to permit economical recovery.

One might expect that the results of tests to be quite variable, and influenced by many factors (i. e., climate conditions, environment, feeds used, skill of the operator, etc.). Further, it is a most difficult area to research, and each individual operator may have to conduct his own tests under his own conditions to gain reliable information. Hence, no broad generalizations are justified at this time.

It would appear from the data available, that perhaps the pre-weaning prior to shipment is the most important aspect of the entire preconditioning procedure. Calves taught to eat properly and past the psychological stress of weaning, quickly go on feed once they arrive at the feedlot. Thus, they rather quickly build back the digestive tract loss, maintain a healthy rumen picture, and gain the needed energy which is so critical in resisting infection. Calves weaned and taught to eat before leaving the ranch may be more resistant to some diseases than vaccinated, but unweaned, calves.

Among the several advantages of weaning on the ranch are:

1. It allows the calf time to overcome stress under the most favorable conditions.
2. It provides time to build immunity if the calf is vaccinated before the weaning period.
3. The calf becomes accustomed to grain or other concentrate feed, and learns to eat from a trough.
4. The rancher has much more flexibility as to shipping time, and often this becomes a distinct advantage during inclement weather.
5. Poor-doing, sick calves can be sorted off to protect the "reputation" of the producer.
6. When calves are sold direct and shipped promptly, shrink and stress are reduced to a minimum.

Despite all of the above, however, many ranchers are still skeptical about the preconditioning program. Among the questions that undoubtedly pass through their minds are:

—What's it worth, and do we get a premium for our efforts?

—Do we absorb all the risk for the feeder?

—What's the probable death loss and feed cost?

—What's the best ration, and will the calves appear "stale" and lose their "bloom" when they reach the market?

—Will the competition and feeder-demand force us into a preconditioning program, whether we like it or not?

Who is most likely to precondition calves in the future? Most probably it will be the larger, more progressive operators, and not the small cowmen who sell in "jackpot" loads at odd times. The difficulty of properly identifying the preconditioned calf is a real problem. It appears that a veterinarian's certification will be required showing what vaccinations were given. However, cow-calf producers, working in close harmony with feeders, may best develop schemes and methods of preconditioning suited to fit their own individual situations and often do the job themselves.

Above all, preconditioning is a healthy sign that the beef business is "growing up"—accepting new responsibilities in merchandising their product and avoiding needless shrink and death loss. With margins in cattle feeding at a razor-thin edge, and with cowmen recognizing the need to establish a "reputation" for high-performance calves, properly "packaged" for the feedlot, it will increase markedly in the future. As a result, all phases of the beef industry will profit.

[1]American Cattle Producer. Nov., 1967. p. 19.
[2]Gill, D. R., 1967, Okla. Preconditioning Seminar. p. 59.
[3]Ewing, *et al.*, Okla. Misc. Pub. MP-80. p. 77.
[4]Totusek, *et al.*, Okla. Misc. Pub. MP-80. p. 72.

Table 1

Oklahoma Experiments on Weaning Calves — 1967

200 calves—weaned on grass plus feed[3]	
Average weaning wt., lb.	464
Average 21 day gain, lb.	21
Steers	30
Heifers	13
Feed per calf, lb.	
Ground milo	8.5
Crimped oats	7.4
Alfalfa hay	34.5
110 calves, weaned on pasture plus feed[4]	
Average weaning wt., lb.	405
Average 12-day gain, lb.	3
Steers	2
Heifers	4
Average shrink to market (74 head), lb.	19 (5%)
Average shrink to feedlot weight (36 head), lb.	56 (12%)
Average 37-day gain in feedlot, lb.	54

[3]Ewing *et al.*, Okla. Misc. Pub. MP-80, p. 77.
[4]Totusek *et al.*, Okla. Misc. Pub. MP-80, p. 72.

"PRECONDITIONING STIRS THE CATTLE INDUSTRY"

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It isn't always new technology that denotes progress or change. Sometimes it is reorganization of the old, programmed differently. Thus it is with preconditioning, a program and a word introduced to the cattle industry only a few months ago. To date, after two national seminars on the subject, speeches at most every cattle meeting and papers delivered at most every veterinary meeting, the program is highly controversial, debatable and argumentive. Yet, the program continues to progress.

In most cases the word is not properly defined. Basically, preconditioning means preparing the animal to better withstand the vigors and rigors of leaving its mother, moving through the channels of trade and into the feedlot. It is more than a vaccination program. It involves castration, dehorning weaning, immunization, nutrition, external and internal parasite control and safe and humane handling and hauling.

Preconditioning has been brought about by the need for cutting the morbidity and mortality losses in animals going to the feedlot which have been estimated to amount to $10-20.00 for every animal. Preconditioning is aimed at the half-hazard management programs that have existed for years in the assembly and movement of animals. It is incomprehensible to explain why the industry has tolerated the practices of intermingling sick animals with the apparently healthy, the inhumane and illegal truck and rail routes, the movement of sick animals through the various markets, even with health certificates, plus many other costly procedures.

The preconditioning program has been criticized by many that the recommendations were without documentation. This is not to be denied, yet, accumulating evidence indicates that these recommendations are valid and sound. In a recent survey of over 200,000 cattle by Iowa State University veterinarians, these problems are vividly demonstrated. When it is revealed that over 80% of the animals are vaccinated for Blackleg under two weeks of age, that time on truck or rail frequently is contrary to intra- and interstate commerce rules and many other irregular practices prevail, a great deal of documentation is not needed. The need is obvious.

At the ranch level, the problem of weaning, thought to be the greatest stress is argued by many cow-calf men. They feel this is an unnecessary expense and have moved their freshly weaned calves the day they took them from their mother. Questions arise as to who is to pay for preconditioning. Accumulating evidence indicates that for $10-14.00, an animal can be confined and fed for 30 days and preconditioned as recommended. During this period the animal should and usually does gain enough to pay for the costs. The main point of getting a better product to the producer is frequently missed.

There are many problems confronting the program. In general, the cow-calf man is willing to participate if the feeder demands the program. To date the feeder hasn't requested preconditioned animals thus there aren't many. Greater progress has been made in the west than in the south. Montana has moved further on the program than in any other state.

Recommendations have been introduced through various committees of the United States Livestock Sanitary Association only to be tabled. Cattle organizations are watching with interest; veterinary associations have adopted the program and the American Association of Bovine Practitioners have led forth with a three-fold program. Yet, no effort has been made to adopt nation-wide cattle identification or to review or reorganize the regulations pertaining to the movement and sale of cattle. As yet, they are loose and improperly supervised.

Preconditioning is a part of the modern effort to prevent trouble before it occurs. To the veterinarian it is an attempt to practice preventative medicine. To the animal scientist it is a program based on the utilization of good management practices. To the cattleman it is a program to produce beef more efficiently and effectively. The reason that it hasn't been accepted is that it takes time for the adoption of new programs.

Veterinarians can aid and abate the program by exhibiting leadership. Fundamentally, there must be uniformity and standardization of the practices and even the fees. Recently, a veterinarian preconditioned over 3,000 calves at "cost" figures to get the program going. He did not know that he set a fee precedent in a large area. A knowledge of the processes of immunity, vaccination procedures and the care and use of vaccines needs to be possessed by the veterinarian. The improper use of vaccines has not been confined to the layman entirely.

All in all, preconditioning is being adopted by the cattle industry and related segments of the industry as rapidly as any program has been accepted. The voids that exist are not with the cow-calf producer or the feeder alone. Preconditioning involves the trucker, the railroad, the auction market, the terminal market and the many, many middlemen involved in handling cattle. There is no controversy that the program is not a contribution to the cattle industry. Geographical differences, age and condition of animals and disease incidences all will affect the program. Professional judgment is needed to aid the program. Veterinarians can contribute to the program by properly advising their cattlemen. Already there are too many improperly informed advisors disrupting the program.

PRECONDITIONING COSTS
30-Day Period

Yardage	5¢/day	$1.50
Interest	3¢/day	.90
Nutrition	15-20¢/day	4.50
Blackleg — Malignant Edema — pasteurella IBR BVD SF_4 Grubacides Worming	$1-2.00	1.50
Administration of Above	$1-2.00	1.50
		$9.90
Animals Gain 20 to 60 Pounds @ 25-30¢ Average		$10-12.00

Properly handled preconditioning "pays" plus yielding a better product for the feeder.

"BASIC PRINCIPLES OF IMMUNITY"

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The active defense mechanisms against disease in an animal are primarily of two kinds. First are the specialized cells which "eat" or phagocytize bacteria and second is the antibody system of the body.

The specialized cells which are called leukocytes or white blood cells are found in the blood, lymph, lymph nodes, liver and spleen. Their purpose is to destroy foreign cells and worn-out body cells. Though these cells are capable of destroying bacteria in the body, they are much more efficient if antibodies against the particular bacteria are present.

Antibodies are made by certain of the white blood cells and appear as a specialized protein in the blood known as gamma globulin. These antibodies are produced by stimulation of the white blood cells by foreign protein in the body. Any material which stimulates antibody production is called an antigen. This antigen may be bacteria, viruses or toxins. The antibodies produced are very specific and neutralize only the antigen which stimulated the production of the antibody. Therefore antibodies or immunizations against one disease are not effective against another.

It takes two to three weeks for an animal to build up a sufficient number of antibodies to overcome a disease once it has been exposed. Because of this long period, it is not possible to immunize an animal after it has been exposed in order to prevent disease. However, pre-exposure immunization is effective. This may be accomplished by injection of killed disease-producing bacteria or by the use of live bacteria which have been altered in the laboratory so they are not pathogenic. Vaccines prepared from bacteria are called bacterins. Toxins may be rendered non-toxic and then used for immunization. These are known as toxoids. Instead of bacteria, viruses may be used in vaccines to immunize against virus diseases.

To produce antibodies, vaccines are normally given in two or three doses, about one week apart. This will stimulate the animal to produce a high concentration of antibodies and protect it from disease.

Some practical consideration in regard to cattle are now examined.

In the cow, there is no passage of antibodies from the dam to the fetus. Consequently, when the calf is born, the only protective system it has is the white blood cells. Thus the new born calf is very susceptible to disease. The cow, however, passes antibodies in the colostrum milk up to about 36 hours after calving. As the calf nurses, it drinks the antibody laden milk. These antibodies now pass through the intestines into the blood of the calf and will protect it. Thus antibodies are passed from the cow to the calf and this type of immunity is known as passive immunity. The presence of antibodies from the cow tends to suppress the active antibody building mechanism in the calf. Therefore immunizing the very young animal is not done because it will not respond to the injection of antigens. However, by the time the animal is three to four months old, most of the antibodies from the cow have disappeared and the calf is now capable of making its own antibodies. Immunizations are now effective in the calf after this age.

Because it takes about three weeks before enough antibodies are produced to protect the animal, immunizations should be begun at least three weeks before possible exposure to disease such as in shipping cattle.

Some precautions in handling vaccines include refrigeration of vaccines until used, follow the directions on the package, honor the expiration date on the vaccine, immunize on a schedule as directed by your veterinarian, buy only from a reliable source to insure you are using quality products and discard any unused portions of vaccine which remain in opened bottles.

"ECONOMICS OF IBR-P13 AND PASTEURELLA VACCINATION IN PRECONDITIONING FEEDER CALVES"

by
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THE DOW CHEMICAL COMPANY,
DALLAS, TEXAS
June 20, 1968

SUMMARY

Two hundred twenty-seven (227) head of calves were purchased and preconditioned for 26 days on a ranch near Muleshoe, Texas. They were then trucked to a public stockyards and held there for three days to expose them to transient cattle. After this exposure they were trucked to the finishing feedyard at Stratford, Texas. The principal group of calves, which had been vaccinated for IBR-PI3 and given Pasteurella bacterin at weaning and a second injection of Pasteurella 26 days later, performed better than the unvaccinated controls.

The net profit for the vaccinates was $7.73 greater than for the non-vaccinates.

INTRODUCTION

Two hundred and twenty-seven (227) head of Hereford calves (average weight 536.9 pounds) were purchased from the Birdwell Ranch near Muleshoe, Texas. This is a 50,000 acre ranch.

The calves were separated from their mothers on October 19, 1967, ear tagged and rib branded. Every other calf was vaccinated with 2cc dose of a combination of Infectious Bovine Rhinotracheitis and Parainfluenza-3 Vaccine, and a dose of Pasteurella bacterin, both manufactured by The Dow Chemical Company. There were 114 vaccinated head of principals and 113 head of controls. A blood sample was drawn from every fourth calf vaccinated (principal) and every 4th control calf. Serological studies were made from these samples to determine the antibody status of the herd at the time of vaccination.

The calves were all dropped between January 15 and February 15, 1967 and were, therefore, eight or nine months of age at the time of vaccination.

After being worked the calves were moved to a weaning trap to be held for 26 days. During this period they were fed two pounds of 20% protein range cubes and five pounds of hay daily. The pasture was very dry during the holding period.

On November 14, 1967 the calves were moved back from the weaning trap to the working chute and weighed again. The principals were given a second 2cc dose of the Pasteurella bacterin, 5cc of Clostridium Chauvei-Septicum Bacterin (Bio. 608) implanted with one dose of Rapigain* (contains 120 mg. testosterone and 24 mg. diethylstilbesterol per dose—0.42cc), and one million units of Vitamin A.D.E. Injectable.

The controls were given Bio. 608, implanted with Rapigain and given one million units of Vitamin A.D.E. Injectable.

The calves were then loaded into trucks and moved 20 miles to a public stockyard in Clovis, New Mexico for exposure to transient cattle from many sources. They were held in the stockyards for three days and then hauled 175 miles to Stratford, Feedyards, Inc., a commercial feedlot located near Stratford, Texas.

While in the weaning trap, three principals and two controls sickened and were treated for pneumonia by a local veterinarian. All five treated calves made uneventful recoveries.

The calves lost an average of 24.9 pounds per head during the 26 days in the weaning trap. (TABLE I) The cost of handling the calves in the weaning trap was $9.00 per head. Additional shrinkage occurred during shipment to Stratford Feedyards via Clovis public stockyards.

When the calves arrived at the feedyard, they were separated into principal and control groups for the first time, weighed in by group and treated for lice.

They were started on a 75% silage-25% concentrate ration for the first three days, then shifted to a ration containing 17% steam-flaked milo plus alfalfa, rice hulls, animal fat, and 72.5% silage for the next four weeks. The following two weeks they were on a ration containing 40% silage and 35% milo plus animal fat, protein supplement and molasses. The finishing ration contained 25% silage and 75% concentrate consisting of steam-flaked milo, animal fat, protein concentrate, alfalfa pellets and rice hulls.

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*TRADEMARK OF E. R. SQUIBB AND SONS, NEW YORK

The morbidity among the calves was less than half as much for the principals as for the controls (1.75% vs. 3.57%). One death occurred among the controls and none among the principals during the feeding period. (TABLE II)

Calves were weighed at 47, 90, 120, 151 and 192 days after arrival in the feedlot. The average daily gain, cost/pound gain, and feed conversion (TABLE III) were based on average weights out of the weaning trap—less 512 pounds (one calf salvaged) from the control group. With five weighings during the feeding period, one can be sure that performance parameters of all calves was adversely affected when compared to normal feeding practices. Even so, performance of both groups was excellent. The principals started ahead and finished ahead according to all parameters of the feedlot's records of performance.

TABLE IV is a summary of costs, income and profits. Principals had a higher feed cost ($151.68) but gained faster at less cost and thus returned $7.73 more net profit per head purchased than the control cattle.

TABLE I

BIRDWELL RANCH
MULESHOE, TEXAS

	LBS.		AVE.
10/19/67:			
PURCHASE WEIGHT—227 HEAD (LESS 3% SHRINK)	121,880	=	5.36.9
11/15/67:			
WEIGHT AFTER 26 DAYS IN WEANING TRAP	116,224	=	512.0
TOTAL SHRINK DURING WEANING PERIOD	5,656		
POUND/HEAD SHRINK		=	24.9
PERCENT SHRINK		=	04.143

TABLE II

WEIGHT SHRINKAGE OF CATTLE DUE TO HANDLING AND SHIPMENT

DATE	NO. OF CATTLE	WEIGHT LBS./TOTAL NO. CATTLE	WEIGHT LBS./HEAD	% SHRINK	REMARKS
A. AMOUNT OF SHRINK DURING WEANING					
10/19/67	227	121,888	536.9	—	PURCHASE WEIGHT
11/15/67	227	116,224	512	—	
SHRINKAGE:		5,664	24.9	4.6	
B. AMOUNT OF SHRINK DURING STAY AT PUBLIC STOCKYARD					
11/15/67	226	115,712	512		1 CALF LOST DUE TO INJURY
11/19/67	226	108,725	481		
SHRINKAGE:		6,987	31	6.0	
C. OVERALL SHRINK FROM PURCHASE TO FEEDYARD					
		12,651	55.9	10.4	

TABLE III
HEALTH DATA

	PERCENT MORBIDITY	DIAGNOSIS	DEATHS	HOSPITAL	HOSPITAL COST
PRINCIPALS	1.75%	DIPHTHERIA PNEUMONIA		10	5.00
CONTROLS	3.57%	PNEUMONIA	1	11	5.50

TABLE IV

FEEDLOT PERFORMANCE

* STARTING WT:
PRINCIPALS—514.7/HD AVE
CONTROLS —505.1/HD AVE

	47 days P	47 days C	90 DAYS P	90 DAYS C	120 DAYS P	120 DAYS C	151 DAYS P	151 DAYS C	FINAL 192 DAYS P	FINAL 192 DAYS C
A.D.G.	1.899	1.746	2.494	2.398	2.654	2.570	2.762	2.6228	2.724	2.544
COST/LB GAIN	.1792	.1971	.1606	.1707	.1602	.1666	.1618	.1691	.1750	.1818
AVE. WT.	604.88	591.98	741.7	729.0	836.0	821.0	934.61	908.7	1029.0	1009.5
FEED CONVERSION	8.58:1	9.25:1	7.52:1	7.87:1	7.46:1	7.74:1	7.44:1	7.83:1	7.93:1	8.22:1

* Based on weight out of weaning trap adjusted to compensate for salvaged steer @ 512 lbs.

TABLE V

SUMMARY OF COSTS, INCOME AND PROFITS

	114 PRINCIPALS	112 CONTROLS
CATTLE COST	$17,596.90	$17,288.18
PRECONDITIONING COST	1,026.00	1,017.00
TRUCKING	327.87	321.53
PROCESSING COST	226.12	220.46
HAY COST	11.30	12.50
VETERINARY MEDICINE	64.95	48.64
TOTAL FEED COST	9,959.68	9,808.00
TOTAL COSTS	$29,212.82	$28,716.31
SELLING PRICE	31,676.40	30,255.39
NET PROFIT PER LOT	$ 2,463.58	$ 1,569.08
NET PROFIT PER HEAD	$ 21.61	$ 13.88

Net Profit Per Head—Principals Vs. Controls = (+) $7.73

TABLE VI

OVERALL SUMMARY

LOT NO.	TREATMENT	HEAD IN	HEAD OUT	AVERAGE DAILY GAIN	COST/LB. GAIN	PROFIT/ HEAD	FEED/GAIN RATIO	DEATHS	SALVAGE
G-1	PRINCIPALS	114	114	2.724	.1750	21.61	7.93:1	0	0
G-2	CONTROLS	113	111	2.544	.1818	13.74	8.22:1	1	1

"IMMUNIZATION AND TREATMENT PROCEDURES"

E. L. Drake
Ext. Veterinarian
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The great *economic loss* to the feedlot industry from respiratory diseases has aroused an interest in formulating a program to *minimize these losses*. The word "preconditioning" was coined to mean a procedure to *reduce death loss during* the transition from the ranch *to the feedlot*. The term has *different meanings* to different people and this has aroused some friction between the components of the industry. I feel that a management program, call *it what you wish*, must be a herd health program that will be beneficial to the entire *industry*. Its merit must be measured in terms of *disease control* and *economics*.

I feel that included in this program must be *recommendations backed* by *research findings* which will increase *unit production* for the *entire industry*. Isn't this the name of the game? Let's formulate a program of management which includes *nutrition, management practices and immunization programs* that will *minimize losses* from infertility, abortions, neonatal calf disease, losses from dehorning and castration, losses from disease at weaning and loss throughout the feeding period. This is a program that the *producer* and the *feedlot operator* can *benefit from. Such management* procedures as early weaning of calves, which is paying off in many of our range operations, can lend itself very well to an immunization program, as *maternal* antibody interference to a vaccination is a necessary consideration. The immunity seems to be transferred to the calf at about the same antibody titre level as occurs in the dam. Why not immunize the cow so as to assure an immunity to the calf? Then vaccinate the calf at a time when there is incomplete protection to the calf from the colostral passive antibodies and at a level where it is the least likely to interfere with the calf's response to the vaccinal antigenicity. For practical purposes in a given calf crop it would appear to be at or near normal weaning time. It should be kept in mind, however, that some calves *lose* the *colostral immunity* at an *earlier* age due to a lower *level* of *immunity* in the dam and biological variations in calves, so vaccination does not always mean solid immunity.

A second injection at shipping time or at arrival to the feeding place is a necessity to insure a high incidence of immunity. At least two to three weeks should be allowed after vaccination before calves should be exposed to field viruses to allow sufficient time for a good functional immunity to be developed.

In the case of imminent field exposure before weaning, all calves should be revaccinated at weaning time. It should be made clear that vaccines are designed to prevent the diseases and not for treatment of the disease. If some of the cattle are in a quiescent or incubative stage of the disease then one may expect some of the vaccinates to develop the disease after vaccination.

What are the vaccines that one should use?

1. Respiratory diseases.
   PI_3, pasteurella, IBR, BVD. Cost of immunization \$1.50-\$1.80 per animal.
2. Blackleg.
   Malignant edema vaccine including Cl Novi and Sardellei.
3. Tetanus toxoid in certain areas.
4. Leptospirosis, anthrax, redwater. Anaplasmoses

From the feeder's point of view, here are some reasons why calves don't perform.

1. Chronic calf disease.
2. Calves that have not learned to eat and drink before shipment.
3. Feeding of small, younger stock that have little disease immunity and require more tender, loving care.
4. Combining cattle from many sources.
5. Poor management and husbandry practices.
6. Movement through several commission companies before reaching final destination.
7. Rough handling and sorting.
8. Going without feed or water for as short a time as 24 hours upsets a calf's metabolism and at 48 hours reduces fermentation to almost zero.
9. ???????????

I feel that an animal health program should begin with the cow—as the name of the game is maximum beef production per animal unit.

1. Each brood cow should be immunized for IBR, lepto and perhaps BVD annually when the cow is in an unpregnant state.
2. If calf scours are a problem, the cow may be immunized against clostridium, perfringens, interitis and autogenous bacterin may be of value. This may be done 60-90 days before calving.
3. A cow should be in breeding condition. We have found that in Nevada it takes about 40-50 days of satisfactory nutrition to repare the reproductive tract for the reproductive process. A five year old cow doesn't require additional nutrients that a heifer requires.
4. If A.I., experienced A.I. inseminators with known viable semen; if natural breeding, fertile bulls. Select bulls with proven progeny.
5. These cows should be pregnancy checked 60-90 days post breeding and all non-pregnant cows treated for whatever pathology can be determined and kept in a small breeding pasture and an intensified effort made to get them bred. Any non-breedable cows should be disposed of.
6. Any aborted fetuses and other samples from aborting

cows should be sent to a laboratory for diagnosis. Any findings should be followed with promt medical attention.

7. Newly acquired cattle should originate from known, healthy herds. They should be held in isolation for a period of 30 days and vaccinated against any pathogens that are prevalent in your area before being turned in with the main herd.

Management of Calves

1. At approximately 2-3 months of age, castrate, dehorn and give blackleg and malignant edema vaccine.
   a. Dehorn with appropriate size spoon and stop all blood.
   b. Castrate with knife and emasculate to stop all blood. If rubber bands are used, it should be done before the calf is 3 weeks old.
   c. If in a tetanus area, give tatanus toxoid at this time.
2. At approximately 4 months of age vaccinate for leptospirosis, redwater and anthrax if prevalent in your area.
3. At 5-6 months of age give IBR, PI_3 and BVD-MD and treat for external and internal parasites when indicated.
4. Pre-wean calves 30 days prior to shipment and teach them to eat and drink from tanks and bunks.
5. Give a booster injection for respiratory diseases at this time or when they arrive at the feedlot.
6. Keep dust down in corrals when weaning by spraying or by use of surfaced corrals.
7. If cattle are to be shipped long distances, I think that long acting antibiotics with cortisones may be indicated. I would like to do some field trials with steroids and see what adverse reactions are to over dosage. Remember, these therapeutic levels only last 36 hours but residues persist for 80 days.

At the feedlot very special attention must be exercised at this time to make a smooth, stress free adjustment as 75-85% of the disease losses occur at this time. If weaning immunization and surgical procedures are done prior to arrival, it certainly eliminates some stress factors.

The management procedure at the feedlot needs to be researched much more to be really valid.

1. If calves have not been preconditioned, I like to immunize these calves and give vitamin A, D and E about 2-3 days after they come into the lot instead of 2 weeks later as many recommend. Proper care of vaccine is important as well as administration.
2. I believe that holding calves off water and filling bunk with grass hay and a pound or two of mill feed is very important. One half pound of dehydrated alfalfa is very good. Three pounds supplement, 50% high energy feed.
3. Narrow pens, 50 feet wide, with 100% feed bunks helps to get them started.
4. Spraying and worming should be done to the calves about 21 days after arrival.
5. Any sick calves should be removed, isolated and treated at least 3 days or until recovered. Pens should be walked twice daily at least.
6. Heifers should be pregnancy examined and aborted about 30 days after arrival. This will depend on the background of the cattle.
7. If 10% of calves are running temperature of 105° or better, antibiotics are indicated to all cattle either by injection, in water or in the feed. Make sure that you don't use drugs that are antagonistic.

Feedlot facilities for calves.

1. Provide adequate feed bunk area 8″ deep for calves and 8-10″ for older cattle. Bunks should be on high side of corral not facing prevailing wind, bunks about 24-30 inches high.
   When handfeeding calves they should have 18-24″ space; older cattle 20-30″.
2. Allow one linear foot of open water tank space for each 10 cattle or one automatic watering bowel for each 25 cattle. This should be palatable water.
3. A satisfactory water temperature range in winter is 40-45° F., in summer 60-80° F.
4. Provide the following lot space:
   a. Paved lots 50-100 square feet per head.
   b. Dirt lots 150-200 square feet per head.
5. Provide a paved area of at least 10 feet around waterers, feed bunks and roughage racks.
6. Allow slope of ¼-½ inch per foot in paved lots and ½ inch or more in dirt lots.
7. Provide housing as economical as possible.
   a. Tree wind break)
   b. Hills as locations) 40-50 square feet for large cattle; 20-30 square feet for calves.
   c. Board fences)
8. Provide artificial shade in hot climate 15-35 square feet per animal.
9. Keep corrals dry.
10. Build fences at least 60 inches high of most economical type of material.
11. Provide devices for external parasite control.
12. Provide facilities for restraining and handling individual animals to minimize production losses and prevent injury to personnel.
13. There should be facilities for isolating new cattle and a series of pens for sick cattle.

General Management

1. Provide iodized salt free choice.
2. To reduce waste and improve feed utilization, grind, roll, flake or crack all grain which is fed.
3. Watch the droppings as an indicator of the condition of the digestive tract.

Treatment of sick cattle

1. Effective treatment depends on an accurate diagnosis and must be confirmed by laboratory work at autopsy after death.
2. Treatment must be directed at stopping infection of virus, bacteria, fungi and mycoplasma and combating ketosis, dehydration and malnutrition.
3. Early detection and isolation of sick animals with adequate facilities for restraint. Those that develop fibrinous pneumonia never completely recover.
4. Immediate treatment with the specific drug of choice administered by the proper route for the specific condi-

tion of the animal and in proper dosage for an adequate length of time for complete recovery.

5. Use of oxygen is indicated in severe cases.
6. Use care in combining drugs; assure that they are not antagonistic.
7. Aseptsis of equipment (change needle every pen).
8. A complete record system with positive identificatior drugs used and response.
9. Disposal of chronics.

"CONDITIONING OF BEEF CALVES[1]"

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Recently, livestock feeders, ranchers, veterinarians and animal scientists have been discussing the merits of conditioning cattle prior to shipment from the producer. Various management programs have been proposed to help cattle, particularly calves, withstand the changes in environment, stress of shipping, new feeding programs, and exposure to disease organisms. This study was undertaken to investigate the influence of management programs on the feedlot adaptation of weaner calves.

Materials and Methods

Twenty-four Hereford steer calves were vaccinated with bovine rhinotracheitis-parainfluenza$_3$ vaccine[2] on October 19, 1967. The calves remained with their dams on native range until they were weaned on November 9, 1967. On this date the 24 vaccinated calves and 51 additional steer calves were corralled, weaned and trucked 60 miles to the Powell substation. All calves were treated for grubs with Neguvon, vaccinated for blackleg, ear tagged and allotted at random to the following 28-day conditioning treatments: 1) controls, 2) 350 mg./hd./day of aureomycin, 3) 350 mg./hd./day of sulfamethazine, 4) 350 mg./hd./day of aureomycin and 350 mg./hd./day of sulfamethazine and 5) those previously vaccinated on October 19th. The initial weights were taken on Nov. 10, after an overnight stand with access to brome hay but without water after 8 P.M. During the 28-day conditioning period the calves were fed corn silage, brome hay and 1 lb./hd/day of a 22% liquid protein supplement. Aureomycin and/or sulfamethazine were mixed with ground corn so that 0.15 lb./hd/day provided the desired dose. This was fed on top of the corn silage once daily. Final weights were taken after an overnight shrink at the end of the 28-day conditioning period. The calves were reassigned according to conditioning treatments to winter rations consisting of alfalfa hay, corn silage, two or four pounds of barley, and one of three different liquid protein supplements. The weight gains of the calves during the winter period were calculated for each conditioning treatment.

Results and Discussion

The calves weighed 410 lb. at the ranch. They lost 19 lb. in transit to the Powell substation. The animal gains during the conditioning period are given in table 1. The in-transit weight losses were regained in approximately two weeks. The calves fed sulfamethazine alone or in combination with aureomycin gained significantly more weight ($P < .05$) during the 28-day conditioning period than calves on the other treatments. Feed efficiency was improved by feeding sulfamethazine alone or in combination with aureomycin. The subsequent gains on the experimental winter rations were not significantly influenced by the conditioning treatments (table 1). The com-

[1]This study was financed in part by a grant-in-aid from American Cyanamid Company.
[2]Manufactured by Ft. Dodge Laboratories

Table 1.

Animal Performance—Trial 1

	Controls	350 mg. Aureo.	350 mg. Sulfa	350 mg. Aureo. 350 mg. Sulfa	Vaccinated
Conditioning period					
No. of calves	15	12	12	12	24
Av. initial wt.—lb.	404	393	389	378	387
Av. final wt.—lb.	440	429	435	426	422
Av. 28-day gain —lb.[1]	36[b]	36[b]	46[a]	48[a]	35[b]
Av. daily gain—lb.	1.29	1.29	1.65	1.72	1.24
Av. daily ration—lb.					
Corn silage	9.4	9.4	9.6	9.4	9.4
Brome hay	5.6	5.6	5.7	5.8	5.4
22% liquid protein	1.0	1.0	1.0	1.0	1.0
Lb. air-dry feed/ lb. gain	7.5	7.5	6.0	5.8	8.8
Winter Period Gains—lb.					
1st 28 days	49	41	44	37	45
2nd 28 days	52	54	56	50	57
1st 56 days	101	95	100	88	102
144 days	267	255	265	234	259
Combined Conditioning and Winter Period Gains—lb.					
1st 28 days[1]	36[b]	36[b]	46[a]	48[a]	35[b]
1st 56 days	85	77	90	86	80
1st 84 days	137	131	147	136	137
172 days	303	291	311	281	293

[1] Means with different superscripts are significantly different ($P < .05$)

bined conditioning and winter gains were not significantly different after 56 days on test (including the 1st 28 days of the conditioning period).

Only one of the control calves and two of the vaccinated calves were treated with combiotic for shipping fever. None of the calves treated with aureomycin, sulfamethazine or the combination needed to be treated for shipping fever. One of the sulfa-fed steers developed clinical symptoms of urinary calculi and one calf which had received the combination of aureomycin and sulfamethazine died from perfringens 56 days following the conditioning period. These calves performed very well evidenced by their good gains and lack of sickness.

Beeson *et al.* (1968) reported that feeding 350 mg. aureomycin per animal daily during a 28-day conditioning period significantly increased daily gain in newly arrived calves in two of three experiments. Feeding a combination of 350 mg. aureomycin and 350 mg. sulfamethazine significantly increased gains over the 350 mg. aureomycin treatment in one of three experiments. Feeding 350 mg. sulfamethazine alone did not significantly influence calf gains. The combination of the two drugs resulted in the most efficient gains. Using aureomycin or sulfamethazine alone or in combination reduced the incidence of the shipping fever syndrome.

Summary

Twenty-four steer calves were vaccinated with bovine rhinotracheitis-parainfluenza$_3$ three weeks before weaning. An additional 51 steer calves were fed 350 mg. aureomycin, 350 mg. sulfamethazine, or a combination of 350 mg. aureomycin and 350 mg. sulfamethazine per day for 28 days after arrival at the feedlot. Calves fed sulfa or a combination of sulfa and aureomycin gained significantly faster ($P < .05$) during the 28-day conditioning period than the control, aureomycin-fed, or vaccinated calves. The calves regained their in-transit weight losses in two weeks. The subsequent gains on experimental winter rations or the combined conditioning and winter gains were not significantly influenced by the previous conditioning treatments. There was no sickness in the aureomycin, sulfa, or combination-treated groups. One control calf and two vaccinated calves were treated for shipping fever.

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"SHRINK AND OTHER MANAGEMENT FACTORS ASSOCIATED WITH THE SHIPMENT OF CATTLE"

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Thank you, Mr. Chairman:

One of the justifications and reasons for this conference was to explain the need for research of the several factors that make up a pre-conditioning program. This is a worthy objective. At the first conference last fall in Stillwater I suggested that this was one of our most pressing needs along with the need for a uniform set of meaningful terms and definitions. These are still pressing needs. When factual information is obtained through properly designed and well conducted research programs it can then be put to good use in an educational program. Until such information is obtained it will be difficult to implement a reliable educational program. Too much of the educational program to date has had a promotional bend and might be described somewhat in this manner; "I have an idea, why don't you try it and see if it is any good."

The livestock people in Iowa are keenly interested in all aspects of the beef cattle industry. One of the problems that is recognized as being of great importance is shrink. It should be recognized that shrink is only one phase of the overall program of management of cattle in and near the shipping period when they are transferred as feeder cattle to the feedlot area. Nevertheless, shrink, as we commonly refer to it, does constitute an extremely important economic phase of the cattle industry. Not only is there a loss in weight which requires time and expense to recover but the manifestations of shrink are such that the lowered natural defense mechanisms of the body renders the animal more susceptible to the various diseases to which they may be exposed during shipment.

TABLE I

SIGNIFICANCE OF SHRINK TO THE CATTLE FEEDER

Buy			
800 lb. Yearling Feeder Steer	9%	Shrink . . .	72 lbs.
Sell			
1088 lb. Slaughter Steer	4.5%	Shrink . . .	49 lbs.
TOTAL SHRINK			121 lbs.
Assume			
Average Daily Gain of 3.0 lbs. During 120 Feeding Period			
121 lbs. lost to shrink / 3.0 lbs. A.D.G. = 40 Days to Regain Shrink			

To indicate and perhaps even dramatize the significance of shrink to the cattle feeder we can examine Table I where I have used as an example the purchase of an 800 lb. yearling feeder steer and used a figure of 9% shrink during in-shipment which results in a total weight loss of 72 lbs. The animal arrives in good physical condition and shows no clinical indications of sickness and subsequently does well in the feedlot. If we assume he will gain 3 lbs. daily and he is fed for 120 days, he should weigh about 1,088 lbs. During shipment to slaughter let us assume he will shrink another 4½% (49 lbs.). If this 49 lbs. is added to the 72 lbs. lost during in-shipment, we have a total shrink of 121 lbs. At an average daily gain of 3 lbs. this will require approximately 40 days to regain the weight lost to shrink. In other words, about a third of the time that the cattle feeder owns this animal he is feeding him to recover shrink. (40 out of 120 days.) As I indicated this may be slightly dramatized but you can take any figure that you want, 500 lbs., 600 lbs., and apply the appropriate shrinkage factors to it and you will find that the cattle feeder is spending a large proportion of the time that he owns cattle regaining shrink lost during shipment.

In the past we have more or less assumed that shrink was an unavoidable part of the business and admittedly we do expect some shrink but this is no excuse for not knowing the magnitude of shrink to expect and the economic role it plays in the cattle industry—and it does affect the whole industry. Furthermore, the greater our understanding of shrink the greater are our chances of finding ways of controlling it.

Shrink as used in this discussion means a loss in weight. We express it on a weight basis because that is about the only trait on which an accurate measurement can be obtained. We cannot with any degree of accuracy say that this animal is 50% or 70% sick or that he has lost 30% of his disease resistance because such factors cannot be measured accurately. However, we feel there is a fairly high correlation between weight loss and illness and the disease resistant factors. Therefore, we will continue to express shrink in terms of weight loss rather than in other terms which we are not yet capable of measuring.

Some of you may feel that the 9% shrink used in the example in Table I is too high. Data collected at Iowa State over a period of years indicates that it is not out of the normal range. In fact it is approximately what we might expect to find. As an example, refer to Table II where there are data collected on a group of 114 steers purchased in North Central Nebraska by a reputable order buying concern. At the time of delivery on October 14, 1961, the average pay weight was 731 lbs. They were loaded about mid morning and hauled by truck approxi-

[1]Presented at the Conference on Pre-Conditioning Cattle. University of Wyoming, Laramie, Wyoming, June 26-28, 1968.

mately 350 miles to the Allee Experimental Farm in Northwest Iowa where they would be used on a shelter-paving-feedlot management research project. Upon arrival at the Allee Farm these steers averaged 638 lbs. which represents a weight loss of 93 lbs. (12.7%) from pay weight. This is an excessive weight loss for a haul of only 350 miles. These cattle were put on a self-feeder where they had access to a complete mixed ration containing 65 percent ground corn cobs.

TABLE II

DATA ON SHRINK AND PURCHASE PRICE FOR YEARLING STEERS (FALL 1961)

Date	Item	Per Head	Per CWT.
10-14	114 Steers	....	....
	Weight Bought	731	....
	Shrink (est.)	93	12.7
	Weight Delivered	638	....
	Steer Cost	$175.44	$24.00
	Other Cost	$ 6.12	$ .84 ($24.84)
	Delivered Costs	$181.56 (Est.)	$28.46[a]
11-13	Weight	734	....
	Feed/Day	20.5	2.8
	Feed Cost	$ 9.55	$ 9.90[b]
	Current Cost	$191.11	$26.40

[a]Cost per hundred weight delivered
[b]Feed cost per hundred weight gained from delivery weight

During the next 30 days they consumed an average of 20.5 lbs. of feed per head per day and during that 30-day period the feed cost per steer averaged $9.55. On November 13 (30 days following delivery) these cattle averaged 734 lbs., 3 lbs. above the pay weight of 731 lbs. on October 14. Thus, approximately 30 days was required for these steers to regain the shipping loss. None of these cattle showed clinical indications of illness during this 30-day period.

Despite the large weight loss and our concern about it, of even greater concern is the effect that such a weight loss has on the purchase price. You will note that the steer cost per 100 lbs. was $24. Other costs such as trucking and commission added an additional .84¢ resulting in a so-called "laid-in" price of $24.84. Each of these steers was delivered at a total average cost of $181.56 and for that we received 638 lbs. average weight per steer. Thus, the actual cost per hundred pounds delivered was $28.46 rather than the $24.84 which is the figure commonly quoted and used in the cattle trade. I think we need to be more realistic as to what cattle are actually costing us when they arrive at the feedlot rather than quoting a so-called "Laid-in" price based on the purchase weight of the steer at some distant point. If we continue to examine the data on this particular group of steers we find that at the end of the first 30 days or on November 13 they weighed 734 lbs. This is only three pounds per steer more than their purchase weight. During this 30-day initial period the cattle consumed 20.5 lbs. of feed per head per day and the total cost of feed during the 30-day period was $9.55 per steer thus increasing our current cost to $191.11 for cattle weighing 734 lbs. which results in an average cost per hundred weight 30 days after delivery of $26.40. This is still $1.56 a hundred above the so-called original "laid-in" price of $24.84. It is important to point out that at no time during this initial 30-day period did we note any indications of illness in any of the steers nor did any of them show a need for medication of any kind. Therefore, this excessive loss in weight was not considered to be due to a disease manifestation.

That first group of cattle was purchased by an order buyer and in view of our experience it would have been prudent to suggest that a new order buyer be selected. However, we placed a second order with the same organization for delivery

TABLE III

DATA ON SHRINK AND PURCHASE PRICE FOR YEARLING STEERS (SPRING 1962)

Date	Item	Per Head	Per CWT.
4-19	120 Steers	....	....
	Weight Bought	702	....
	Shrink (Est.)	28	4.0
	Weight Delivered	674	....
	Steer Cost	$177.54	$25.30
	Other Cost	$ 9.02	$ 1.28 ($26.58)
	Delivered	$186.56	$27.68[a]
4-23	Weight	702	....
	Feed/Day	14.9	2.16
	Feed Cost	$ .82	$ .03[b]
	Current Cost	187.38	$26.69

[a]Cost per hundred weight delivered
[b]Feed cost per hundred weight gained from delivery weight

in the spring of 1962. On April 19, 1962, 120 steers originating on wheat pasture near Salina, Kansas, were received at an average purchase weight of 702 lbs. (Tabke III) They were shipped by truck approximately 550 miles to the Allee Experimental Farm where they arrived weighing 674 lbs. This is a loss in weight of 28 lbs. or an average of 4%. The total cost per steer was $186.56 which was an average per hundred weight of $27.68 which is only a $1.10 per hundred weight above the so-called "laid-in" price of $26.58. If we follow the weight pattern of these steers following arrival, we note that on April 23, four days following delivery, they weighed 702 lbs. and they had consumed 14.9 lbs. of feed per head per day resulting in a total cost during the four day period of .82¢ per steer for feed while they were regaining the shrink lost during in-shipment. On the fourth day after arrival, the cost per hundred pounds was $26.69 which is only .11¢ higher than the so-called "laid-in" price of $26.58. This, of course, is a low rate of shrink in cattle of this size as contrasted to a high rate of shrink on the cattle shown in Table 2. In this second group of cattle you are seeing the lowest losses due to shrink that we have observed over the six year period and you are seeing the highest shrink values in the first group that has been observed during this same six year period. (4% in one case and 12.7% in the other case.) The amount of shrink in the other shipments has averaged between these two extremes.

TABLE IV

SUMMARY OF DATA ON SHRINK AND PURCHASE PRICE FOR YEARLINGS AND CALVES (3 YEAR PERIOD)

	Average Per Head	Average Per CWT.
970 Yearlings[1]		
Weight bought	676	....
Shrink	65	9.62
Weight delivered	611	....
Animal cost	$149.13	$22.06
Other cost (feed, truck.)	8.22	1.22 ($23.28)[a]
Total Costs	$157.35	$25.75[b]
335 Calves[2]		
Weight bought	506	....
Shrink	48	9.49
Weight delivered	458	....
Animal costs	$103.19	$20.39
Other costs (feed, truck.)	7.03	1.39 ($21.78)
Total Costs	$110.22	$24.07[b]

[1] Yearlings were purchased from the fall of 1961 through the fall of 1964.
[2] Calves were purchased in the fall of 1963 and spring and fall of 1964.
[a] Total cost per hundred pounds based on purchase weight.
[b] Total cost per hundred pounds based on delivered weight.

In Table IV we have summarized data on a total of 970 yearlings representing ten shipments of cattle ranging in number from 20 head to 200 animals per shipment. The average purchase weight of the yearlings was 676 lbs. The average shrink was 65 lbs. per steer during in-shipment (9.62%). In the lower part of the table the data on 335 calves represent about six separate shipments. The average purchase weight was 506 lbs. and the shrink was 48 lbs. (9.49%) during in-shipment. The shrink for calves was not appreciably different from the shrink for yearlings. We found that regardless of the size and age, we could expect approximately 9.5% shrink during in-shipment. The data in this table represent purchases made by five different order buying organizations that purchased cattle for us in seven different states. The cattle were shipped an average of 660 miles from the point of purchase to the point of delivery and lost about 9½% of their pay weight by the time they arrived at the farm. In the case of yearlings, the shrink increased the cost of the pounds delivered from $23.28 to $25.75 per hundred whereas the cost of calves was increased from $21.78 to $24.07 which is $2.29 increased cost per hundred weight due to shrink alone.

We believe that the cattle purchased and the methods of handling the cattle as reported here are fairly accurate representations of the general kind and type of feeder cattle that came into the State of Iowa during that four year period.

Having learned the magnitude we might expect in terms of percent shrink, we became concerned about learning more regarding the causes of shrink. For example, what portion of the animal actually loses the most weight during in-shipment? What other traits can be measured that would give us greater insight into this source of rather large economic losses in the Iowa livestock industry? In an attempt to obtain greater insight into the problem, arrangements were made with the Black Estate Ranch, Granbury, Texas, (40 miles west of Ft. Worth) to follow several shipments of feeder cattle in considerable detail.

Our experimental design arranged for us to arrive at the ranch several days prior to the actual date of shipment. Upon arrival at the ranch the cattle were driven very gently and in small groups into a handling facility in the central portion of the ranch. The animals were handled quietly and with a minimum of excitement. Each steer was run through a chute individually for weighing. At that time a numbered tag was affixed to their back for individual identification. They were immediately released back to pasture. In most cases an animal was not off pasture for longer than two hours and in many instances it was only a matter of a few minutes from the time they came into the lot until they were back on pasture. The weight thus obtained is referred to as the pasture weight. From two to five days following this activity we returned to the ranch, rounded up the cattle and shipped them just as if we had never been to the ranch previously. At that time we handled the cattle under two different procedures.

Procedure I provided for driving the cattle into the corral, loading onto a large truck for direct transport to Iowa. The pay weight was obtained by weighing the truck before and after loading and reducing the net load by 1.5%. Procedure II provided for the rancher to deliver the cattle to a weighing and loading facility 15 miles from the ranch. The cattle were loaded onto their trucks at the ranch, hauled about 15 miles to the delivery point, unloaded, sorted into groups of ten or twelve head for weighing and then loaded on trucks that would haul them to Iowa.

TABLE V

COMPARISON OF TWO PROCEDURES FOR SHIPPING YEARLING STEERS (SPRING 1965)

	Pasture Wt. 4-13-65	Pay Wt. 4-15-65	Arrival 4-16-65	Shrink From Past. Wt.	Shrink From Pay Wt.
Procedure I[a] 55 head	609	591	551	9.52	6.67
Procedure II[b] 135 head	631	617	559	11.41	9.34

[a] Loaded at ranch and purchase weight obtained "on-truck".
[b] Purchase weight obtained "on-foot" at central weighing and loading point.

Procedure II resulted in the cattle being handled four or five times prior to obtaining the "on foot" weight as the basis for payment. You may note in Table V the 55 head (one load) of cattle handled under Procedure I weighed 609 lbs. on pasture on April 13, 1965. Two days later on April 15 the pay weight was 591 lbs. (Procedure I pay weight was the weight on truck reduced by 1.5%). The arrival weight in Iowa was 551 lbs. or 9.52% less than the pasture weight of April 13 and 6.67% less than the pay weight of April 15. Cattle handled under Procedure II weighed 631 lbs. on April 13 and the "on foot" weight taken after the cattle were delivered into the loading facility by the rancher was 617 lbs. The arrival weight in Iowa was 559 lbs. The shrink from the pasture weight for Procedure II was 11.41% and the shrink from pay weight was 9.34%. Clearly, the cattle that were handled several times prior to obtaining the pay weight (Procedure II) suffered a greater shrink during shipment than did Procedure I cattle. However, in the case of Procedure I cattle, keep in mind that the actual weight on truck was reduced by 1.5% to determine the pay weight. But if the 1.5% were added to the 6.67% (8.17%) there was less weight loss for Procedure I cattle than for Procedure II cattle. Admittedly, this was opposite to the expected trend we had expected when we designed and initiated this series of studies.

In the fall of 1965 the same procedure as previously described was followed on four loads of cattle. Two loads were handled according to Procedure I and two loads according to Procedure II. In Table VI you can note that the shrink from pay weight for Procedure I was 7.63% whereas Procedure II had 8.4% shrink.

TABLE VI

COMPARISON OF TWO PROCEDURES FOR SHIPPING YEARLING STEERS (FALL 1965)

	Pasture Wt. 10-21-65	Pay Wt. 10-25-65	Arrival 10-26-65	Shrink From Past. Wt.	Shrink From Pay Wt.
Procedure I					
116 Head	577	577	533	7.63	7.63
Procedure II					
117 Head	578	583	534	7.61	8.40

In most cases where cattle are not to be handled prior to loading it is much easier to obtain a pencil shrink as a part of the bargain than it is to obtain pencil shrink where cattle are to be handled several times. Again, in this second set of shipments it can be noted that Procedure II cattle shrunk significantly more than Procedure I cattle. This study was repeated in the spring of 1966 and the results are shown in Table VII. Note that on May 2, 1966, one load of cattle shipped under Procedure I shrunk 7.0% from pay weight

TABLE VII

COMPARISON OF TWO PROCEDURES FOR SHIPPING YEARLING STEERS (SPRING 1966)

	Wt. on Truck	Pay wt.	Arrival Wt.	Shrink From Total Wt.	Shrink From Pay Wt.
Procedure I					
5-2-66 (58)[1]	671	661	615	8.4%	7.0%
5-4-66 (57)	673	663	610	9.4%	8.0%
Procedure II					
5-2-66 (57)	. . .	660	609	. . .	7.6%
5-4-66 (56)	. . .	657	598	. . .	9.1%

[1]Number in parenthesis is total steers hauled per truck.

whereas cattle handled under Procedure II on that same date shrunk 7.6%. If the pencil shrink which had been allowed on the Procedure I shipments is ignored, then the cattle handled under Procedure II shrunk 0.8% less than Procedure I cattle shipped on May 2, 1966. Two days later on May 4 two more loads of cattle were shipped from the same ranch under the same conditions except for the weather. Note that cattle on that date under Procedure I shrunk 8.0% whereas the cattle under Procedure II shrunk 9.1%. The 9.1% was 1.5 percentage points greater shrink on May 4 than on May 2 for cattle under Procedure II. Under Procedure I it was 1.0% greater shrink than had occurred two days prior. The only explanation that we can offer for this discrepancy or difference between the amount of shrink encountered on the two shipping dates is the weather. On May 2 the weather was dreary, overcast, and with intermittent showers. On May 4 the storm had passed, the weather was clear with a bright sun and relatively mild temperatures. These conditions resulted in the cattle being out grazing quite early in the morning. Consequently we suspect that on May 4 the cattle had ample opportunity to obtain a fill of their digestive tract to a much higher degree than was the case on May 2 when the weather was quite disagreeable. If this explanation is correct, weather effects on percent of shrink may be much higher than previously expected.

Summarizing the three seasons of experience with these shipments of feeder cattle, we see the results as shown in Table VIII. Under Procedure I the shrink was 7.48% from pay weight. For Procedure II it was 8.74%. Glancing back through the tables just discussed, you can note that the shrink from pasture weight was always greater under Procedure II than under Procedure I. This is thought to be due to the extra number of times that the cattle were handled under Procedure II as compared to Procedure I. However, it is not clear why the cattle under Procedure II continued to shrink more following the determination of pay weight than cattle under Procedure I. The data suggest at least that once an animal is excited and put under sufficient stress to start the shrinking process, the process is not easy to stop or to reverse direction. Therefore, once shrink starts it is likely to continue for an indefinite period of time and this appears to be the explanation as to why Procedure II cattle tended to shrink more than Procedure I cattle.

TABLE VIII

SUMMARY OF SHIPMENTS OF FEEDER CATTLE DURING 3 SEASONS FROM THE BLACK ESTATE RANCH

	Pay wt.	Arrival wt.	Shrink from Pay Wt.
Procedure I	614	568	7.48
Procedure II	619	565	8.74

We were also interested in learning as much as we could about the source of the weight loss. Consequently, each time cattle were shipped, ten pairs of animals were selected. The two members of each pair was loaded on an Iowa bound truck. Upon arrival in Iowa and after a haul of approximately 850 miles which ranged in time from 22 to 26 hours, they were slaughtered as soon as was practical. This was usually within two to three hours following arrival. In both cases (Texas and Iowa slaughter) the component parts of the animal were weighed. In other words, the weight of the head shanks, hide, digestive tract full, digestive tract empty, lungs heart, trachea and carcass were obtained. The data are outlined in Table IX. Note that the live weight on pasture for those cattle slaughtered in Texas was 609.3 lbs. whereas those slaughtered in Iowa weighed 611.8 lbs. on pasture. The pasture weight is used because this is the only common or stand ard weight between the two groups. The cattle slaughtered in Texas produced 321 lbs. of carcass compared to only 310.7 lbs. of carcass for those slaughtered in Iowa. In other words, there was a ten to eleven pound loss in weight of the carcass during shipment from Texas to Iowa. The hide shrunk from

TABLE IX

SOURCES OF WEIGHT LOSS IN YEARLING FEEDER STEERS DURING SHIPMENT

	Texas Slaughter (Pre-haul) Percent	Lbs.	Iowa Slaughter (Post-haul) Percent	Lbs.	Difference
Live Wt. on pasture		(609.3)		(611.8)	+2.5 ns
% Carcass	52.7	(321.1)	50.8	(310.7)	−1.9 **
% Hide	8.7	(53.1)	8.1	(49.2)	−0.6 **
% Intestines					
full	21.3	(117.2)	18.1	(93.0)	−3.2 **
empty	9.0	(55.1)[1]	8.6	(52.7)[1]	−0.4 ns
% Head	3.7	(22.6)	3.6	(22.1)	−0.1 *
% Shank	2.2	(13.3)	2.1	(12.7)	−0.1 *
% Pluck[2]	2.0	(12.3)	1.8	(10.6)	−0.2 **
% Liver	1.5	(9.0)	1.6	(9.8)	+0.1 **
Total		(549.0)		(508)	

ns: No significant difference
*: Difference significant at 5% level
**: Difference significant at 1% level
[1]Also included as part of "full" value
[2]Included heart, lungs, and trachea

53.1 lbs. down to 49.2 lbs. which is 0.6% loss in weight. The full intestines lost 24.2 lbs. (117.2 lbs. versus 93.0 lbs.). There was some loss in weight of the digestive tract itself (55 lbs. down to 52.7 lbs.). The head shrunk from 22.6 to 22.1 lbs. The shanks from 13.3 to 12.7 lbs. and the pluck from 12.3 down to 10.6 lbs. These values were statistically significant. Contrary to the other components the liver increased in weight from 9 lbs. up to 9.8 lbs. which is almost a 10% increase in weight. Thus all portions of the animals's body with the exception of the liver lost weight during shipment.

It is important to note that when stress conditions are severe enough to cause a non-meaty portion of the body such as the shank and the head to lose weight then we are putting those animals under a rather severe stress situation and one that should be avoided whenever possible. If it cannot be avoided, it should be restricted to the shortest period of time possible. Again, examination of the data in Table IX suggest that shrink is not quite as simple as we have often pictured it. It appears to be much more than just a simple emptying of the digestive tract. In this case it appears that approximately 40% of the loss in weight is from sources other than from the digestive tract. In other words, the head, shanks, hide and carcass account for 40% of the loss in weight under these conditions.

There are several suggestions that can be made to avoid or to reduce shrink in cattle during shipment but paramount among these is to start with fresh cattle and keep them fresh by keeping the time in transit to a minimum. The shipments from the Black Estate Ranch that I have just discussed were on the ranch as fresh cattle and in less than 30 hours they were in the feedlot in Iowa with fresh water, fresh feed, and plenty of room available for them to rest. They were not exposed to other cattle. Except for trucks they were not exposed to facilities where other cattle had been kept and the period of stress was held to a minimum. Also keep in mind that tired cattle will probably prefer rest to feed and/or water. Don't try to "drive" the cattle to the feed bunk or the water trough. They will locate it after they have rested for a few hours.

Moving on to another item which I want to present to you, perhaps as a justification for pre-conditioning but even more so as a testimonial of what can happen—even when everyones intentions are good. The data in Table X were collected and are presented here because they were available and not because of a well designed experiment in a formal research program. The cattle represented in this table were purchased from the same source that had supplied cattle on five or six previous consecutive occasions. The program of handling prior to shipment had been very satisfactory. In fact, the cattle could have been termed pre-conditioned cattle in that they were routinely treated for external parasites, dehorning and castrating those missed as calves. The spray program called for the use of a systemic insecticide. On the particular group of cattle under discussion the spraying program had been modified to omit the systemic insecticide at the recommendation of his animal health consultant. Upon inquiry as to the history on these cattle we were told that they had been sprayed. No further questions were asked and no comments were made. It was our assumption that the systemic insecticide had been included as in the past. On this basis treatment for grubs was not done on this group of yearling steers following arrival in the feed yards.

On September 9, 24 steers were shipped to slaughter. There was no evidence of grub damage. On September 30 another group of 24 steers was shipped, and a report from the packer indicated that eight of these were "bruised". (See Table X) Our procedures and facilities were examined carefully and no explanation was available to explain the bruises.

TABLE X

SUMMARY OF REDUCED VALUE FROM GRUB DAMAGE

Date	Group	Total No.	No. Grubby	Percent No Grubby	Av. Loss Per Head (total no.)	Av. Loss Per Damaged
9-9	1	24	0	0	0	0
9-30	2	24	8	33	$ 1.96	$ 5.86
10-14	3	24	11	46	2.04	4.44
10-31	4	24	11	46	5.26	11.47
10-31	5	48	38	79	9.79	12.37
11-2	6	24	13	54	4.89	9.03
11-2	7	22	17	77	$19.75	25.56
TOTALS		190	98	52	$ 6.55	$12.69

However, upon examining other cattle remaining in the feed yards, grubs were found under the hide. The "bruises" were actually an early infestation of cattle grubs. By the time the true situation was discovered the cattle were too near market condition to use grub control measures. On October 14 a third shipment of 24 head was made. Eleven of these were infested and the value of the carcass was reduced sufficiently that we realized $2.04 less per head for the 24 head than would have been the case had the grub damage not been present. Restricting the loss to only those showing grub damage would have resulted in a loss of $4.44 per infected carcass. On October 31 two more shipments were made. One of 24 head and one of 48 head. These went to two different packing plants. In the case of the 24 head, 46% showed grub damage and in the case of the 48 head 79% showed grub damage. If we examine the average decreased return per head due to a reduced value per hundred pounds of the carcass, we find a loss of $11.47 per grub infested animal in one shipment and $12.37 loss per grubby animal in the other shipment. The last two shipments to slaughter were made on November 2, 1967. These are shown as shipments 6 and 7 in Table X. Shipment 6 had 54% infested and shipment 7 showed grub infestation in 77% to an extent as to require trimming of the carcass. The price was reduced by approximately $4 per hundred weight of the carcass in shipment 7 which resulted in an average loss of $25.56 per grub infested animal. These are direct monetary loses only and do not reflect the losses in carcass weight due to trimming for grub damage. In this group of 190 head of cattle sold to slaughter, 98 (52%) showed grub damage. The average per head loss for the 190 head was $6.55. If we restrict the average loss to only those showing grub infestation, it amounted to $12.69 per damaged carcass. Without question, this is a greater monetary loss per head than would have been required as a cash outlay for grub treatment at the start of the feeding program. It seems to me that if any of you have been "doubters" as to the merits or benefits of grub control measures, these data should remove all such doubts. I want to emphasize that this was not an intentional experiment. It was one which because of lack of complete and thorough communications between the buyer and seller an accident occurred. Because it did occur and because it did offer us an opportunity to collect these data we took advantage of it and they are presented here for your information.

I want to take this opportunity to point out other aspects and phases of work which we have under way and in which we are participating at Iowa State. Many people are involved. For example, Dr. Ned Brown in the Veterinary Diagnostic Lab in the College of Veterinary Medicine at Iowa State University; Dr. Richard Bristol, in the Bovine Clinic at Iowa State; personnel from the Veterinary Medical Research Institute; and recently we have involved people from the National Animal Disease Laboratory which is located near Ames.

The cooperative aspects involved in this phase is demonstrated by referring to a pilot study conducted last fall. A group of 200 feeder calves was purchased from a ranch in the Texas Panhandle. Because of a drouth situation it was not possible for the rancher to wean half the calves and leave the other half on their dams. However, he did agree to wean and weigh 20 head of calves and on the same date to select another 20 head and obtain a weight on them. Ten days later the calves were shipped. They arrived at the McNay Memorial Farm in Southern Iowa about 24 hours later (November 5, 1967). Blood samples were obtained at the ranch on both groups prior to shipment. The samples were centrifuged and given other preliminary processing at the ranch. In addition to blood samples, nasal smears were obtained. Upon arrival the following day in Iowa, the same personnel obtained a second set of blood samples and nasal smears from the two groups of animals. A third sample was obtained three weeks after shipment. Some of the data and analyses have been completed but there are still other tests to be run. Although this can be considered nothing more than a pilot study, and some of the data are not yet to be analyzed, several interesting aspects have developed. For example, no animal so far tested has shown an antibody titer for IBR or BVD. On the other hand, PI_3 seemed to be quite prevalent in about two-thirds of the samples taken pre-shipment. Titers in those animals showed an increase of several fold during the three weeks post shipment period. In addition to the type of information just mentioned, blood hematocrit is being determined. A measure of electrolyte levels in the blood is being obtained. Also hemoglobin and other similar types of routine information. We expect this preliminary study to assist us in designing and developing studies in the future. It is hoped that such studies will be helpful in providing guidelines for reducing economic losses in general but specifically we hope they provide greater insight into the problem of weight losses during and following shipment as well as stresses which lower disease resistance.

The stated purpose of this conference was to explain the need for research. As you can see we have been active in research in certain aspects of livestock handling and management. It has been my intent to indicate to you the scope and magnitude of some of the studies underway at Iowa State. We hope these will provide factual information upon which to base some recommendations for handling livestock with a minimum of economic loss. To date our results have been quite satisfactory. We realize that the data presented in this paper deals with only a few of the may facets of an overall industry program. These data do emphasize, however, the meagerness of some of the supporting evidence for certain current recommendations.

It has been a pleasure to be a part of this program. I appreciate the opportunity to visit with you and I also appreciate the invitation to be a participant at this conference.

Thank you.

Conference On Preconditioning Cattle
June 26, 27, 28, 1968
University of Wyoming, Laramie

"WHAT KIND OF CALF?"

C. O. Schoonover,
Extension Livestock Specialist

What kind of calf best makes the transition from range environment to the environment of the feedlot? If 10 to 20 of the calves making this transition become beset with some form of illness, then what about the 80 to 90 percent that are not afflicted? Obviously all calves of the same origin are subject to the same stress and infectious agents. What about the healthy calves? What keeps them healthy without benefit of preconditioning procedures. Is it a natural or genetic resistance to disease? Is it maturation immunity i. e., some calves are physiologically more mature and better able to resist infection? Or is it just due to good preweaning nutrition?

I would suggest that any or all of the aforementioned factors may account for healthy calves. In the wild state genetic or natural resistence is easy to understand—the weak perish and the strong survive. However, under mans manipulation the very opposite can occur. For example, how many bulls now in service were treated and saved from some calfhood disease. It is unrealistic to imagine that some of their progeny may also have to be treated for the same disease?

Maturation and good nutrition would seem to go hand in hand. We are well aware that more mature animals are less subject to stress. Physiologically some calves are far more mature at six months than others. I would suggest that preweaning nutrition is most important. Nutrition spelled M-I-L-K. Emphasis should be placed on quantity and persistency of milk production in the cow herd. The nutritional value of milk has been well-recognized. Note the use of that all-American mother the nurse cow.

Should we concern ourselves with such a thing as genetics, natural immunity, maturity or preweaning nutrition. The alternative is to rely entirely on artificial means, treatment with a host of available drugs, antibiotics and manipulation of the environment to minimize stress. There can be no question of the value of medicines or of immunizing agents. Treatment of sick animals is good husbandry and generally economical. But what happens to treated breeding animals? Too often they are returned to the breeding herd and allowed to reproduce. Are we, through the increased and effective use of therapeutics, simultaneously weakening the constitution of the beef cattle population?

Feedlot sickness; its accompanying loss and treatment is costly. Preconditioning on a national scale would also be costly. The beef cattle industry can ill afford either one. Additional costs will be born by either the producer, the feeder, or both.

Before we accept a program based on therapeutic treatment and management manipulation I would suggest that we:

1. Examine our breeding and selection programs. Can we breed a more vigorous cattle population?
2. Study physiological maturity, preweaning nutrition and its relationship to stress.
3. What kind of calf best makes the transition from range to feedlot? Is it necessary to treat 100 percent to protect 10 to 20 percent.

"NUTRITIONAL AND MANAGEMENTAL ASPECTS OF CONDITIONING CALVES"

by John W. Algeo
Santa Ynez Research Farms; Santa Ynez, Calif.

I will direct my remarks primarily toward some of the practical managemental aspects of putting nutritional programs into effect in conditioning calves. It should be recognized that any recommendations made are for optimum management and varying degrees of use and practicality will exist in actual situations.

Preconditioning on the ranch

1. Weaning

Where possible take cows away from calves to cut down on fence walking etc. This involves moving the cows into weaning fields 1-2 weeks prior and equiping them with creeps. Feed the calves the preconditioning ration in the creeps, this will accustom them to feed and they will know where it is and how to get it. If equiped give the 1st round of shots while the calves are still on the cows and the boosters at weaning or as is required by the necessary time lag for drug or vaccine efficacy. Wean on the grass by removing cows not by taking calves to dry lot. This system helps to avoid mechanical pneumonia from dusty pens and minimizes such problems as pink eye. Do not lock calves up in the dry lot until the first 7 days weaning stress are passed or perhaps not at all. Some find it a good practice to feed conditioning calves in small pastures. The extra room seems to help in not spreading diseases. If calves get sick, remove them from the field to a hospital pen to help prevent the spread of the problem. Unless there is absolutely no other way, do not rope sick calves!

Backgrounding at the feedlot

One of our clients has an excellent system in which paddocks of about 2 acres are maintained in grass and which have manger space at one end. In a sense this amounts to over-sized dry lot type pens with pasture in them. Calves are placed in the pens with plenty of grass and clean water and the starting feed used at the feed yard is offered ad lib. The calves, thus, have a good clean place to recuperate from their trip, etc.

Weaning and preconditioning diets can be the same and this minimizes inventory problems attendant with feeding various rations and obviates any possible stress of changing diets. Ration will necessarily vary with areas and locally available feeds. Our experience indicates there is probably little reason for high priced, high protein supplemental feed, but rather a simple mixture of highly palatable ingredients will suffice. Remember you're not going into a high efficiency finishing regime but more of a warehousing program. We feel the crude protein level should be around 11-12% with an energy level of 50-55 megcal/cwt. This type of diet will have about 50-60% good quality roughage with mixed grass, legume types being preferrable. Grain or grain plus by-products such as mill run, beet pulp and so forth can make up the concentrate protein along with molasses and the mineral-protein supplement. A small amount of urea, probably around 10-20% of the crude protein, is adviseable since this will speed adaptation to NPN in the feedlot. If Vitamin A is injected it is not necessary to feed it on this type of program. An antibiotic will generally be beneficial in such rations and should be fed at the highest rate (cleared) in the second week and discontinued for the balance of the preconditioning period or fed at the standard low level for the drug being used.

Feeding

Calves should be fed at least two times daily and water troughs checked daily or more often if needed, and water troughs should be cleaned at least weekly. Calves should be watered from troughs if possible rather than ponds or streams since this acquaints them with the type of watering situation they will encounter in the feed yard. This almost eliminates the problem of "drys" at the feed yard.

Health checks

Calves should be checked at least twice daily for any sign of disease. This requires competent help not run of the mill cowboys, saddle tramps etc. We find a very close relationship between the type of help used and the death loss, morbidity and treatments required. Men doing such work should be instructed to pickup any suspicious calf. When in doubt do not wait until the next day to be sure the animal is sick but rather get him out, take his temperature and treat according to symptoms, temperature and your established program. Such a program should be set up with the help of a thoroughly competent *large animal* veterinarian. We find that feed yard problems are such that a good degree of specialization is required and our best results are invariably where the specialist is used.

When the calves are being checked for sickness make each animal get up and move or you're not doing a good job. The man doing this work *must* see each calf not just a cursory examination of the herd. This is one case where one must not only be "close enough to the forest to see the trees" but must make sure he does in fact see them. I feel that for preconditioning to work for the rancher he must have a source of cheap feed locally available, top quality personnel to care for the calves and be prepared to feed the calves 30 days.

A two week period is generally only enough time to get the weaning shrink back and the ranch thus looses the cost of the program. Barring serious mortality or morbidity, at 30 days the animals should have gained enough to return a profit on the preconditioning. Since preconditioning costs at least $12.00/head it will require 40 lbs. extra weight at $30.00/cwt. to break even. To do this in two weeks requires a gain of 2.8 lbs./day which is unrealistic in the face of weaning stress. However, the required break even gain (with no death loss) at 30 days is only 1.33 lb./day. In this type of conditioning program we would rather not have the calves implanted with hormones since we wish to use a different program in the feed yard.

If it is not possible to condition calves on the ranch due to unavailability of feed or for other reasons, then in our experience the calves should either go direct to the feed yard or to a backing yard. The latter of course is another method of conditioning available to either the rancher or the feeder. In California and across the Southwest there is developing a sub-industry for backgrounding within the cattle industry. Also, there is a great amount of backgrounding done at the commercial feed yards and some of our clients with excellent management feel they would rather have the calves at their own pens where they can bring them along at a rate commensurate to their age, weight, condition and type for all of these are important factors which at times are either overlooked or due to plant insufficiency cannot be accomplished in the farmer-feeder conditioning program. For example, 300 lb. Holstein calves need a high energy diet for most efficient production whereas 300-400 lb. English breds and Okies will finish to light on the same program and must grow to a heavier weight before being given the high energy diets. The degree of fleshiness and weight must also be considered in how long one should grow calves before fattening them. Highly efficient calves out of production tested herds with weaning of 550 lbs. or better, for example, need no backgrounding but only an adaptation period of preconditioning before going on high energy programs. This type of operation is by nature a commercial feeding venture and has attendant problems not usually found in the rancher-conditioning type of venture.

Nutritional regimes for such operations are generally based upon roughage diets supplemented for energy, protein and minerals. As in the reconditioning set up, the greatest need in this operation is for competent people handling and feeding the cattle. I am sure that some practices used cause more sickness than they cure or prevent.

"COST OF PRE-CONDITIONING CALVES"

Jack Winninger
Livestockman; Meeteesee, Wyoming

Talk given to Conference on Pre-Conditioning Cattle,
June 26, 1968
University of Wyoming, Laramie

In 1961, at the Cobblestone Inn, Storm Lake, Iowa, I said to a group of feeders gathered there that: "I as a beef raiser can no longer slam the freight car door shut on my stock with no concern for what they will do for the feeder, the packer and the retailer or the consumer. Since that time there has never been a year that I have not visited our cattle in the feed lots at least once and usually several times, and again at the time of slaughter. This interest has brought about a relationship between me, the feeder, and the packer which has been very advantageous from an economic stand point for all of us. With this sincere interest in the problems of the other fellow we have tried all types of preparation of calves for shipment with a wide range of results. Some shipments had less than one percent of death loss, while others had more then seven percent death loss.

The topic given me today was the cost of handling and processing preconditioned calves. I have prepared some charts to show our costs of pre-conditioning cattle.

COST OF PRE-CONDITIONING CALVES TO RANCHER
FOR 30 DAYS TO GAIN 40 POUNDS

Calf 400 @$30.00/cwt October 15 value 120.00 dollars

Death loss ½%	.60
Wash out calves 1% at half value	.60
Interest on calf 30 days @7%	.70
Freight on additional 40 lbs. @ $1.50/cwt	.60
Fixed Cost	3.00
Yardage for 30 days @6¢/hd/day	1.80
Bedding	.50
Combiotic 4% of herd	.02
	$7.82

Vaccination and Parasite Control

Para Influenza 2 doses	1.20
IBR Lepto Combination	.25
Malignant Edema and Blackleg	.133
BVD	.375
Grub and lice control	.25
Worm control thiabendazole	.832
Handling 2 vaccinations @15¢/ time	.30
1 spraying or dipping	.25
	$3.59

Feed Costs

2 lbs. Supplement @ $.07/lb. 30 days 60 lbs.	4.20
3½ lbs. Beet Pulp & Oats @ 2.50/100 lbs. 30 days 105 lbs.	2.625
3 lbs. Hay @ 25/Ton 90 lbs.	1.125
Mineral	.14
	$8.09

Value of Calf Rancher November 15

Calf cost	$120.00
Calf costs 30 days	7.82
Vacc. & Parasite control	3.59
Feed costs	8.09
	$139.50

On November 15 a 440 lb. calf must bring $31.70 per hundred to break even with no return to management.

COST OF PRE-CONDITIONING CALVES TO FEEDER
FOR 30 DAYS

Calf 400 lbs. @ 30.00/cwt October 15 value $120.00

Death loss 1%	$1.20
Wash out calves 1% at half value	.60
Interest on calves 30 days @7%	.70
Fixed Cost	.70
Yardage for 30 days @5¢/hd/day	1.50
Bedding	.40
Combiotic 8% of herd	.08
	$5.18

Vaccination and Parasite Control

Para Influenza 1 dose	.80
IBR	.20
Malignant Edema and Blackleg	.133
BVD	.375
Grub and lice control	.25
Worm control thiabendazole	.832
Handling 2 vaccinations @15¢/time	.30
1 spraying or dipping	.25
	$3.14

Feed Cost in Feed lot for 30 days

2 lbs. Supplement/day 30 days 60 lbs. @ .0517	3.10
3½ lbs. Cracked Corn/day @ $1.1564/bu. 105 lbs. @ .0193	2.03
6 lbs. Silage @ $10.00/Ton 180 lbs. @ .05 lbs.	.90
Mineral	.14
	$6.17

Value of Calf November 15 to Feeder	120.00
Cost of Calf 30 days	5.18
Vacc. & Parasite control	3.14
Feed costs	6.17
	$134.49

On November 15 cost of the calf in the feeders lot started on his feed and located in his facilities is $134.49 or $5.01 less than the cost to the rancher.

In closing I would like to give three reasons why producers ship their calves. One and the most important is that our main crop is grass and we do not have an abundance of harvested feed so our feed and bedding costs are much more than they are in the feeding areas where we usually market our cattle. Two, we do not have the facilities to feed cattle because we do not have the type of feed product that we need to market through the lot feeding of cattle and the third point is that I for one after seven years of pre-conditioning accept my short comings as a feeder and feel that getting cattle on feed and started is the job for a professional. My feeder tells me he wants the "bawl" out of his calves, feed bunk broke, with no sickness when he gets them, but he does not feel it is worth any per pound to him other than the vaccine costs. He thinks all the premium he can afford is the extra 40 lb. gain I can get in the pre-conditioning period. This means that he wants more than I can give him at a reasonable price so I think more work needs to be done on the shipping and especially the receiving of calves to implement ways of lowering death loss and getting cattle started on feed.

"SPEECH: NATIONAL PRECONDITIONING CONFERENCE" UNIVERSITY OF WYOMING, LARAMIE, WYOMING JUNE 26-27-28, 1968

Earl Reynolds,
President, Bitterroot Valley Stockman's Assn.;
Corvallis, Montana

It is indeed a privilege for me to represent the Bitter Root Valley Stockman's Ass'n. to discuss some of the aspects of preconditioning of cattle. It's something we don't know much about really, but we have had some experience. I have been asked to talk particularly about the cost of handling and processing preconditioned cattle. When extra costs are mentioned it certainly increases the concern of the producer, and justifiably so, because of the cost-price squeeze which he is in today. But I believe this is only half of the story which I will go into a little later. We in the Bitter Root like to think of preconditioning in another term, that of quality control. It could be known by any other pertinent term and have varied meanings to various people in the beef cattle industry. Preconditioning, though not too precisely defined, this term is generally accepted.

To a feeder a preconditioned calf might refer to one that is in good health, has been introduced to feed bunks and water troughs, and has been immunized against the common diseases, treated for parasites and is ready to start eating and gaining as soon as he arrives at the feedlot.

To the rancher-producer preconditioning means a combination of ways of handling calves preceeding, during and after weaning and marketing for the purpose of improving the health and vigor and assisting them to adapt to their new surroundings as feeder cattle. This quality control, marketing management practice or preconditioning is not entirely new to us in the Bitter Root, some phases of preconditioning have been practiced for sometime and I'm sure it is not new to others. Since our initial efforts of cooperative marketing in 1963 we have made extra effort to make more attractive and increase the value of our product by these practices. We have strived to supply our customers with better calves and yearlings and build a reputation for healthy good doing cattle. It began rather small and unnoticed, but in 1967 we received considerable attention because of our efforts at a valley wide cattle grub control program and the shipment of a certified trainload of calves and yearlings to a midwest market. We haven't always been compensated for the extra labor and costs of these practices and procedures. It takes time, information, education, performance and other factors to bring this about. Now . . . how can we determine costs until we know the extent of the practices involved. Just what are some of the facets of preconditioning? Speaking as a producer it begins the day the calf is born and technically it begins even before this . . . if gainability, culability, and other heritable traits are considered a part of preconditioning. This will come if we are to meet maximum efficiency in the industry. Extr weight on the calf adds return to the product and therefor supplies the means to offset the extra costs of this program

Because of the variables of demand it is very difficult t put a dollar and cent cost on an average over-all program Experience has shown that a death loss of 1½% to 3% may b expected on calves and ½% to 1½% on yearlings. If precondition ing will affect this mortality and reduce the disease loss then it has a place in the economic structure of the beef in dustry. In Montana, at least in our area, the basic practice begin when the calf is dropped and are necessary to get hir through to weaning. The producer must complete these fo his benefit but are also passed along for the benefit of other who use the product.

Vitamin A, D, and E, Selenium, Blackleg, and Malignan Edema . . . costs? Sure, but would we neglect them? And wh benefits? *Dehorning and castration* surely involve setbac costs. What are the benefits and how many progressive pro ducers do not dehorn or castrate? *Weaning* prior to shipmen and marketing, this is one of the most controversial and agai who benefits? I can cite instances among our group whe pre-weaning was not on the cost side of the ledger and I'r sure others have had similar experiences . . . again manage ment . . . I would think the benefits however would lea heavily to the feeder. Dr. Jack Ward, who has worked ver closely with our Ass'n in this marketing program, recommend pre-weaning at least 30 days as one of the most importan practices to reduce stress at marketing and shipping time *Shipping fever* accounts for great losses and all of us ar familiar with this one and realize that control of this comple offers considerable benefits. Studies have shown that calve weaned 30 days or more prior to marketing have less respira tory trouble than those weaned less than 30 days. What abou shipping facilities and preparation of carriers? Is beddin very important? Rapid movement from producer to feede are these part of preconditioning? I think so. Can you put dollar and cent cost or return on these procedures? It ha been shown that direct movement reduced the average deat loss by about 2%. Time in transit has a relationship to th incidence of respiratory disease. Who benefits here? *I.B.R Lepto,* is generally considered necessary in the midwest an northwest. *B.V.D.* is not nearly so conclusive and some vete inary practioners feel that there is substantial negative reactio to the vaccine.

At present it seems there is no reliable information fo determining when a group of cattle are infested with a *worm load* sufficient to retard their performance. There is no excuse for any rancher to produce grubby cattle since the advent of the systemic phosphates. We are convinced that the return from this practice much more than offsets the cost by product improvement, wintering the cow herd and the reduction of the heelfly itself. *Identification*, a very important part of the preconditioning concept. How are we to identify these preconditioned calves? We certainly can't tell them by looking at the product. I think we are going to have to look under the hood so to speak, and this is where an identification enters in. We in the Bitter Root have some concrete ideas about this also. Last year we made an attempt to identify our calves and yearlings with metal numbered and colored tags. This hasn't been too successful. After the calves were in the feedlot they had to be handled individually to get the information from the tag. Now we have a system that seems to be working very well. The individual ear tag can be read without individual handling and the numbers can be traced to individual producers and correlated with all the important preconditioning certificate or herd management record that should accompany the calves. The practices that are not visible on the calf will be evident on the tag itself. We are testing this method on approximately 5000 calves and yearlings this year. Identification records a cost? Certainly . . . but what are the possibilities concerning product demand, follow-up information and repeat sales because of customer satisfaction. Certainly there are other practices which are important to some and less important to others. I suppose there are others who would disagree with the concept for there are disadvantages as well as extra costs involved. The need for extra facilities for holding and handling. Earlier than normal movement off the summer range and so on. . . . Who is to determine which practices are of benefit and who is to bear the cost of these services and who benefits?

The whole idea involves good judgment and proper timing with goals of merchandising a better product. The best attempt at preconditioning can be nullified by careless shipping procedures and improper handling after delivery to the feedlot.

My personal pet peeve . . . that of the lack of communication between the producer and feeder concerning the product. How are we as producers going to supply the needs of the feeder if we don't know what they are? We think the feeder should support this program or it could be lost. I would like to stress these communications in this respect because preconditioning as I see it is simply a management program that supplies the needs of the producer, feeder, and packer and procedures that benefit those who use the product.

We have had requests for preconditioned calves and in many cases when we ask what practices are required some do not know. Here is room for education and information. Because demands vary in different areas surely veteriniarians should play important roles in determining and recommending the practices required for their respective areas. Costs depend on the extent of these practices. Costs have been quoted from $2.00 to $14.00 per head. Costs are relative to areas with the variables of extra handling and processing considered. Preconditioning involves fixed labor, and variable costs much like any other merchandising effort.

There is some speculation that eventually preconditioned calves will bring the basic market value and others will be discounted as was the case with dehorning, but how many operators can afford not to dehorn? Can we afford not to precondition? Does it cost or pay?

If quality control makes a product worth more it certainly should bring more. Many other industries spend considerable amounts on quality control. Would this be done if it was entirely on the cost side of the ledger? I think not. Can we as an industry afford not to consider quality control? This is another tool to improve efficiency of production and marketing all the way from the range to the consumer. And therefore increases returns to the industry. Which must reflect to each segment.

We in Bitter Root Valley Stockman's Ass'n. believe that this concept preconditioning is our opportunity to add to our reputation as a source of healthy good doing cattle which should command price advantage at market time. It fits us very well and we are going to take advantage of it.

PROBLEMS AND MANAGEMENT ALTERNATIVES OF THE RANGE LIVESTOCK INDUSTRY IN RELATIONSHIP TO PRE-CONDITIONING

by
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INTRODUCTION

Pre-conditioning means many different things to people. One veterinarian, Dr. Roy Echeverria of Casa Grande, Arizona, described pre-conditioning as a "a nebulous word". (21[c]. That seems to be the most appropriate description in the literature.

The pre-conditioning program apparently originated in Iowa, "designed and born in Iowa only eighteen months ago." (1) Dr. J. B. Herrick, Extension Veterinarian, Iowa State University, is quoted as saying, "The problems are monumental, encompassing many aspects". . . . "The plight of the cow-calf man is serious due to the rising cost of production. He must be considered, yet he must realize that pre-conditioning is a management program that is essential. Accumulating evidence shows that pre-conditioning is a money-maker for the cow-calf man. Premiums should be ignored. Those that are not pre-conditioned are worth less."(1) The assertion that pre-conditioning can be a money-maker for the cow-calf man if some premium is not paid requires some further evaluation.

LAGGING TECHNOLOGY — A PROBLEM

The western range livestock area can be delineated as roughly that area west of a line extending through Bismark, North Dakota and southward to Fort Worth and San Antonio, Texas and on south to the Rio Grande.

The economic problem of earning an adequate return is the principal problem besetting the range livestock industry. One of the principal causes of the problem is the failure or inability of the range livestock industry to advance rapidly by adopting new technology.

Dr. A. F. Vass made studies of cattle ranching in the Northern Plains and mountain areas of Wyoming in 1925 and 1926.(32, 33) He reported a calf crop of 69 percent, and sale weights of steer calves of 400 pounds in the mountain areas. Heifer calves weighed 384 pounds, and yearling steers 656 and yearling heifers 630 pounds. He also found labor use of 131 cows per man equivalent. The study for the plains areas showed a calf crop of 57 percent and yearling steers and heifers sold at 663 pounds and 617 pounds. Those studies were probably not based on average operations or performance, but on operations slightly above average.

Studies were made by Stevens and Agee in the mountain areas and by Kearl in the plains areas in Wyoming in 1959.(13, 31) Calf crop percentages of 85 and 84 percent, respectiv were reported in those studies. Steer and heifer calves weig 369 and 352 pounds and yearling steers and yearling hei averaged 689 and 608 pounds in the mountain areas. In plains areas steer and heifer calves weighed 422 and pounds, and yearling steers and heifers weighed 696 and pounds. Both studies were repeated in 1965 with essenti the same results.(14, 30) Advances in weights may have b retarded due to a higher percentage of calves from two three-year-old heifers in latter years.

There have been some improvements in labor efficiency 186 cows were cared for per man for larger sized ranch erations in the mountain areas in 1959.

The Wyoming Stockgrowers Association has for the five years, as a promotional device, published a feeder ca edition. Ranchers have listed their cattle for sale and estimated weights. These data were summarized for the ye from 1963 through 1967 (Table 1). Steer calves have b offered at an average weight of 389 pounds. Heifer cal have averaged 368 pounds, and yearling steers and yearl heifers 688 and 629 pounds.

There has been little progress in weights of cattle sold tween the studies made by Vass in 1925 and 1926 and studies made by Stevens and Agee, and Kearl, or the offer weights of cattle advertised in "Feeder Cattle" editions "Cow Country", the Wyoming Stockgrowers Associat magazine.

Calf crops have increased since 1925 or 1926. The C

[a]Numbers in parentheses refer to literature cited.

TABLE I

Numbers and Weighted Average Weights of Cattle Offe Through Feeder Cattle Editions of the Wyoming Stockgrow Feeder Cattle Editions, 1963-1967

Kind	Reports	Number Offered	Average Weights
Steer Calves	1,097	143,508	389
Heifer Calves	965	88,747	368
Total Calves	xxx	232,255	xxx
Yearling Steers	889	190,791	688
Yearling Heifers	799	82,875	629
Total Yearlings	xxx	273,666	xxx
TOTAL	1,651	505,921	xxx

SOURCE: Summarized from "Feeder Editions" of "Cow Country" Ann Issues, 1963-1967, Wyoming Stockgrowers Association, Cheyen Wyoming.

and Livestock Reporting Service of the U.S. Department of Agriculture estimates the number of calves born and the calf crop as a percent of cows two years old and over on January 1 of each year. Many heifers coming two years of age on January 1 should be expected to calve during the year. Consequently, the published estimates are not, strictly speaking, a percent calf crop. Calf crop born, as reported, averaged about 80 percent in Wyoming from 1946 through 1950, including a low of 72 percent in 1949 and a high of 87 percent in 1950. Calf crop born as a percentage of cows and heifers over two years old on January 1 has averaged between 85 and 90 percent since that time and varies only 1 to 4 percent from year to year.

It is doubtful if calf crop born in Wyoming has ever exceeded 80 percent when yearling heifers expected to calve as two-year-olds are also included in the cow herd. This is also true of all 17 of the states which can be considered entirely or partly in the range livestock area. South Dakota and Colorado have achieved calf crops as high as 93 percent, based on cows two years and over in January 1 inventories but states such as Texas, New Mexico, Arizona, and Nevada still fall far short of 90 percent based on cows two years and over in January 1 inventories. (Table 2)

TABLE 2

Calves Born as a Percentage of Cows and Heifers Two Years Old and Older in January 1 Inventories

State	Averages for 1946-1955	1956-1960	1961-1965	1966	1967	1968[a]
North Dakota	89	89	91	88	90	90
South Dakota	89	90	92	93	93	94
Nebraska	89	90	91	90	92	89
Kansas	89	88	90	88	93	94
Oklahoma	88	85	85	86	88	91
Texas	81	85	83	84	86	86
Montana	90	90	91	91	91	92
Idaho	86	89	90	90	92	93
Wyoming	83	88	89	89	91	90
Colorado	86	89	90	93	92	93
New Mexico	79	84	84	86	88	86
Arizona	78	77	79	85	79	80
Utah	84	85	87	88	90	91
Nevada	76	78	79	81	80	78
Washington	85	88	89	89	88	87
Oregon	82	86	87	89	90	90
California	83	87	88	87	88	88
Eleven Western States	85	87	87	88	88	88

SOURCES: "Livestock and Meat Statistics, 1967," U.S. Department of Agriculture, Agricultural Marketing Service, Statistical Bulletin No. 230, July 1958.

"Livestock and Meat Statistics, 1962," U.S. Department of Agriculture, Statistical Reporting Service, Statistical Bulletin 333, 1962 and supplements for 1963, 1964, 1965, and 1966.

"1967 Calf Crop Report," Wyoming Cooperative Crop and Livestock Reporting Service, U.S. Department of Agriculture and Wyoming Department of Agriculture.

[a]Calves born before June 1, plus the number expected to be born after June 1.

A Western Regional Research Project (W-79) to study economics of livestock ranching in the western states is currently under way and nearing completion. Work in eastern Oregon, western and northeastern Nevada, and Utah all show weights very comparable to those for Wyoming.(13, 14, 24, 26, 27) Work by LeRoy Rogers reported slightly lower performance for southern Nevada cattle ranches.(25) Studies applicable to northeastern New Mexico reported weights of calves slightly higher than those indicated for Wyoming and also slightly higher yearling weights.(11) If data from all these studies were pooled and tested for homogeneity of sale weights, it is doubtful whether significant differences would be shown. A possible exception could be southern Nevada.

Roland Bevan studied the mountain type cattle ranches in central Idaho.(2) He reported considerably heavier calf weights but lighter weights of yearlings than the studies previously cited. His study was continued over five years, and by the nature of cooperation required, undoubtedly involved superior ranch operators.

Other principal areas for technological advances are in crop yields. Unfortunately, in much of the western range livestock area the principal crops being produced are small grain and dryland prairie hay, or native or improved meadow hays grown in high altitude, irrigated valleys. In either case, climate is not favorable to the adoption of technologies to greatly enhance yields. In Wyoming, for instance, there has been no significant upward trend in yields per acre of wild hay, or of clover and timothy hay, or of all hay combined since 1924.(38) The same is probably true for prairie hay or native hay production in all of the 17 range states.

Where cattle ranchers are able to produce feed grains or corn-silage then improved varieties, fertilization, and increased plant populations, and irrigation resulted in increasing yields. In those situations, however, pre-conditioning is not such an issue because frequently ranchers with those types of resources are doing their own feeding.

In summary, technological advances have been difficult to achieve on ranches. Technological advances come more readily in feedlot operations, or in farming operations where hybrid corn or grain sorghums are grown under heavy fertilization and with relatively complete mechanization of operations. Cattle ranches have made some gains in labor efficiency by substitution of capital in the form of machinery and vehicles for labor. There has also been a shift to marketing yearlings or calves which probably results in more efficient resource use, as compared with marketing two-year-olds.

APPLICABLE NEW TECHNIQUES UNADOPTED

There are some technological advances which may be relevant to range livestock operations. Reseeding with crested wheatgrass for an early spring range might be expected to increase calf crop born and weaned by as much as 10 percent under Northern Plains conditions, due to the flushing effect on conception rates.(12) The same result might also occur in other areas. Calf weaning weights could likely be increased by 20 pounds. The use of such pastures should have a cumulative effect on calf crop since yearling heifers could also be expected to gain 20 pounds or more in addition to the gain of calves, and weigh 40 to 50 pounds more than heifers from native ranges at breeding time.(6, 29) Additional beneficial effects should be observed in calving of larger two-year-old heifers and rebreeding to calve as three-year-olds. The calves will be discounted slightly in price. However, the discount is not great enough to result in a net discount in value of the heavier animals.

Crossbreeding is another advance in technology which may have application. Some work on crossbreeding was done in the early 1940's at the Northern Plains Experimental Range at Miles City.(5) Crossbreeds showed considerable advantage in weaning weights of calves. Crossbreeding, however, has not been actively promoted in Wyoming, or in many other western states due to discrimination in price by livestock feeders. Discrimination was quite great at several markets in the Northern Plains Area in 1959. Discrimination probably still exists at other places also. A study by Blaine Bickel indicated that some degree of discrimination against crossbreeds persisted at the Torrington, Wyoming auction from 1959 through 1965.(3) There was some reduction in discrimination between 1959 and 1965, and fear of discrimination against crossbreeding need not be a deterrent in the future.

Subsequent research in many parts of the United States has indicated that crossbreed calves generally will show an advantage in a lower death loss and hence in a higher weaned calf crop, and in weaning weight. They will show an advantage in post-weaning gain; they will show an advantage in feedlot performance; and, they will show an advantage in carcass quality on the rail.(5) Yet there has been, and perhaps still is in many places, price discrimination against crossbreed calves and yearlings, foreclosing a technology which might be of considerable value to ranch operators. The livestock feeder apparently has reaped the advantage of this discrimination.

Another technological development which might be advantageous to range livestock producers is the use of hormone implants. Research at the University of Wyoming between about 1955 and 1958 showed that suckling calves, steer calves on a wintering ration, or yearling cattle on pastures would all respond to treatments of 12 to 36 mgs of stilbestrol. The advantages were as much as 30 pounds for suckling calves and 33 pounds for yearlings for the 12 mg dosage.(15, 17, 18, 19, 20) Other tests have used multiple implants in different growth stages.(7, 16, 22, 23, 28) Results are variable, but it appears that implants could be given in one or two of the three growing stages prior to fattening, with advantages accruing to the ranchers. In some cases, feedlot performance was enhanced and in other cases not seriously affected.

These studies were made between 1955 and the early 1960's. Yet, the use of hormones for these classes of animals has not been actively promoted or adopted in Wyoming, or many of the other range states because buyers discriminated severely in prices. For some reason, it was thought necessary to surrender the advantages in technology stemming from the use of stilbestrol entirely to the feeders.

The livestock feeders discriminate in price against crossbreeding, against heavier calves, and against the use of hormones by ranch operators. Now ranch operators are being told they should introduce a new technological development, pre-conditioning, which should have great benefit to the livestock feeders. It should be done with no price premium being given to the ranch operators. There is no assurance that it can be accomplished without incurring serious loss on the weight of the animals. Out-of-pocket costs for vaccines, feeds, and investment in facilities are a certain requirement. If preconditioning is not done then an additional basis for discrimination is found because the cattle are "worth less".

It would be very desirable to have more inter-disciplinary cooperation in choosing and designing economically relevant experiments and subsequently evaluating them. Greater research efforts should be made by argicultural economists to provide economic evaluations of the technologies previously developed by biological scientists, and which have not been properly evaluated in the past. Greater extension efforts should also be made by all disciplines having contact with the livestock industry in educating ranch operators, and livestock feeders as well, to the possible beneficial effects from adoption of new technologies.

LAND RESOURCES IN RELATIONSHIP TO SPECIAL HANDLING AND IMMUNIZATION

A set of recommendations for an "optimal" immunization program was given by the panel for the symposium on immunity to the bovine respiratory disease complex held at Oklahoma State University in 1967.(35) The recommendations are as follows:

Pre-Conditioning Program for Calves on the Ranch

At approximately 2 months of age (May and June in much of the range livestock area)	Castrate, dehorn, and give blackleg and malignant edema bacterin. Identify animals. Start records.
At approximately 4 months of age (July or August)	Give IBR and PI-3 vaccines and pasteurella bacterins to all calves, and brucella vaccine to the heifer calves only.
At approximately 5 months of age (August or September)	Give BVD-MD and PI-3 vaccines and leptospira pomona, pasteurella, blackleg, and malignant edema bacterins. Treat for external and internal parasitism as indicated.
At approximately 6 months of age	Have records accompany animals when sold.

The U.S. Department of Agriculture has for years published a "Costs and Returns" series for different types of farms in the United States, including some types of livestock ranches. Ranch budgets have been prepared to represent "typical ranches", which are actually slightly larger and differ in some other ways from an arithmetic average for ranches. Typical cattle ranches for the Northern Plains area show 110 cows and heifers two years old and over and 174 total cattle in 1965.(10) About 30 acres are required per cow-year equivalent. A greater acreage of land is used as summer range than is used as winter range due to the use of supplemental feeding and closer utilization of the forage on winter range. If one assumes that about 16 of the 30 acres are used per cow equivalent as summer range, then the 105 head of cows could be expected to be scattered over about 1,700 acres in the Northern Plains.

The recommendations for an "optimal" immunization program call for ranchers in the Northern Plains area, for instance, to be gathering 100 head of cows from 1,600 acres, or perhaps 1,000 head of cows from 16,000 acres. Shrinkage, and detrimental effects on rate of gain would affect cows and heifer calves to be retained as replacements, as well as the calves intended for pre-conditioning and sale. There would also be labor and materials costs for gathering, handling, and immunizing the animals. A reduced rate of gain may also result for a time as an immediate after-effect. The cattle would be gathered in August and again in September.

The Northern Plains are more closely cross fenced into pastures than most other range areas, but there are still many large pastures and not a great deal of cross fencing. Even under relatively favorable conditions which exist in the Northern Plains, these recommendations for an immunization program would be extremely difficult to implement.

In the southwest, the typical ranches showed 151 head of cows and heifers two years old and over, and 227 total cattle on 11,640 acres. About 58 acres would be required per cow equivalent and the cows would be scattered with their calves over proportionately a much larger area even than is true of the Northern Plains.

Data for the intermountain cattle ranching area, from this source, does not mean very much, because only the deeded acres of land are reported. There is no indication of land use in Forest Service or Bureau of Land Management permits.

There are about 20.7 million acres of land in Wyoming under jurisdiction of the Bureau of Land Management, and slightly more than 2 million animal-unit-months of grazing on them.(36) Average carrying capacity on these lands is a little over 10 acres per AUM. Sheep ranges which includes desert range areas are, on the average, probably not as good as some of the cattle ranges, and this contributes to low average carrying capacity. But, when cows are turned out for a four to six month grazing season, even on better-than-average BLM ranges, they can scatter to 25 to 50 acres or more per cow.

There are also about 8.6 million acres of National Forest lands in Wyoming, including about 2.4 million of Wilderness or Primitive areas.(37) Much of the Wilderness or Primitive areas, and some other areas also, is classified as unsuitable for cattle grazing. However, much land unsuitable for grazing is scattered and intermingled among that which is suitable. The steep or rough timber or brush covered land provides refuge and escape routes for cattle that don't want to be gathered and herded together.

There were 115,000 head of cattle and about 300,000 head of sheep grazing on National Forests in Wyoming in 1965. This is equivalent to about 175,000 cattle. This, in turn, using 6 million acres as the area of forest to which the cattle could scatter, averages about 34 acres per head. It would be an extremely difficult task to determine exactly the acreage used by cattle on the National Forests, the degree of use on different allotments or the number of acres per head on different allotments. However, the point should be adequately made that cattle are widely scattered on National Forests.

The problem in conjunction with public lands is compounded by the fact that relatively little fencing is used. Frequently, two or several more ranchers together use a common allotment, and quite often the grazing land is located at a considerable distance from the ranch headquarters. That is particularly true for much of the National Forest lands.

Implementing the recommended "optimal" immunization program on a tract of intermingled deeded and BLM land, or on a block of BLM land, such as is found in many arid portions of the west would involve a ranch operator in attempting to gather 100 head of cows with their calves from perhaps 6,000 acres or perhaps several ranchers pooling their efforts to gather cows from a much larger area.

Cattle in the National Forests will graze early in the day and usually "shade up" by 8:00 or 9:00 in the morning. In the early evening, 4:00 or 5:00 p.m. perhaps, they will begin to move out of the groves to graze again. In the heat of the summer it is almost impossible to control the cattle and move them without their escaping into brush or rough terrain. It is not really easy even to find most of the cattle except in early morning and late evening.

Criteria for Optimality

Actions might be justified on various criteria, including aesthetics, humanitarianism, humaneness, hedonism or some other psychological basis such as status-seeking, affectional, etc. However, none of these considerations are relevant to pre-conditioning. The criteria for decisions on pre-conditioning should be reduced to economics and humane treatment of animals. Any pre-conditioning program recommended can be optimal only if it is optimal on an economic basis, with due regard for humane treatment of the animals.

Optimum actions or conditions can be specified only in relationship to a given and specified objective or end. The optimum is the best or most favorable action or condition. The existence of realistic alternatives is implied, and consideration of all of them and rejection of all except the optimum is also implied. The fact that alternative actions exist to achieve given ends, implies in turn that if the objectives differ among decision makers or if the objectives or other conditions change then the optimum solution or action might also change or be different. Obviously, the ends or objectives of all decision makers must be given consideration and a great many specific situations must also be taken into consideration in specifying optimal courses of action. Consequently, there will be a great multiplicity of different optimal actions rather than a single optimal immunization program.

No one can seriously suppose that the recommendation put forth as an optimal recommendation could be optimal in all instances. In many cases it could not be implemented and in other cases it would not be feasible to attempt to do so. It serves primarily as a starting point in discussing conditions of optimality and programs to achieve optimums.

Returns In Ranching

The W-79 study, previously mentioned, dealt with economics of the western range livestock industry. Summary ranch budgets for a large number of typical ranches were prepared to reflect average performance. Price levels, inputs, and output were set at the average prevailing from 1956 through 1965. The usual result in net returns in eastern Oregon, northeastern Nevada, Utah, Wyoming, various areas in California, northeastern New Mexico, or the High Plains and Rolling Plains in Texas, was a return on total investment ranging from zero or perhaps a negative value to about two percent on total investment. (4, 11, 13, 24, 25, 26, 27) There were some notable exceptions where higher rates of return were earned.

Returns were calculated assuming full ownership of the ranch. Indebtedness can have a severe impact. If a ranch has about 17 percent indebtedness, which is not far from the average indebtedness for the western states area, then the interest on indebtedness would reduce a two percent return on total capital to a one percent return on owned capital. One percent of the return on total capital must be allocated to pay interest on the debt at six percent. The situation and outlook for ranches which are very heavily in debt is and has been quite bleak. Indebtedness is increasing each year on many ranches simply because they cannot pay interest on their indebtedness and pay operating costs on the ranch. On the other hand, land values have been appreciating so that net worth can increase even though net cash income may be negative or quite low and indebtedness increasing.

Pre-Conditioning and Net Returns

There is very little experimental data which can be used to evaluate pre-conditioning. It would perhaps be appropriate to initiate work to examine the effects of handling and the immediate after-effects of immunization procedures on rate of animal growth. If such work has been done, then it should be evaluated, published, and publicized.

Pre-weaning, manger breaking, and accustoming calves to hay and grain are also parts of the pre-conditioning routine usually recommended. There is little or no experimental data for evaluating these practices either.

Some data from the Northern Plains Experimental Range showed the results of a number of winter feeding trials conducted at Miles City between the winter 1955-1956 and 1959-1960 inclusive.[1] The general plan in these trials was to wean and weigh the calves about the first of December. They were then put through some type of program which was designed to accustom the calves to the experimental conditions and rations. The animals were then started on tests, typically about the 14th or 15th of December, or two weeks after the weaning date. From 40 to 60 calves were used each year, and a total of 256 calves were used through the five years. These calves averaged 451 pounds when weaned and 439 pounds 14 days later when started on tests, for an average loss in weight of 12 pounds during the time period. A gain occurred in only one year, and was less than one pound in that year. The loss in weight was equal to or greater than the 12 pound average loss in weight in each of the other four years.

After the animals were started on tests, different feeding rations were used from year to year and consequently, results were variable. In the first year, 1955-56, a ration was fed to produce about one pound per head per day gain through the winter feeding period. In that year, the test animals had gained 40.4 pounds at the end of the first 42 days after weaning, including the 14 day adjustment period of the weaning and the first 28 day period of the experiment. In other years, gains varied from a loss of 4.9 pounds to gains of 24.5 pounds through the first 42 days. Obviously, this test does not represent pre-conditioning. However, on June 25, 1968 the author was unable to find any references or literature reporting feeding or pasture trials which did represent what could be expected from pre-conditioning.[1]

The amount of gain in any program will be highly dependent on the type of ration and amount of feed being fed. Performance in the feedlot might also be affected by the type of ration used in the pre-conditioning program. Additional wo should be initiated to test the effect of different rations durii a pre-conditioning period, as they would affect costs of pr conditioning and subsequent feedlot performance and cos If such work has already been done, then the results should l published, the economics evaluated, and published, and tl results publicized.

It is normal for heavier animals to command lower pric than lighter animals for the same quality. If no premium paid for pre-conditioned calves then one might logically e pect that a normal discounting in price would occur due increased weights. The average differential between goo and choice 300-500 pound steer calves and 500-800 pour good and choice steers at Omaha, Nebraska for 1956-65 h been $2.85 per hundredweight. A calf gaining from 400 t to 450 pounds with the normal discounting in price would i crease from $108 to $119 in value at 1956-1965 averag prices. It is rather doubtful that 50 pounds gain could be a complished in less than 40 or 50 days. It is also rather doubtf that the handling, immunizations, and feeding costs for a 4 or 50 day pre-conditioning period could be recovered from a $11 increase in value.

Other Ramifications of Pre-Conditioning

In many cases it will be necessary for ranchers to build ne corrals or facilities with feed bunks or mangers in order accomplish the weaning, manger-breaking and accustoming feed, which has been called for in pre-conditioning. On these facilities are built the depreciation, interest on inves ment, taxes, insurance and part of the repairs on the faciliti are fixed costs which remain the same whether the facility used for two weeks, one month, or the full year. Logicall the facility should be used as long as the marginal returns b time period, considering both gain in weight and change price, are adequate to recover the variable costs of feedin by time period. Once the facility is built, then, the optimu course of action for the ranch operator might actually be feed for four or five months instead of two weeks or four six weeks as would perhaps be preferred by the livesto feeders calling for pre-conditioning.

Construction of facilities for pre-conditioning would co stitute a large increase in feedlot capacity, with consequenc only dimly foreseen.

Rancher's Alternatives to the Cow-Calf System an Pre-Conditioning

One can easily get the impression that the cow-calf syste is the most prevalent system of operation for the range liv stock industry by an overwhelming margin. That is not tru for the state of Wyoming. It is probably not true for quite few other western states.

An average of 615,000 calves were born in Wyoming eac year from 1964 through 1967. The best information availab indicates that 190,000 calves were sold (Table 3). Deat losses and some required purchases to balance inventori leaves 437,000 calves in the inventory at the end of the yea

[1]The assistance of F. J. Rice and J. R. Quesenberry, formerly of the U. S. Range Livestock Experiment Station at Miles City, Montana is gratefully acknowledged. The data were obtained in conjunction with another study.

[1]The first public distribution of proceedings of the previous pr conditioning seminar occurred on June 26, 1968, which was t opening day of the conference.

After allowance for retention of yearling replacement heifers and for an estimated death loss, there were 302,000 animals available for sale from the ending inventory of 437,000. However, the best information available indicated that 420,000 steers and heifers were sold and there was a requirement for 118,000 head to be purchased in order to reconcile inventories.

TABLE 3

Balance Sheet for Calf and Yearling Marketings from Wyoming 1964-1967

Item	Number (000)
Calves born[a]	615
Calf Sales[b]	190
Death Loss[c]	20
Required Purchases[d]	22
Ending Inventory[e]	437
Replacement Heifers[e]	126
Death Loss[c]	9
Available for Sales	302
Yearling Sales[b]	420
Required Purchases[f]	118

[a] Average number of calves born in Wyoming, 1964-67.
Source: "Calf-Crop Reports", Annual issues, Wyoming Cooperative Crop and Livestock Reporting Service, U.S. Department of Agriculture and Wyoming Department of Agriculture.

[b] Calf and yearling sales are based on interstate shipments of cattle from Wyoming as determined from brand certificates. Yearling sales also will include some sales of two-year-old animals and will also include sales of fattened animals.
Source: "Number of Wyoming Cattle and Calves Moved on Brand Certificates", (Annual Issues, 1964-1967) Wyoming Cooperative Livestock Reporting Service, U.S. Department of Agriculture and Wyoming Department of Agriculture.

[c] Death loss set rather aribtrarily at about 3 percent for calves from birth to end of year and 2 percent for yearlings.

[d] Required purchases is a calculated figure to make the transactions between calves born and ending inventory balance out.

[e] Number in ending inventory and replacement numbers are inventory numbers as indicated by "Annual Livestock Report—Wyoming, (Annual Issues)" Wyoming Cooperative Crop and Livestock Reporting Service, U.S. Department of Agriculture and Wyoming Department of Agriculture.

[f] Required purchases is a calculated figure to balance disposition of cattle with inventory numbers available for disposal.

The data for this balance sheet were derived from a number of different sources. Information on calves born, and ending inventories of calves and replacement heifers can be considered quite reliable. The information on sales was taken from brand certificates for inter-state shipments (exports), and there is a possibility of misclassification or of double-counting. For instance, some calves which were sold may have been listed as steers and heifers without the additional notation of calves on the certificate. If so, then calf sales may have been understated. However, if the calf sales were greatly different from those shown, then a considerably larger number purchased and brought into the state would be required to reconcile with the ending inventory. Similarly, some of the sales which were indicated as calves may actually have been yearlings, however, that error is less likely than the other error.

It is evident from the calves born and from the ending inventory of calves and replacement heifers which are all determined with a good degree of accuracy, that the cow yearling operation is the predominant type in Wyoming. That is confirmed by studies of cattle movements by truck (8) and sales through auctions (9) as well as by calf-crop, inventories, brand certificates and "Feeder Cattle" editions of "Cow Country" Magazine.

There are probably more cow-calf types of operations in Wyoming than cow-yearling operations. However, the former tend to be small in average size, whereas the latter tend to be much larger in average size and predominant in numbers marketed. There are also many operations marketing both calves and yearlings, and a few ranches, some of them quite large, which use a purchased stocker system of operations. The mixed marketing and purchased stocker systems contribute to the predominance of yearling sales.

Examination of inventory data for Wyoming shows that young cattle not on feed were about 59 percent of beef cows and heifers coming two years of age (Table 4). Among the western states, New Mexico, Arizona, Utah, Nevada, Oregon, Montana, and Colorado, were somewhat below that percentage. This indicates a greater proportion of cow-calf operations in those states, than in Wyoming. California, Idaho, and Washington all had a greater proportion of young cattle not on feed in relation to the breeding herd than did Wyoming. Thus, a greater prevalence of cow-yearling or straight stocker operations is indicated, although results may be confounded by fall calving in some of the states. New Mexico, which is more nearly a straight cow-calf state than any other still has more than twice as many young cattle as would be required for heifer replacement.

The cow-yearling system of operation is both more prevalent and more profitable than is generally supposed. In the Western Regional Research Study on Economics of Livestock Operations in the Western states, budgets for typical ranches operating on a cow-calf or a cow-yearling basis were prepared for western Nevada, Northeastern Nevada, and for the Northern Plains area of Wyoming.

The sizes of operation varied slightly between the cow-calf and cow-yearling operations in Nevada. Consequently, there is some confounding between changes in system of operations and changes in size. However, when the ranches are paired as well as possible on size, then five out of the six cow-yearling systems of operation in Nevada produce net ranch incomes per cattle unit superior to the corresponding cow-calf systems. The cow-calf system was superior only at the smallest sized ranch considered.

There were a total of 12 different ranches considered, to allow the six comparisons in the Nevada studies. Four of them had negative rates of return on total investment, five had rates of return between 0 and 2.3 percent, and three had rates of return above 3 percent (Table 5). Those with highest rates of return were the largest and ranged from 1,600 animal units to over 2,000 animal units.

The resource situation and feed purchases allowed operation of about a 500 animal unit ranch and was held constant between the cow-calf and cow-yearling operations in the Wyoming study. The cow-calf system produced \$21 net ranch income per animal unit compared to \$24 for the cow-yearling system. Rates of return on investment were 1.6 for the cow-calf system compared to 2.1 for the cow-yearling system of operation.

TABLE 4

Numbers of Various Classes of Beef Cattle on Farms, by States
January 1, 1966 (1,000 head)

State	Beef Cows and Heifers	Beef calves	Steers over one year	Total beef cattle (a)	Young cattle on feed	Young cattle not on feed[b] Total	Young cattle not on feed[b] Pct. of beef cows & heifers
California	1,325	892	1,153	3,461	952	1,093	82.5
Arizona	475	240	300	1,036	364	176	37.1
New Mexico	708	270	60	1,062	112	218	30.8
Utah	357	166	55	589	81	140	39.2
Nevada	339	145	30	528	29	146	43.1
Idaho	641	418	177	1,265	172	423	66.0
Oregon	792	370	104	1,305	97	377	47.6
Washington	445	347	184	1,004	131	400	89.9
Montana	1,723	853	94	2,739	97	850	49.3
Wyoming	775	408	87	1,302	41	454	58.6
Colorado	1,364	810	465	2,693	596	679	49.8

[a] Includes bulls also.
[b] Young cattle are defined here as beef calves and steers 1 year and older.
SOURCE: "Western Livestock Roundup," Vol. XIII, No. 3. Agricultural Extension Service, University of Wyoming, in cooperation with the U.S. Department of Agriculture.

Wyoming Cooperative Crop and Livestock Reporting Service, *Cattle on Feed Report—January 1, 1966*, Wyoming Department of Agriculture and USDA Statistical Reporting Service.

TABLE 5

Summary of Net Ranch Incomes Per Animal-Unit and Rates of Return on Total Investment for Selected Typical Ranching Operations in the Western States—1956-1965 Average Prices and Conditions.

Ranch Location and Size and Type	Cow-Calf Net ranch income (Dols.)	Cow-Calf Rate of return (percent)	Cow-Yearling Net ranch income (Dols)	Cow-Yearling Rate of return (Percent)
Western Nevada[1]				
160 A-U	38	a	—	—
200 A-U	—	—	23	b
395 A-U	12	b	—	—
565 A-U	—	—	24	2.1
912 A-U	19	2.3	—	—
2,065 A-U	—	—	29	5.4
Northeastern Nevada[2]				
234 A-U	10	b	—	—
298 A-U	—	—	13	b
530 A-U	14	.4	—	—
673 A-U	—	—	18	1.3
1,571 A-U	22	3.1	—	—
2,003 A-U	—	—	25	3.5
Wyoming[3]				
503 A-U	21	1.6	24	2.1
Northeastern N.M.[4]				
80 A-U	29	.4	—	—
260 A-U	23	.7	—	—
578 A-U	25	.9	—	—
135 A-U[c]	—	—	38[c]	2.8[c]
588 A-U[c]	—	—	27[c]	2.2[c]

[a] Less than .05 percent.
[b] Return on investment not calculated because it would be negative.
[c] Purchased yearling operations, rather than cow-yearling operations.

SOURCES: [1]LeRoy F. Rogers, "Budgets for Western Nevada Cattle Ranches" Nevada Expt. Stat. MS8.
[2]LeRoy F. Rogers, "Budgets for Northeastern Nevada Catt Ranches", Nevada Expt. Stat. MS9.
[3]Willis Gordon Kearl, "Comparative Livestock Systems and Tec nologies on Ranches in the Northern Plains Region of the Unite States", Ph.D. Dissertation, University of California, Berkele California.
[4]James R. Gray, "Production and Production Requirements, Cos and Returns for Range Cattle Ranches—Southern Great Plains Northeastern New Mexico." Department of Agricultural Economic New Mexico State University, Processed Report to the W- Technical Committee.

The capital gain treatment in selling cull cows can affect comparisons between systems. Results in the Wyoming studies were evaluated based on returns after estimated income taxes. Thus, the returns are slightly depressed in Wyoming, relative to returns shown by the studies in other states. The cow-calf system received a slightly more advantageous treatment than other systems because it benefits more from capital gains provisions. Even with this advantage, the cow-calf system appears less desirable than the cow-yearling system.

Some other systems of operations were also considered in Nevada, Wyoming, and northeastern New Mexico. Two purchased yearling types of operations had rates of return of 2.2 and 2.8 percent on investment in northeastern New Mexico.(11) Rates of return were from .4 to .9 percent on total investment for three different types of cow-calf operations covering the same size range in animal units.

Warmup feeding operations in conjunction with cow-yearling systems were considered and also a finishing operation in conjunction with a cow herd was considered in western Nevada.(27) A 940 animal unit cow herd with a warmup operation produced a 4.7 percent rate of return on total investment compared to 2.3 percent rate of return for a 912 animal unit cow-calf operation (Table 6). A 605 animal unit cow herd with finishing operation produced a 3.6 percent return on total investment compared to a negative rate of return for a 395 animal unit cow-calf operation and a 2.1 percent rate of return for a 565 animal unit cow-yearling operation.

The Wyoming study, applicable to Northern Plains ranching conditions, indicated that the cow-yearling system of operation would be superior to a cow-calf system of operation.(14) Other systems of operation tested in cluded fall or spring purchased stockers in addition to cow herd, fall or spring purchased stockers separatel and fall and spring purchased stockers together. Resul were calculated assuming several different distances fo hauling purchased stockers. Regardless of the assum tions or the combinations, the systems using purchase stockers either alone or in addition to a cow herd we all superior to either a cow-yearling or a cow-calf syste of operation.

The study has application particularly to the plai area in Wyoming. However, we see increasing eviden of application of purchased stocker systems in the mou tain valley areas of Wyoming. The problems associat with haying the relatively unproductive high elevati irrigated meadows and the problems then of feeding be cattle through the winters in the high mountain-valley areas are becoming acute. Labor is scarce and it is difficult to mechanize the hay harvesting and the feeding jobs to the extent that much other farm work has been mechanized. Heavy expenditures for equipment which would allow mechanization of these processes can hardly be justified for 30 to 45 days of use each year on hay which yields about 1 ton per acre and produces only one cutting per year. Consequently, many ranch operators are looking for means to escape the haying and winter feeding operations. The use of purchased stocker systems has been selected as the solution by a number of ranch operations, especially by larger operations.

Reference to Table 4 indicates that young cattle not on feed on January 1, 1966, exceeds the number of cattle on feed in each of the 11 western states except for Arizona. In several of the states the numbers not on a fattening ration exceed those on a fattening ration by a large margin. In view of the large numbers of animals which are being carried under some type of wintering, "backgrounding", or warmup type of operation, it would seem appropriate for Animal Science departments in the west to redirect greater efforts toward study of feeding of these types of animals.

Wintering costs per pound of gain can be greatly reduced by feeding for a good rate of gain through the winter. However, the advantage of higher rates of gain through the wintering period are partially offset by compensatory gain during the summer. If different types of rations, or if different types of pastures, or different treatment for animals on pasture could be applied to allow animals fed for a higher rate of gain through the winter to hold a greater proportion of the advantage on through the summering period, the results could be very significant from an economic point of view.

There have been studies relating the amount of subsequent summer gains to the amount of gain in the previous wintering period. It would also be desirable to examine the amount of summer gain in relation to the kinds of feed fed as well as the rates of gain achieved in the previous wintering period.

Also, it would be desirable to study the relationship between previous winter period gain and amount of summer gain as it is influenced by the turnout date on pastures or ranges, the range or pasture readiness for grazing, the type of pasture used, etc. Previously, it was mentioned that the use of crested wheatgrass pastures for four to six weeks in the spring of the year can have a significant effect on rate of gain on yearling animals on Northern Plains or Intermountain ranges. The use of such pastures might also be advantageous for animals fed for a higher rate of winter gain.

TABLE 6

Summary of Net Ranch Incomes per Animal Unit and Rates of Return on Total Investment for Selected Typical Ranching Operations Using Warm-up, Finishing, or Purchased Stocker Systems in the Western States.

Location, Type and Size	Net Ranch Income (Dols)	Rate of Return (Percent)
Western Nevada[1]		
Cow-yearling with warm-up		
225 AU	21	
940 AU	33	4.7
Cow herd with finishing		
605 AU	37	3.6
Wyoming (502 AU resources base)[2]		
Cow-Calf	21	1.6
Cow-Yearling	24	2.1
Fall-purchased Stockers plus Cow herd[b]	26	2.4
Spring-purchased Stockers plus Cow-herd[b]	29	2.8
Fall purchased Stockers only[b]	31	3.3
Spring purchased Stocker only[c]	33	3.5
Fall and Spring purchased stockers[b c]	34	3.7
Spring purchased stockers only	47	5.8
Fall and Spring purchased stockers[b]	42	5.0

a Negative returns to capital.
b Assumes 400 mile transportation cost in procuring fall or spring purchased stockers.
c Assumes 1,200 mile transportation cost in procuring spring purchased stockers.

SOURCES: 1 LeRoy F. Rogers, "Budgets for Western Nevada Cattle Ranches", Nevada Expt. Stat. MS8.
2 Willis Gordon Kearl, "Comparative Livestock Systems and Technologies on Ranches in the Northern Plains Regions of the United States", Ph.D. Dissertation, University of California, Berkeley, California.

Equilibrium Adjustments

An individual producing firm (a farm or ranch) in a static economy will be in equilibrium if resources are organized and used so that the firm is maximizing profits and there is not a tendency for the firm to wish to either reduce or increase output, or convert to a different form of output or a different line of production. An industry will be in equilibrium if all firms in the industry are in equilibrium and if there is no tendency for firms to enter or to leave the industry. A host of physical factors and relationships are important, but the determinants of equilibrium conditions can be resolved to price of output and cost of production. Obviously, economic equilibrium is an idealized or conceptual situation which could be achieved in a static economy where demand, technology, and other conditions continue unchanged. In a dynamic economy, equilibrium is continually being approached but never being achieved.

The range livestock industry at the present time is approaching an equilibrium adjustment between the marketing of cattle as calves or yearlings, and in use of various different stocker or warm-up systems of operations. Firms are constantly making adjustments. Obviously, anything which affects the cost structure or the output prices of the industry will immediately dictate more rapid readjustments and reallocation of resources within the industry in order to approach equilibrium under changed conditions.

Two things are presently happening in respect to the range livestock industry which may dictate rapid changes. The Bureau of Land Management and the U.S. Forest Service in the past have considered every animal over six months of age as one animal-unit. The Bureau of Land Management is presently considering calculating animal-unit-months at 2/3 of an animal-unit for a yearling compared to one animal-unit for a dry cow or a cow with a calf. A change from the use of one animal unit for each animal over six months to the use of 2/3 of an animal-unit for yearlings would allow stocking of three yearlings on the BLM ranges where previously only two yearlings or two cows either with or without calves could be stocked. It would allow substitution of three yearlings for two cows on the range where previously the substitution had been two yearlings for two cows. This constitutes a major change in resource requirements for yearlings compared with cows and it would result in making yearling operations or cow-yearling operations more advantageous than they have been in the past.

This prospective change in method of calculating animal units also emphasizes the importance of further research on all ramifications of winter feeding programs in relation to subsequent summer gains for yearlings. Further work on the use of stilbestrol implants through growing stages would also be important.

The second factor which could have a great effect on the equilibrium conditions for the range livestock industry would be the use of preconditioning. This may introduce large costs without compensating price increases and dictate a further rapid shift toward a cow-yearling system of operation, for producers who have not otherwise been considering it.

Integrated Operations and Optimizing Programs

In the range livestock industry and the livestock feeding industry, at least two decision makers with some conflict in goals are involved in moving most of the cattle from conception or birth to slaughter. These decision makers might quite naturally have conflicting views on the use of preconditioning. In completely integrated operations, a single decision maker with no conflict in goals can decide on the approach which is most economical for getting beef from conception to slaughter. Examination of the practices followed by such integrated operations may give a good indication of the most efficient procedures, since there is no conflict in goals to distort decisions. In many cases, such integrated operations will wean calves and keep them on the ranges until they are past yearling age or approaching two-year-olds before they are sent into the feedlot. Also, a principal objective in many such integrated operations is to minimize the handling of cattle, minimize the time in transit and minimize the use of immunizations insofar as possible. This might be the preferred procedure in marketing, as contrasted with some of the steps advocated for pre-conditioning.

There is a ranch in Montana which is consistently doing much better, financially, than any others of comparable size in that area[1]. It is a moderately large-sized ranch which uses Charolais bulls for cross-breeding, puts the weaned calves into some type of wintering or warmup program, then back onto the range or into feedlots. Finally the cattle are custom-slaughtered and sold on the rail on a carcass grade and weight basis. This approach to management may well be the equilibrium adjustment presently indicated, and the wave of the future for medium and larger-sized ranch operations. The use of stilbestrol implants at one or two of the three pre-fattening stages might also be desirable for such an integrated operation.

[1]Personal conversation with Mr. Richard O. Wheeler, Agricultural Economist, Economic Research Service, U.S. Department of Agriculture, Bozeman, Montana.

Conclusions

Among academicians, it is always safe to conclude a paper or a talk by advocating further research. Further research is required into the subject of pre-conditioning. The published information which is available would give no basis for recommending an optimum pre-condition procedure, even if only one decision maker and one set of conditions and objectives were involved. It is not clear whether the optimum procedure would be a large amount of immunization and post-weaning feeding routines prior to shipment, or whether the optimum procedure would be to minimize handling and immunization at the ranch and also to minimize time in transit to the feeder, or whether yet another procedure would be the optimum.

Additional research is required to determine the optimum procedures for a ranch operator to follow in order to maximize his own profits.

There is some research presently under way and some nearing conclusion, which would shed light on important questions pertaining to pre-conditioning. However, there must be time to allow completion and publication of research and further time to allow economic evaluation of it before rendering any final judgment or making any final recommendations pertaining to pre-conditioning.

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"FEEDER'S STANDPOINT"

Mr. R. McDougal
President, California Cattle Feeders Assn.;
Nevada-Nile Ranch; Lovelock, Nevada

I like this sort of job when somebody asks me to tell them what my problems are as long as I don't have to figure out what the answers are or explain them. It's not such a difficult job. I was not fortunate enough to be here yesterday so I don't know the depth at which you went into some of these things so I suspect that probably many of these problems that the feeder encounters have been delved into and somewhat digested by the speakers yesterday. So I am going to hit some high points and I doubt that George is going to have to flash any cards at me other than get going or something like that. First I'd like to point out that these preconditioning problems as we call them today, in my estimation, didn't really exist until the last five or six years when the feeder started buying calves. When we were buying yearling cattle from five and a half, six, six and a half, seven and clear up to eight hundred pounds, we surely didn't have the problems with acclimation into the feedlot which we see today in our western feedlots. I suspect that this is a result of a demand for backgrounded type of beef that the packers want from us today and also the availability of yearlings to the feeder. In years past, we just went out and bought yearling cattle, whereas today the cow- and calf-man has to crank his operation up a little faster and get those calves sold as calves to make more room for a few more cows on the pasture. Our industry has evolved around to a situation where the feeder is buying a heck of a lot of calves and I don't see where this situation is going to change too much in the near future. As far as the problems go, I don't think that they are completely confined to the stress situation as we know it. I'm from the northern part of California and Nevada so that my problems are not the same problems that exist, for instance, in southern California. For instance, the calves we buy for our feedlots come probably from the maximum haul of six or seven hours and probably three to five is most typical. Whereas down in southern California, a haul of anywhere from 72 to 96 hours is not untypical. This is certainly where the stress situation comes in. But nevertheless we still have our problems with our calves and this is why I say that the stress is not the only problem that we are facing here. I can recite instance after instance where we've hauled in cattle twenty miles from our ranch and had more problems getting those calves straightened out than calves we hauled in from five or six hundred miles away. So as far as the transportation stress or an auction yard stress or something like this, it just wasn't present. But nevertheless we do have our health problems when the cattle get to the feedlot. I'd say only that stress accentuates the problem. We have these certain sicknesses that develop in the calves and stress probably just makes them ten times worse than they normally would be. As far as what can the feeder do to help reach a solution to this problem of the sickness in these calves that they are coming into the feedlot, I think that the one big item for us to do is to maintain proper husbandry in the feedlots. Proper nutrition and proper medication can be developed through the expertise of our nutritionists and our veterinarians who are available to give us the services and the medicines at their disposal. But our contribution more than anything, I think, is just the proper husbandry of the cattle. By that I mean having relatively sanitary pens when the cattle come to us, having good hay for the calves to eat when they get there, having good clean water available, and having the cattle away from an area where there is a lot of activity going on. I think this is certainly my most valuable contribution as to what I can do to eliminate this problem. I'd like to ask a question. What would the feeder like to have done to calves before shipment? Maybe some of you won't agree with me and probably most of you won't, but in order of importance in my estimation as to what I'd like to have done are the following: (1) Have the feeder calves broke to eat and drink out of troughs before they ever get to the feedlot. I think that this is probably one of the most important things because if any of the calves won't eat or drink, we can hardly get some of these medications into them and get their rumen turned around and headed in the right direction. (2) I'd like to see the calves weaned on the ranch. Now this isn't a panacea to end all problems or anything like that, I realize—this weaning on the ranch. But it certainly is better than having a lot of these calves weaned on their way to the feedlot and having them walk fences because certainly we create a lot of problems when we have calves walking the fenceline. (3) An immunization program I would put down third on my list, such as being discussed here at this conference. Certainly this is important and probably the most *scientifically* important aspect of these things that I have brought out, but this husbandry problem I think is number one. Now there are some unanswered questions in my mind that I would like to ask you people. Maybe some of them have been answered. (1) What is the feeders' best method and time for indoctrination procedures after the calves have got to the feedlot? The shots, branding, dehorning, and castrating, if necessary—when is the best time to do it? I know when I do it, and I think I have fair success, but I also know when my good friends down the road do it. They do it completely opposite from me and they have fairly good success also. There is an inconsistency involved in this whole thing it seems, and I just don't know when the *best* time to handle these calves would be. Is it the day they get in there and get this over with and let them get out in the pen and get straightened out or should we let them straighten out in the pens and then pull them back out again two or three weeks later and give them their various immunization shots and dehorning? I just don't know what the answer is to it. (2) Another thing I'd like to ask you and I know there has been a lot of discussion on this—Should high antibiotic levels be fed and if so, for how long? Now maybe this is going to be an academic question in a few months if they take the antibiotics away from us, but let's presume that they aren't going to take the antibiotics away from the feedlots. How high a level should be fed to these incoming calves and for how long if we do go on a high antibiotic program, should we keep it up? Now I've been on some programs that I know that every time I talk to anybody that is supposed to know something about it they say, "Oh, my God, you're going to ruin your cattle." But last year our death loss on about 7 to 8 thousand calves brought into the lot, ran right around a quarter of one percent so I think that is a fairly good response to the program we're operating under. But I'm not certain that it is the best way. These are some of the things that are in my mind and maybe as I listen here today, I will get some of the answers. Thank you very much.

"PROBLEMS OF THE NUTRITIONIST"

E. S. Erwin, President
E. S. Erwin and Associates; Tolleson, Arizona

I asked Dr. O'Rourke, one of my associates, what I should discuss. He said, "People, commodities, cattle, in that order."

People:

Indeed, the cattle feeder is in the people business and not the cattle business. Computing a ration on a piece of paper is not difficult. Implementing a ration is the difficulty. Rations and feed ingredients need to fit into management and machinery capabilities. For instance, we deal with three large feed yards in Phoenix. Even though they are in the same commodity area, each feed yard has a different ration formulation. Some feed yards: 1. Cannot accurately add an ingredient less than 4-5% of the diet, 2. Have little control in liquid additions, and 3. Have limited capabilities with men and machinery for proper processing of grains. I could go on for the next 15 minutes describing these types of problems. Consequently, least cost rations have to take into account management and machinery and are not based just on ingredient costs.

Other problems associated with people-nutrition are in the proper feeding of cattle. The better we process grains and feed higher fermentable rations, the more importance needs to be given to how cattle are fed. With these types of rations, cattle must never run out of feed. Cattle may founder, die of acidosis and upset the veterinarians. Furthermore, more buller steers result from cattle being out of feed. When cattle are overfed, mold and separation of commodities can occur. Cattle may eat irregularly during sudden weather change. During rain or snow too much feed in the bunk will be spoiled and simultaneously, a problem may occur. Depending upon the area of the U.S. and expected severity of weather, a nutritionist may be required to formulate a special ration that is easy to mill and reduce risk of mold and overeating of highly fermentable diets. For the most part, we recommend feeding each pen of cattle at least three times daily.

Nutrition and people have another major problem—record keeping and quality control. Poor conversions and high costs of cattle gain are not *a* problem but the result of many problems. Many times the difficulty is pinpointing problem areas. Consequently, maintaining quality control of rations and cattle performance to centralize decision making into a few hands is imperative to interpret whether problem areas are nutritional, managerial or health. This is a subject within itself.

Commodities:

By a computer or sometimes simple arithmetic, we can calculate diets with extreme accuracy. However, we buy commodities by the ton. All of us understand the variance in composition of roughage. However, few understand the variance in grains, our principal feed today. Not only can protein and phosphorus vary markedly but more important, different varieties of a single grain can present sources of problems that are difficult to assess. In the Texas area alone there are probably 125 different varieties of milo produced. Most feed yards just buy milo and do not recognize variety difference. We have studied this problem for the last couple of years and recognize that there is a terrific difference in processing one variety to another. Furthermore, the relative energy value of these processed varieties can vary markedly.

Molasses is another example where we buy by the ton and brix which has little to do with nutritional value. Sugar content of molasses can vary from 46-60%, yet we all buy by the ton at the same price.

Another example is fat. Animal fat is sold on million IU basis $/ton. Vegetable fat is sold on a total fatty matter basis. The latter does not take into account unsaponifiable matter. The energy value of this fraction is a small part of true fat. Furthermore, vegetable fat has a natural emulsifier and can carry a high amount of water. Proper checks and quality control of this product is imperative. You can appreciate the difficulty these factors can contribute in implementing a ration with a certain nutrient composition.

Cattle:

Starting cattle on feed poses one of the real problems in a large feed yard and in particular, a custom feed yard. This is because cattle arrive in a feed yard with different degrees of stress and in particular, different types of nutritional background. We start cattle from grass that are shipped from any distance on a fairly high grain ration with long hay for a couple of days. By the time they are consuming a normal daily amount we can change to a top ration with little difficulty. Problem groups of cattle can be those that originate from a growing program or those who have been in a feed yard and turned out to grass. These cattle know how to eat and will load up the first day or so on the normal high grain feed. Acidosis, etc., can occur. These cattle have to be fed a lower grain feed and carefully adjusted to the top ration. While these cattle can be properly handled, the real problem arises from improper communication and sometimes the lack of information. Other cattle come from irrigated pasture, dry grass and even cactus. Each requires special consideration.

While we nutritionists have many more other problems for discussion that the time here permits, I suspect we can write to Dear Abby for the answers.

"VETERINARIAN'S STANDPOINT"

by
Dr. D. Flack
Veterinarian; Monford Feedlot; Greeley, Colorado

We are meeting to discuss "preconditioning of feeder cattle." I would like to inject another term—"Total herd health management." These cattle are living, physiologically functioning organisms. We're using them as a tool to produce a desired product. We must rely on natural processes of this animal to actually accomplish this production, but we're not satisfied with a status-quo—we want more—for less. We're going to push these animals for all the production we can get, and seeing as how they all vary somewhat we're pushing a few too hard in order to get the most out of the most. I like to look at our health problems in the feed lot as products of our own making.

A cow wandering the prairies of days gone by has a calf. He receives his needed nourishment in the God given manner and bit by bit introduces himself to that same grass his mother feeds on. Little by little the milk supply diminishes in amount to nothing and the calf is on forage to grow and mature. No sudden changes, immunity by natural exposure over a period of time, and illness a thing seldom heard of.

It's been our eagerness that has decided that a cow should be improved so as to produce 2 to 4 times as much milk and maintain that production right up to the day we wean that calf. At that time, we not only take away his familiar nourishment, we jostle him around, pen him up, run him up and down alleys, slam him around in gates, pop whips, yell, shout, chase with horses, poke needles in his rump, crowd him in a cage that goes rumbling down ribbons of steel or on mats of concrete. Wind blows, dust swirls, floors are wet and cold. Then we let him loose, poke him in the rump a few more times, more chasing, yelling, whips popping and into a new small, small world, here the ground is bare compared with what's been home, water is in a little box and sure tastes different, and there's some kind of ground up stuff over there on the other side of that fence but it sure doesn't look like anything he's ever eaten before, and he is hungry, scared, tired, thirsty, cold, wet.

I don't think anybody really expects a two cc shot of anything to protect us against all these various stresses, combined or separately. The picture I paint is the extreme, naturally; but yet many times closer to being true than we would like to admit.

We Must Consider Management As A Cause of S.F.

When examining the many various infectious agents we are confronted with we must not over-look the total effect of exposure, close confinement to a large variety of animals and potential pathogens, handling, processing, vaccination, infections, dehorning, castrating, nutritional changes, demands of extraordinary and maximal consumption of unusually high quality and energy producing feeds, abnormal hormonal stimulation, production processes, and many more, all occuring within a relatively small portion of this animals total life span, but at that exact time in his life when he is probably the least capable of combating these stresses.

These are the reasons I like to look at "total herd health management," not just a vaccination routine.

When considering the causes of feed lot diseases:

Reoviruses	Pasteurella
Rhinoviruses	Streptococcus
Adenoviruses	Staphlococcus
Myxoviruses SF_4 PI_3	Hemphilus
BVD	Corynebacterium
MCF	Spherophorus
IBR	Mycoplasma
Psittacosis-lymphogranuloma related organisms	

I don't want to leave the impression that I don't support the concepts of "preconditioning". I do,—wholeheartedly—death loss, therapy costs, shrink compensation, etc. can be easily calculated. Considering death loss alone—800 lb steers, \$26.50—every 1% death loss is an added ¼ purchase cost. This is purchase cost only. No shipment, feed, handling, treatment, etc. The costs are definitely there, they're high, and they're easy to substantiate—health management is needed—but I don't think that health management can be described as a list of vaccines. The proper vaccines at the proper time are important, but they are only a part of the picture. It must also be remembered, that practicalities don't always coincide with theoretical and sometimes we have to settle for second best, or worse. When this is the case however, it should be recognized as such and compensations, where indicated, be made.

The best single tool we have available for the management of the disease syndromes of cattle is the human mind. We cannot justify the expense or the efficacy of unnecessarily administering various products, but when a genuine need exists, the proper agent and proper administration at the proper time is an economic necessity. This determination is where the judgment of the qualified veterinarian must be interjected. But when considering all the technicalities, ramifications, and complications involved, never forget that there isn't a university in the world that ever gave a degree in "common sense".

"ECONOMIC PROBLEMS OF THE FEEDER[1]"

by
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The economic problems of a cattle feeder in connection with his purchases of feeder cattle are:

1. *Price—*
   With a consideration of quality and quality differences —with a consideration of likely differences in cost of gain —with consideration of likely differences in sale prices at the end of the feeding period.
2. *Timing—*
   With increasing year-round feeding and frequent placements on feed, a feedlot operator has supply problems at certain times of the year.
3. Getting the particular weights of cattle and the sex of cattle wanted for placement on feed.
4. Getting cattle that have been treated in certain ways before delivery to the feeder.

If the feedlot operator is unable to get what he wants in feeder cattle—and when he wants them, he is going to try to set up other contract or ownership arrangements to assure the supply of the kind of feeders he wants and when he wants them.

With specific reference to "preconditioning," the need on the part of producers to obtain additional returns for special preconditioning practices bumps up against the interest of feedlot operators in buying the cheapest cattle possible with consideration of quality differences, gainability and cost of production differences, and differences in market returns.

Dr. Carlson said last night that "We must define the problem." In this case, isn't it a communications problem? If so, we have a choice of solving this problem through the educational system—or through the market system—or a combination of both. Frequently, the market system is ineffective in this "communications" we talk about. The communications needed in this case are from the slaughterer or the feedlot operator back to the owner of the cows that produce the feeders that were fed and slaughtered. The purpose of the market system is to facilitate the transfer of ownership. But we expect it will also provide some of the needed communication.

In his talk yesterday afternoon, Dr. Kearl said that, based on research data, he doesn't see how producers can provide preconditioning services which require special handling without receiving any special premium. Dr. Bristol's casual response to this was "You are going to have to change your economics." That response was about as creditable as someone who might say "You are going to have to change your reproduction principals and get a calf every six months."

Dr. Wayne Burch of Wisconsin has written "Preconditioning adds production costs which may be passed on to the buyer. The buyer can expect to cover these costs through better calf performance in the feedlot."

Dick McDougal indicated that from a feeder's standpoint, he must look closely at prices between his alternatives for obtaining supplies of feeder cattle. Now we are back to communications again. In this communications problem in the market system, with regard to preconditioning, the feeder needs to know how the cattle have been handled and treated before he gets them. And he needs to have indications of whether additional preconditioning costs will be recovered by better performance in the feedlot.

There is also much difference in how this communication can be accomplished with the small farmer-feeder in comparison with the large commercial feeder. Communication can be quite effective between a small farmer-feeder and the rancher from whom he buys feeder cattle. It is much more difficult to obtain the needed communication from a large commercial feeder through many order buyers or many market outlets back to the individual cow herd owners spread over a wide geographical area. There is also a lot of difference in the "how" of this communication with suppliers of feeder cattle from different areas and different scales of operation.

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[1]Comments made at the Conference on Preconditioning Cattle, University of Wyoming, June 27, 1968.

"PARAINFLUENZA 3 (PI-3) AND PASTEURELLA"

by
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It has been almost nine years since the first report of the isolation of the SF-4 strain of bovine myxovirus parainfluenza (PI-3) from cattle infected with the bovine respiratory disease complex known as "shipping fever" by Dr. R. C. Reisinger and co-workers at Beltsville, Maryland in August of 1958.[6] Their report closely followed the report of the isolation of a nearly identical virus from young children with "croup".[1]

These reports seemed to stimulate renewed research efforts on this bovine respiratory disease complex which is responsible for losses due to death, failure to utilize feed and gain weight and expense of treatment. Some of the subsequent research work was accomplished cooperatively as a regional research project by research workers of the Agricultural Experiment Stations of the Land Grant Universities of the North Central Region of the United States. The results of the regional project were published as a regional research bulletin on "shipping fever" in 1965.[3]

One of the original members of the regional research project committee, Dr. A. L. Hoerlein, proposed the theory that a combination of stress factors plus a virus infection plus a secondary bacterial infection resulted in "shipping fever".[5] He concluded that the factors were not specific but that the results were the same, a disease diagnosed as "shipping fever".

Following the initial isolation of PI-3 virus many other isolations of it were made from cattle with the disease in many geographic areas of the United States and in many other nations around the world. Serological surveys revealed that many cattle in widespread areas had specific antibody for PI-3 virus in their serum indicating previous exposure and serologic response to it.

The infection associated with PI-3 virus appears to be most important in the fall of the year in calves stressed by weaning, shipping, inclement weather, dusty conditions, nutritional changes and poor management. Signs include high fever, depression, clear nasal discharge which becomes purulent in a few days, watering of the eyes, loss of appetite with failure to gain weight, cough, and sometimes difficult breathing. The latter is often associated with the development of fibrinous bronchopneumonia and in severe cases death. Failure of infected calves to gain weight during the convalescent period has been observed for as long as 56 days after viral infection even though food consumption had returned to normal.[8] This has important economic implications. Subclinical infections with PI-3 virus in the spring in the absence of stress factors resulted in antibody production but no signs of illness.[7]

Research workers were unable to experimentally reproduce the same disease as seen in the field with the PI-3 virus alone. In susceptible calves the virus would cause a rise in temperature, depression of the white blood cell count and clear nasal discharge, but not the complete disease syndrome. The experimental reproduction of "shipping fever" was accomplished by research workers at the Ohio Agricultural Research Development Center at Wooster, Ohio.[4] They used calves which were raised in isolation with no contact with either the PI-3 virus or *Pasteurella* bacteria. They exposed different groups of such calves to stress factors alone, PI-3 virus alone, *Pasteurella* alone, stress and virus, stress and bacteria, virus and bacteria, and finally the combination of stress, virus and bacteria. It was only in calves exposed to the combination of stress factors, PI-3 virus and *Pasteurella* bacteria in combination that the disease was reproduced and Dr. Hoerlein's theory proven.

The numerous and various stress factors lower the disease resistance of the animal in many ways. The PI-3 virus acts specifically on epithelial cells which line the surface of the respiratory tract. It invades them and ultimately destroys them in the process of producing more virus particles. Other viruses such as Infectious Bovine Rhinotracheitis (IBR) virus can also do this. With lowered resistance by stress and destruction of respiratory epithelium by virus, bacteria such as *Pasteurella multocida* and *Pasteurella hemolytica*, especially are able to invade the damaged tissue which acts as a substrate for them to grow and multiply. The bacterial infection is what ultimately produces fibrinous bronchopneumonia and death.[2]

Subsequent research work with cow herds with antibody to PI-3 virus has revealed that the level of specific circulating antibody to PI-3 virus increases in the cow prior to calving and then returns to the former level during lacation.[7] When the calf is born, it has no antibody until it nurses the cow. Antibodies are passed to the calf in colostrum and result in blood levels in the calf equal to or greater than that of the dam. However, cows which have never been infected with the virus or vaccinated with PI-3 virus vaccine or which have failed to produce antibody would not have PI-3 virus antibodies circulating in their blood or present in their colostrum. In calves which do receive specific PI-3 virus antibody in the colostrum from dams with antibody, the level decreased with age and disappears by weaning time at 6 to 8 months of age.[7]

Calves do not develop antibody of their own until they are exposed to the virus. High levels of specific PI-3 colostral antibody neutralize PI-3 virus and prevents infection. Antibody against PI-3 virus develops when the calf comes in contact with the virus after colostral antibody has decreased or disappeared. If exposure occurs at the time of weaning along with stresses such as shipping, change of feed, inclement weather, and poor nutrition and management, and in the presence of *Pasteurella* signs of "shipping fever" may develop. Infection with the virus alone in the absence of stresses apparently does not cause obvious signs of the disease.[7]

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Following exposure to the virus, antibody develops within a week to ten days and reaches a peak in three to four weeks.[7] Following the peak, the level drops soon after to a low level where it remains until re-exposure to the virus occurs. This drop has important implications in interpretation of laboratory tests. Anamnestic response with no illness follows re-exposure to the virus. It is demonstrated by a rise in antibody level which later decreases but to higher level than previously. Antibody remains detectable into maturity.

It appears that the optimum time to administer a vaccine for PI-3 virus to protect against infection would be approximately 3 to 4 weeks before weaning.[7] At such time, colostral antibody would have probably decreased to a low level which would not interfere with active antibody production stimulated by the vaccine. Such timing would also allow time for active development of vaccine antibodies to protect from active virus infection at the time the stresses associated with weaning occurs. It is believed that if adequate circulating antibody to the virus can be produced so that protective amounts of antibody are also present in respiratory secretions that PI-3 virus invasion can be prevented and then bacteria could not penetrate the intact epithelial cells of the respiratory tract. An animal with such immunization would probably respond to virus challenge by active production or specific antibody to the virus.

There is no effective way to treat virus infections in cattle. It was demonstrated with polio and IBR viruses that the only practical approach to such virus diseases was to prevent them with vaccines. Following the advent of new knowledge of the role of PI-3 virus in "shipping fever" considerable interest was aroused in the development of PI-3 virus vaccines to stimulate antibody and immunity to the virus in cattle in order to prevent the morbidity, mortality and economic losses associated with the disease. As with polio, both inactivated and modified live PI-3 virus vaccines capable to stimulating antibody production have been developed, licensed and marketed. There are inactivated PI-3 virus vaccines combined with *Pasteurella* bacterins and modified live PI-3 virus vaccines combined with other modified live virus vaccines. Each as its own specific merits and all are subject to the limitations of any immunizing process. No immunizing process results in 100% protection. All work best when properly used according to the manufacturer's recommendations in healthy animals. Too many vaccines are used too late to be effective in stimulating protective antibody before exposure and some are even misused as treatment instead of prophylaxis.

For many years *Pasteurella multocida* was thought to be the cause of "shipping fever". Bacterins made from this species of bacteria have been used for years but it has been obvious that they did not do the job of preventing the disease. This led some to believe that the bacteria was not the cause of the disease and to suspect that a virus was involved. One problem, however, was that virus diseases do not respond to sulfonamide and antibiotic therapy. "Shipping fever," however, does respond to such therapy when treated early in the disease.

It is now known that certain serotypes of both *Pasteurella multocida* and *Pasteurella hemolytica* do invade virus damaged epithelial tissue of the respiratory tract and proceed to produce fibrinous bronchopneumonia.[2] They apparently are not capable of doing this without preceeding stress and/or virus infection devitalizing and destroying the epithelial cells which serve as a substrate for bacterial growth.[2] They are the organisms which are susceptible to sulfonamide and antibiotic therapy.

Such information helps explain why early *Pasteurella* bacterins were not effective in preventing the disease. They were directed at the agents of secondary infection. However, it has also been emphasized by Dr. J. R. Collier that the early types of *Pasteurella* bacterins did not include the serotypes of *Pasteurella multocida* and *Pasteurella hemolytica* which he has found to also be involved in the disease.[2]

If PI-3 and IBR viruses were the only epitheliotropic viruses involved in the bovine respiratory disease complex and adequate local immunity in the respiratory tract was stimulated by vaccination for them, then immunity to the *Pasteurella* bacteria would probably not be necessary. There are, however, a number of other viruses including the adenoviruses, the rhinoviruses, the reoviruses, the enteroviruses and others which may invade the cells of the bovine respiratory tract and open the way for bacterial invasion. Considerable research on the epizootiology and pathogenesis of these viruses is needed before their real importance will be known. Consequently, improvement in *Pasteurella* bacterins and development of better immuniity to the proper serotypes of both *Pasteurella multocida* and *Pasteurella hemolytica* should be of continuing practical interest.

In conclusion, the proper use of any vaccine and/or bacterin prior to weaning requires extra handling of the calves in addition to the products used. The extra work and expense would be worthwhile, however, to both the producers for the heifer calves which they keep as replacements and feeders for the feeder calves they purchase if the procedure was effective in preventing or reducing the incidence of the bovine respiratory disease complex. The extra investment would also pay a good dividend if it should prevent or reduce the 50 to 60 day period during and following infection when the animals fail to gain weight.

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"UPPER RESPIRATORY COMPLEX"

Research IBR - BVD - Mycoplasma

by

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Upper respiratory complex in cattle is as the name implies, very complex as to the causative agents.

It is a well documented fact that Infectious Rhinotracheitis and Bovine Virus Diarrhea are two major significant contributing causes. In fact, there are enough published articles confirming this that the papers would well cover the walls of this auditorium.

Research, in reference to these two major cattle virus diseases, has produced some very complete facts. Let's review the known facts before entering into today and tomorrow's research.

I.B.R. and B.V.D. are contagious virus diseases of low mortality with morbidity being the major, expensive end results. They have been diagnosed in every state and every type of cattle operation; not just the feedlot. University and industrial researchers have done an excellent job of developing a highly successful, modified live vaccines for both diseases. When properly used, they have done an excellent job of preventing these diseases.

Millions have been spent to obtain the previously mentioned information and vaccines. The federal Animal Research Services, Biological Control Division, has confirmed industry statements that these vaccines are effective when properly used, stable, and non-transmissible. These facts are confirmed with each serial lot produced for sale by extensive quality control procedures.

Why then are not these two diseases being controlled? This question is perplexing federal, university, and industry people daily.

With the dollars spent in the area of research and development to arrive at this point, it now has forced federal, university and industrial groups to extend their efforts and money into this new area. Why have these products not controlled the diseases?

The first area being explored is the use of these vaccines. This brought to light many surprising facts.

Much of the vaccine was being used in calves who were carrying maternal antibodies for I.B.R. and B.V.D. Depending upon the levels, but in most cases these antibodies neutralized the vaccines. These animals then were completely susceptible when the maternal antibodies were gone.

Literature and vaccine direction explicitly recommend that I.B.R. be used on calves four to six months of age. Maternal antibodies for I.B.R. have been demonstrated to maintain an interfering level up to four months, and in some instances, six months. Therefore, calves should not be vaccinated for I.B.R. before four months, and if vaccinated between four and six months, they should receive a second shot of vaccine after six months of age.

B.V.D. presents a different picture. Maternal antibody interference occurs up to six months, and can persist up to eight or nine months. This then means that B.V.D. immunization should not occur younger than six months. If vaccination does occur between six and nine months, a second injection is indicated.

Researching these just mentioned facts and demonstrating one area that contributed to problems in the control of these diseases opened up another area of exploration. The control of most diseases usually starts with the brood stock. Research into this area demonstrated few users of these efficient vaccines in cow-calf operations, and when used in numerous instances they were used on pregnant animals. This produced abortions, weak infected calves, and many other problems creating a negative vaccine attitude.

Protecting parent stock is the first step in control of these viral diseases and empty or non-pregnant animals should be vaccinated. This then establishes herd protection, as well as calf protection, with a positive maternal protection picture to develop a sound control program.

Another area explored in this expensive field research was in the feedlots where the real visual problem occurs. Researchers found that a large percent of the vaccines were being used in the face of infection, which is not the reason these vaccines were developed. Biologicals are preventive, not therapeutic products. Although cellular protection may aid in the course of the disease, in many cases they can be detrimental or create a lack of confidence in the vaccines.

Feedlot usage is very crucial because these vaccines will apply a certain amount of stress being, modified live viruses, and when this is superimposed upon a shipping or nutritional stress, many times results can be disastrous.

Nutrition, as was just mentioned, is an all important factor which has been brought out at this conference as well as in numerous publications. An animal must have those ingredients necessary for ammunition to utilize its inherited ability to fight disease.

Field exploratory research brought out into the open another surprising area that contributes to the over-all problem. Industry is duty and legal bound to supply a stable, effective product for consumer and professional use. Desiccated or dried modified live vaccine are extremely stable in this form. When reconstituted and properly used, the products deliver a fully potent immunizing dose. The facts collected in the area of handling and actual usage of these two vaccines were very astounding.

The products, in many instances, were stored unrefrigerated. These products in their desiccated form are stable under normal shipping, but not indefinitely.

Needles one quarter to one half inch in length were used to obtain an intramuscular injection. A good hided animal chosen from selective breeding has a hide this thick in many cases, or thicker. In many cases, because of the numbers to be vaccinated, the animals were injected while proceeding through an alley chute at a pace in some instance that it was difficult to keep up with the tally.

With these factors found in reference to product handling and usage, the question is posed, what percentage of effectiveness can a vaccine obtain under these circumstances?

Continual surveilance research has also pinpointed another major area of concern. The majority of freshly reconstituted, modified live vaccines are not being used immediately as directed. In many cases enough vaccine was reconstituted to complete one-half or the whole job in advance. This, in numerous cases, meant four to eight hours in advance of use. Research has demonstrated that reconstituted modified live viruses are very sensitive to direct light exposure. B.V.D. and I.B.R. Vaccine reconstituted exposed to direct light, even though setting in or on ice, will have no live viral particles in 60 to 90 minutes. Both vaccines are quality controlled to contain, upon reconstitution, enough live viral particles so that when the recommended dose is given by directions, immunity will be produced. How much immunity is produced when a light exposed I.B.R. or B.V.D. Vaccine is used two hours after reconstitution?

The present investigational field research has opened up many avenues for improvement. It is without saying that utilization of scientifically known facts and products properly will solve many of the problems facing the cattle industry today.

If the knowns can be implemented properly, and the facts be transmitted from one portion of this industry to another, great progress can be achieved.

Tremendous strides have been made into this area of upper respiratory complex. Numerous knowns have been compiled, but like any problem there still are many unknowns. The I.B.R.—B.V.D. portion of this complex presents some needed answers. A satisfactory method of identification so that the serological status is available so that immunization is possible and not just vaccination. Another unknown is the interrelationship between these two virus and other viruses. Still another unknown factor is how complete is the cattle industry's knowledge of biologicals and their place in the management programs to attain the ultimate, economically usable animals.

It probably has been quite apparent that, to this point, we have not incorporated Mycoplasma (PPLO) into this presentation. At this point Mycoplasma has been isolated in numerous places and cases. The bare fact that they do exist and can be a problem in bovine upper respiratory complex is a step in the right direction. Much data has been compiled, but very little comparison and evaluation of the facts has occurred at this time. It can only be stated that all portions of the cattle industry should be aware and on the alert for future developments concerning Mycoplasma.

In conclusion, it must be stated that research has produced an abundance of factual, usable information and products for the I.B.R.—B.V.D. portion of the bovine upper respiratory complex, and if applied properly, should contribute tremendously to the preconditioning program, or shall we say to sound efficient cattle production.

"RESEARCH ON BACTERIAL AND VIRAL ENTERIC DISEASES OF CATTLE"

By
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Enteric diseases of cattle will be discussed under two major headings: (1) calf scours, and (2) diarrhea of older cattle.

Calf Scours

In bacterial enteric diseases of calves, *E. coli* is most frequently incriminated. Research is attempting to determine why *E. coli* may cause a toxemia, enteritis, bacteremia or death of newborn calves.[1] We know that some *E. coli* strains are "normal" inhabitants of the calf's intestinal tract. Why do these bacteria become highly pathogenic in some calves and not in others? What factor or factors permit rapid proliferation of these pathogenic strains of *E. coli*? How can this be prevented? Research has indicated that during the initial stages of calf scours, a change in the pH or acidity of the upper intestinal tract favors proliferation of *E. coli* at the expense of other bacteria.[3]

Research is still looking for the factors that are responsible for pathogenicity. It may be associated with specific antigens in or on the bacteria. Recent Russian reports suggest an improperly functioning pancreas gland (deficiency of pancreatin enzyme) may be the factor that permits *E. coli* strains to become highly pathogenic in the intestinal tract. English researchers, however, explain the pathogenicity of *E. coli* for newborn calves as being dependent upon the bacteria's ability to proliferate and produce an enterotoxin.

Frequently, *E. coli* is not the only bacteria involved. Mixed infections of *E. coli*, and species of *Clostridium, Salmonella* and other bacteria are common.

The wide variation in serologic types of *E. coli* has limited the efficacy of many bacterins administered to dams in late gestation.

Colostrum still remains a potent defense against calf scours due to *E. coli*, however, recent studies have shown considerable variation in specific antibody content of colostrum from different cows. This is primarily due to the variety of previous experiences of the dams with infectious agents.

Scottish researchers have been able to predict which calves would die of scours by measuring their respective levels of gamma globulin during the first few days of life. Calves with low levels of gamma globulin would generally die in four to ten days from calf scours.

Recent research indicates some viral agents, particularly BVD virus, play an important role in calf scours.[2] Use of anti-viral serums may be beneficial in these cases.

Diarrhea of Older Cattle

By far the most important disease is Bovine Viral Diarrhea. This affects feedlot cattle and also cow-calf operations. The mechanisms of transmission of this disease is the subject of considerable current research.[4]

The role of the inapparent infection or the subclinical spreader is not well understood. Intermittent shedding of BVD in the feces and urine has been common. The nature of the dam to calf transmission is also being studied. In utero prenatal BVD infections are not rare, particularly in the fetal kidney.

Methods for differentiating maternal or passive antibody in calves from active or infection antibody are not available. This has raised serious questions as to the proper age to vaccinate for BVD. How important is the maternal antibody interference? How many calves have no circulating BVD antibodies before vaccination and hence, no protection?

It would seem that most calves could be safely vaccinated at an earlier age such as pre-weaning. They may be revaccinated in six months time if warranted.

Does maternal antibody interfere with postvaccinal immunity in a few cattle at the younger age or does a latent field infection in some become aggravated by the stress of movement, multiple vaccination or other handling resulting in a "break?"

These and other problems are being actively pursued by researchers around the world. There are obvious gaps in our knowledge. Progress is further hindered by the fact that we seldom see BVD enteric disease as a single entity. In both the young calf and the feedlot animal, mixed enteric and respiratory infections of viral and bacterial origins are the rule rather than the exception. However, much progress is being made and effective vaccines are now available for the more important syndromes.

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"ENTERIC PARASITISM AND PRECONDITIONING WITH EMPHASIS ON THE FEEDLOT"

by

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The concept of pre-conditioning means many things to many people. Perhaps this is good in that it is quite possible if not probable that pre-conditioning programs will have to be constructed in such a manner that they vary from one locality to another. Further, the program most desirable for cattle moving to feedlots in West Texas may either be inadequate, or unduly sophisticated, for the needs of Iowa.

For the most part, however, the preconditioning program as presently envisioned entails appropriate immunization, weaning, and identification prior to shipment from point of origin. In many of these suggested programs consideration is given to parasite examination, anthelmintic administration, and/or health evaluation by the veterinarian, which would imply evaluation of the status of "parasitism." The nature of the pre-conditioning program, as well as the mechanics of the cow-calf operation, for the most part dictates that such programs be instituted at weaning and completed over a period of 3 to 4 weeks. There can be little question that enteric parasitism must be considered in such programs, however, as indicated by Baker (1967a, 1967b) the nature of gastrointestinal parasites does not lend itself to such a limited approach.

While as discussed by Baker (1967a) the same basic events lead to epidemic disease of parasite origin as with other disease agents, there presently is no available immunizing agent of value against helminths for the preconditioning program. In this regard it is essential that one recall the concept of the infection cycle and be fully cognizant that anthelmintic agents are active only against parasites already in the host and only then for a short period, 24 hrs. or less, following administration. For one reason or another many individuals have come to believe that the administration of an anthelmintic insures them against losses attributable to enteric parasitism. The reasons why this is not so, are too voluminous to consider in this presentation but have been alluded to in previous discussions (Baker 1967a, 1967b, Ewing 1967). It should be remembered that the potential for infection is present in all phases of the pastured life of the calf and indeed his propensity to a parasitic form of symbioses with enteric parasitis may well have been determined at the time of conception (Whitlock and Georgi, 1968).

In previous discussions we have dealt with general concepts of enteric parasitism (Baker, 1967a, 1967b). In this paper we will restrict our discussion to a consideration of so-called "subclinical parasitism." In this regard I will attempt to focus attention on the research needs and economic considerations as related to the post-weaning period. This is not done with the view that enteric parasitism is of little consequence to the cow-calf operation, but rather as a means of limiting the scope of this presentation.

To digress briefly, we will do well to give some attention to the development and use of anthelmintics. In our present state of knowledge relative to the mechanisms of anthelmintic action it is unfortunate, but true, that the search for new drugs must still be done by empirical screening methods. Nevertheless, the pharmaceutical industry through expenditures of large sums of man power and monies has, and is supplying veterinary medicine with highly efficient compounds of ever widening spectrums of activity.

The introduction of these highly efficient anthelmintics has allowed the diligent livestock producer to avoid the ravages of acute gastrointestinal parasitism. It is not surprising that such striking success in the control of acute helminth disease led to complacency and an overdependence on drug administration. As predicted by many, and overlooked by others, the control of acute disease pushed to the forefront the long recognized but little appreciated insidious nature of these helminth parasites. Continuing studies by personnel of the pharmaceutical industry, veterinarians, and experiment station personnel as well as others have demonstrated that when these efficient anthelmintics are administered at frequent intervals to animals on pasture, and to all animals entering drylot, the problem of so-called subclinical parasitism with its attendant reduction in weight gains and food conversion can be controlled. It is my belief that all concerned must confess that it is at this point that the application of anthelmintics has moved from the rational to the empirical approach. To some extent this is justified because of our lack of information and/or the ability to properly interpret existing information. It is the opinion of this contributor that it is just as important that unnecessary therapy, with its attendant expense in drugs, labor, and animal stress be avoided, as it is that necessary anthelmintic therapy be administered!

Before proceeding further, I would like to clarify some apparent misinterpretations of my previous presentations relative to animals entering feedlot. I have stated before, and take this opportunity to state again, that in my opinion, all animals entering feedlots will not benefit from treatment with anthelmintics. *This statement should not be interpreted as meaning that in my opinion no animals entering feedlot will benefit from such treatment!* The problem is one of differentiating those that will from those that will not! Such a differential diagnosis can not be made by visual observation, by fecal examination, by history of the animals, or by physical examination alone. It is only when (a) a complete history, including origin and an evaluation of the potential rate of the infection cycle at the origin, (b) a careful physical examination of individual animals as well as the group as a whole, (c) quantitative parasite egg counts on an adequate number of individual animals, and (d) a careful appraisal of their acceptance of feed and water at the feedlot is taken into account and evaluated that one is in a position to make judgment relative to the need of anthelmintic therapy. Admittedly, this appears to be a process involving professional services of a competent veterinarian, and indeed it is! This should not be surprising, however, since the problem is one of diagnosis not of prevention in the sense of vaccination. Fundamentally no more, and no less, is required than in the case of proper diagnosis of many other disease conditions. This then brings us to the point where a brief discussion of "sub-clinical" parasitism is in order. First, I would state that this is a misnomer when used to denote a state of symbiosis whereby beneficial results accrue from anthelmintic therapy. Ewing (1967) has presented a discussion of the two views held by parasitologists relative to "sub clinical parasitism". Fundamentally, the one extreme is that a single worm causes a given amount of damage and thus if any worms are present, treatment will result in a measurable return. The other extreme holds that some worms may be harbored without harm to the hosts performance and it is only after a certain number are present that a "breakpoint" occurs following which there is a significant restraint on the performance of the host. This latter view incidently is held by the writer and is in line with the concept of the three types of symbiosis previously discussed (Baker 1967a). To emphasize our position relative to these symbiotic stages we have selected three experimental trials under different management practices wherein we believe the symbiotic relationships were either commensalistic or mutualistic.

Trial I: One hundred and sixty-nine steer calves, primarily Herefords, were purchased at McArthur, California in mid November and moved to a ranch in Marysville, California. The Marysville home ranch consisted of some 2000 acres of which approximately 1200 is in irrigated pasture. The calves were worked at the home ranch, branded, vaccinated for BVD, IBR, lestopirosis, and blackleg. Individual fecal samples indicated a mean count of some 200 parasite eggs per gram feces (epg) with a range of less than 50 to 400 epg. Early in December the calves were moved to winter range in the Sierra Foothills east of Marysville.

By mid-January the epg had increased and these animals were selected for trial. At the initiation of the trial, February 7, 1968, the animals were in good health and all indications other than the epg, were such that anthelmintic administration was not indicated from a therapeutic standpoint. As noted in appendix 1, epg counts at this time averaged above 300. Had the animals been on irrigated pasture such counts might have indicated the need for prophylactic therapy, however, the potential of the infection cycle was not unduly great under the rangeland conditions which existed. The results of this trial are summarized in appendix 1. It is noted that in no case during the 104 days of the trial reported was anthelmintic administration of value in these animals. Further, it is noted that following therapy, the epg, and presumably the worm numbers were markedly reduced, only to again return to a level commensurate with that of the untreated animals. The same events occurred following a second treatment. The animals have been returned to irrigated pasture and a third treatment administered but as yet no further information is available for incorporation in this report.

Trial 2: This trial was conducted in a feedlot in Southern California, in the summer of 1967. The animals, primarily Hereford steers, had been backgrounded in drylot at Yuma, Arizona, for 225 days.

The objective of the trial was two fold; first, to ascertain whether or not a therapeutic treatment with an anthelmintic would be of value (5 gms. Thibenzole/100 lbs. body weight) and, second, whether or not a "prophylactic" dosage of the same anthelmintic (3 gms/100 lbs. body weight) would be of value.

The results of this trial are summarized in appendix 2.

It is noteworthy that even though accepted statistical methods of randomization were used, rather marked differences in mean weights and mean epg were found at the start of the trial. These apparent differences however, are not significant and one should always be careful in evaluation of such differences, particularly where they pertain to performance data. It was found that although both treatment groups showed somewhat higher daily gain and feed consumption, feed conversion and cost of gain was the same in all groups. It is not possible to say whether this slightly reduced rate of gain in control animals was due to their tendency to be smaller as indicated by starting weights, or to the possibility that they may have been verging on a parasitic form of symbiosis as indicated by their epg at the start of the trial. In either case, no financial benefit was obtained by the use of the anthelmintic, unless one would hypothesize that the somewhat lower finish weights of control animals was due to lack of therapy. Such a projection would be without foundation and of a purely speculative nature.

Trial 3: This trial, summarized in appendix 3, was initiated in a feedlot in central California in May of 1966. The animals were Hereford steers from a group of calves put together from Modoc Co., California, Lane Co., Oregon, Lake Co., Oregon, and Humbolt Co., Nevada. From December 7, at which time the mean weight was 384 lbs. until April 28 the calves were backgrounded on native pasture near Fairfield, California. One hundred head from a group of 287 were "gate cut" into two groups, one which was treated with 5 gms. Thibenzole/100 lbs. body weight, and the other which was untreated. The Thibenzole was administered as a top dressing.

In this trial it is again noted that no financial benefit was obtained from therapy even though the epg was at a level many persons believe to be indictive of the need for treatment. In this instance, it was the opinion of the consulting veterinarian and of the writer that no benefit would accrue. This opinion was based on a detailed and professional approach to the diagnosis and serves to confirm the validity of that concept.

Discussion

In none of the three trials described was anthelmintic therapy of monetary value. Further, in trial 2, it should also be noted that were anthelmintic therapy needed in these animals, it should have been administered at the time they were placed in the drylot for backgrounding!

Again, I would like to point out that these trials, do not indicate that no anthelmintic need be administered to animals entering feedlot, but rather, they substantiate our views relative to the symbiotic relationships and further indicate one area in which the outlay for consultative services of a veterinarian can be returned many times over. We are the first to admit that a great deal more research is needed before the differential diagnosis relative to the need for anthelmintic therapy can always be made with certainty. We are also strong advocates of the fact that if a competent veterinarian approaches this problem from the standpoint of diagnosis of disease, without the handicap of the negative attitude implied by the improper use of "sub-clinical," he can very often eliminate the unneeded empirical use of anthelmintics.

In summation, I would like to state that it is my opinion that internal parasitism is an integral part of pre-conditioning but by its very nature can not be restricted to that part of management. There is a demanding need for research and simplification of diagnostic methods in parasitology. However, if the veterinarian fully appreciates the symbiotic relationships of host and parasite, and applies the art and science of differential diagnosis, much can presently be done to evaluate which animals may be expected to respond to therapy and which can not. The livestock producer, and the veterinarian, must accept the fact that such a diagnosis can not be made on any one facet of his examination, but must be based on all facets as an integrated entirety.

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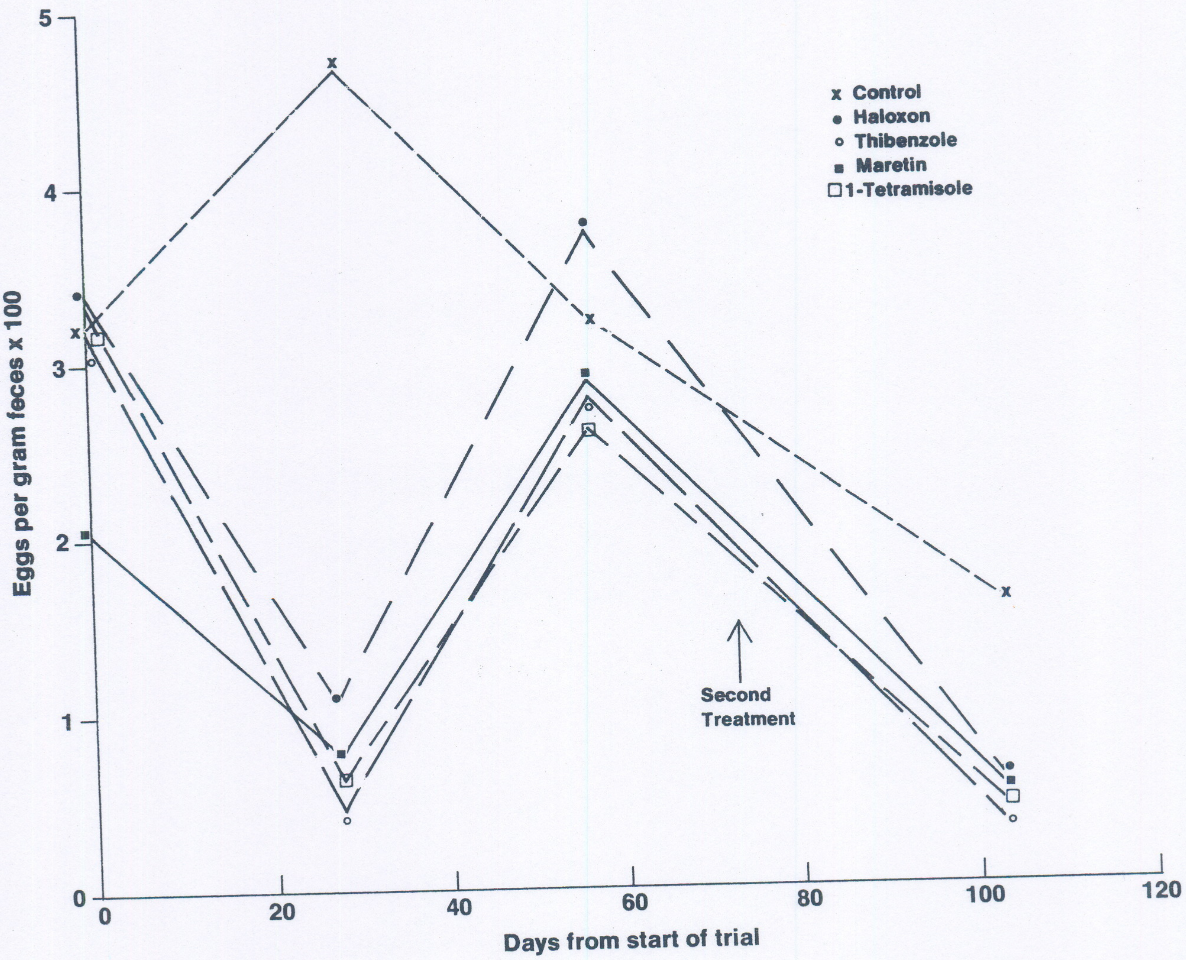
Appendix 1

Rangeland Trial

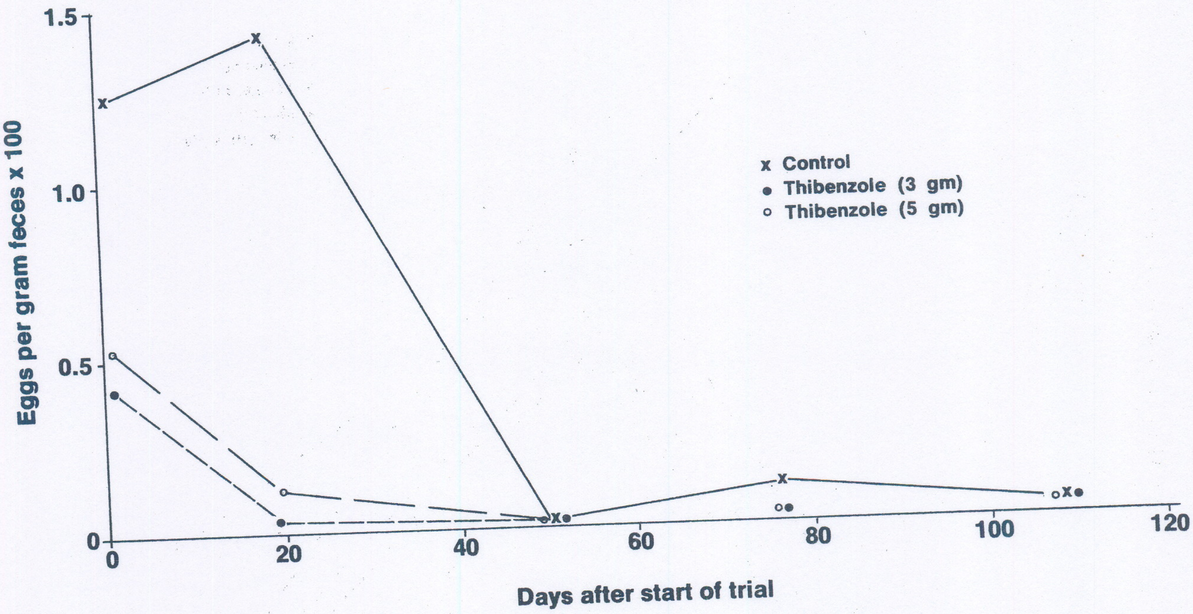
	Control	Haloxon (50 mg/Kg)	Thibenzole (110 mg/Kg)	Maretin (110 mg/Kg)	1-Tetramisole (8 mg/Kg)
Number of Animals	35	33	34	33	34
Starting Weight (lbs.)	359	357	354	356	350
Daily Gain (0-28 days)	0.64	0.50	0.50	0.54	0.71
Daily Gain (0-57 days)	1.36	1.37	1.24	1.30	1.39
Daily Gain (0-104 days)	1.88	1.89	1.84	1.88	1.90



Appendix 2

Feedlot Trial, Southern California

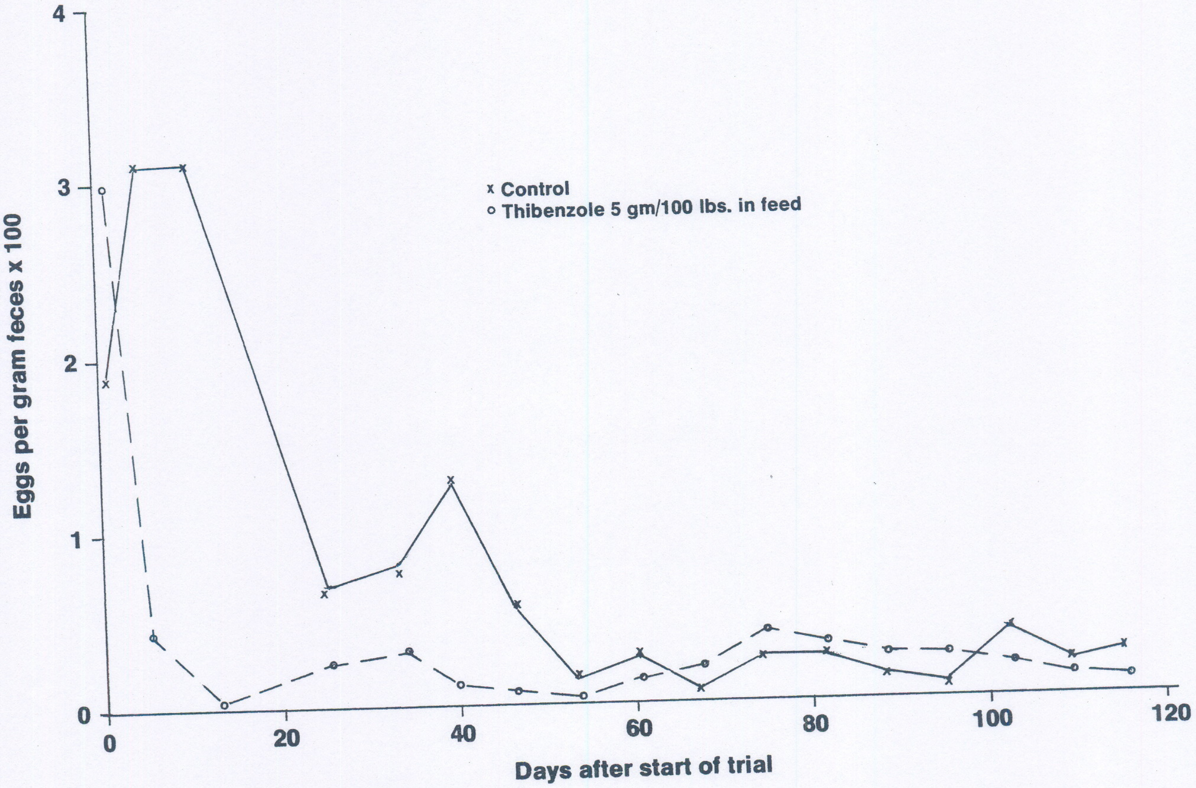
	Control	Thibenzole (3 gm/100 lb.)	Thibenzole (5 gm/100 lb.)
Number of Animals	82	82	80
Starting Weight (lbs.)	597	615	606
Finish Weight (124 days)	904	941	928
Daily Gain (lbs.)	2.48	2.64	2.60
Feed Intake (lbs./day)	16.96	17.82	17.81
Feed Conversion	6.84	6.75	6.84
Feed Cost/100 lb. Gain	22.29	21.97	22.29



Appendix 3

Feedlot Trial, Central California

	Control	Thibenzole (5 gm/100 lbs.)
Number Animals	50	50
Starting Weight (lbs.)	603.0	600.6
Finish Weight (122 days)	982.4	973.9
Daily Gain	3.11	3.06
Daily Feed Intake	24.63	24.24
Feed Conversion	7.92	7.92
Feed Cost/lb. Gain	21.64	21.64



"CATTLE GRUB PRESENTATION"

Laramie Preconditioning Conference
Donald K. Scharff
Montana State University
Zoology & Entomology Dept.

Known for 200 years, cattle grubs and their depredations have been the object of intensive scientific study for slightly less than 100 years. During, and since, the early 1880's, tremendous amounts of energy have been expended in extensive and intensive studies of cattle grubs, and much has been learned of their biology and habits. Nevertheless, due to the elusive habits of the larvae within their hosts' expensive bodies, and the likewise evasive habits of the adults in nature, there are still some very serious voids in our knowledge of these creatures. Let us briefly review their biology and habits. Two species, *Hypoderma bovis* (the northern or late grub) and *H. lineatum* (the common or early grub), are recognized. The adults—heel flies—which superficially resemble small bumblebees, attach their eggs to the host's hairs, near the skin, primarily on the feet, legs and lower parts of the host's body, during sunny, warm, quiet weather in spring. Viewed from our anthropomorphic position, the egg-laying activities of the adults create undue distress among the cattle. Why, with no stinger, and no ability to bite, should these innocuous creatures propel herds of cattle into headlong, tail-erect, unreasoning flight? We don't know for sure, but there are several theories, and researchers continue to study the problem.

In approximately 5 days the eggs hatch, and the young larvae—grubs—crawl to the skin, and using their mouthparts, and perhaps protein-digesting enzymes, bore into the host's body. It might be interesting to note here that for some 40 years previous to about 1920, it was generally accepted that entrance into the host was through the digestive system, following the removal of the eggs from the hairs by licking, and then swallowing them, in a manner similar to that by which horse bots gain entrance to their hosts. A further point of interest: Webster's Third New International Dictionary, the 1961 edition, still infers that such is the case.

A variable period of migration through the host's connective tissues follows, averaging some 7 months. *H. lineatum* appears to migrate indiscriminately, whereas *H. bovis* is thought by some to generally follow the routes of the greater nerves of the body. Most, if not all, of the *H. lineatum* infestation in an individual host animal, spend approximately the last half of this migratory period in the connective tissues between the mucosa and the muscularis of the host's esophagus. A similar period is spent by *H. bovis* in the perineural fat in the spinal canal. Most of the growth of the first stage grubs occurs during this latter "congregation" period. During the migratory phase, the first stage grubs secrete protein-digesting enzymes, then eat the resultant partially digested materials.

The presence of the grubs and their secretions in the host's body causes local irritations and edemas of varying degrees of severity, depending apparently upon the amount of irritant present, and the individual host's degree of sensitivity to these foreign intruders.

The first stage grub, when fully developed, migrates quite rapidly to the sub-dermal tissues of the back, where it cuts an opening through the epidermis, molts to the second stage, and becomes enclosed in a cyst, formed by the defensive mechanisms of the host. Irritation of the cyst walls by the spiny skin of the grub causes the host to secrete pus-like materials into the cyst, which serve as food for the developing grub. The duration of time spent in the sub-dermal cyst varies considerably, but averages about 7 weeks, during which a second molt occurs. When fully developed, the third stage grub works its way out through the epidermal opening, which has been gradually enlarged, drops to the ground, crawls aimlessly for a time, and pupates, usually in a secluded spot in or under some debris. Four to 7 ssweeks later, the adults emerge, sexually mature, ready to mate and lay their eggs.

Adult longevity of laboratory-reared heel flies is approximately one week, and a similar longevity is thought to be characteristic of the flies in nature, although actual data on this point are not abundant. The average number of eggs laid is approximately 500.

It seems generally to be the opinion of investigators that heel flies have very little tendency to migrate more than a mile from one area to another, although some insist that they may travel upwards to 10 miles. The collection of worthwhile data to help answer this important question has been and will continue to be very difficult to achieve.

The non-parasitic stages of the heel fly, the pupae and the adult, are virtually pawns of the weather and climate, and as a result the seasonal history of cattle grubs and heel flies varies widely from place to place, and from season to season. Low spring temperatures, or excessive moisture, may greatly prolong the change from grub to fly or prevent its completion. Low temperatures and cloudy or rainy weather prevent egg-laying by the adult. Conversely, warm, sunny spring weather is favorable. Thus, if warm, sunny weather prevails during the pupal and adult period, the heel fly season may be as much as several weeks earlier than during a cold, wet, cloudy spring, and grub numbers will probably be greater. For the same general reasons the heel fly season averages 4 to 5 months earlier in parts of the South than is the case in northern Montana, for example, where spring is that much later.

Excessively high temperatures of the sub-tropics and warm temperate regions may be lethal to the adults. It appears that such high temperatures have prevented the spread of *H. lineatum* south beyond Florida, southern Texas and northern Mexico, and *H. bovis* south into and beyond several of our southern states, despite repeated introductions of infested cattle. Both species, however, seem to be gradually increasing their southern range in recent years.

"LOUSE AND FLY CONTROL"

by
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When asked to talk about louse and fly control in ten minutes, I felt like the gentleman reviewing his harem for the first time. I had a good idea of what to do, but I didn't know where to start. As you can see louse and fly control on cattle may not fit into the preconditioning program as such but as Mr. Reynolds pointed out yesterday, it will aid us in producing a quality product that will go to work for the feedlot owner as soon as he gets them. Maybe this will help the cattle do a better job for him as a result of keeping your animals free of lice in the winter and free of horn fles during the summer.

The U. S. Department of Agriculture put out a book entitled *Losses in Agriculture*, 1965. Probably some of these figures have changes by this time. As the price of cattle and calves go up there is going to be an increase in the losses. As you lose a pound of gain you've lost more money. This publication lists the loss due to lice as 47 million dollars a year. The loss due to horn flies is 179 million dollars and stable flies, 142 million dollars. Gentlemen, this is a lot of money and it is coming out of your pocket—it may mean the difference between profit and loss to both the feeder calf producer and the feedlot owner.

This morning I would like to discuss some of the methods of treating cattle, for lice and flies. I will discuss some aspects of the old methods as well as some of the newer methods that have been introduced in the last few years. First let us evaluate the problems that we are talking about. Chronic louse carriers can be picked out by the dark greasy look. At the present time there is some work being done on why some animals are chronic carriers and other animals, you can clean up and keep clean. It is impossible to keep the lice off some of these chronic carrier cattle. The total loss due to lice is not to your cattle. In many instances, there is considerable loss to your fences, your feedlot, and etc. from the cattle scratching and rubbing. Just this loss alone according to some producers will pay for your treatment for lice.

All of us are familiar with the old bull and the horn flies. You can go out and look at some of these animals, and sometimes you can count 500-700, maybe a thousand, flies on them and for some reason the bull seems to have more flies than the cows or some of his associates. There is some work being done as to why bulls attract more flies. As of yet we do not know the answer to this. Maybe some of you fellows have opinions of this. The face fly has become quite a problem in some areas, in the last few years. Many producers report that the incidence of pink eye trouble goes up as the number of face flies in their area increases.

The question has often been asked: "Can cattle grubs be controlled? Fifteen years ago, I stated that although it was possible, and had been done on occasion, it was totally impracticable under United States conditions. The primitive methods used in those days—attacking the grubs during the period when they are under the skin of the back—was very laborious and not completely effective, even under the most favorable conditions. Then, about 12 years ago, new organic insecticides were created—systemic insecticides—chemicals which, when administered to the cattle, are absorbed into the body fluids. They circulate throughout the body, seeking out the grubs, so to speak, wherever they may be in the host's body, and killing them. At least seven different chemicals of this nature are not available for rancher use or scientific testing. Any of them are very effective in killing grubs if properly administered. Administration methods, depending on the insecticide used, should fit almost any cattle owner's desire: as an additive to the feed, mineral or water ration, or as a spray, dip, or pour-on. Their use has demonstrated that grub eradication can be achieved in as few as 3 or 4 years in herds of cattle that are effectively isolated from reinvasion by heel flies or cattle grubs. In other herds, not so effectively isolated, very large reductions of grub populations are sometimes achieved in a year or two, and can subsequently be maintained at very low levels. Some unknowns are present in this area—how large an area must be treated—how extensive and of what type must the isolation be—how far will a heel fly travel and why, and under what conditions? Considerable research, but not enough, is being pursued in this area.

Now, with extremely effective grub control methods available to us, the question often arises as to when is the best time to treat cattle. Perhaps the best answer is: as soon as possible after the heel fly season is over, when grubs are smallest and are doing the least damage. In much of Montana this would ordinarily be in late July or early August—in some of our southern areas, as early as March or April. It is quite important, if possible, to avoid treating during the period of aproximately 3 months before the first anticipated appearance of grubs in the backs of cattle. This is that period when grubs are present in greatest mass in the critical esophageal and peri-neural connective tissues. Rapid killing of the grubs in these tissues, by the systemic insecticides, oftentimes temporarily greatly increases the irritation and edema that are already associated with the grubs there. Esophagi may temporarily swell shut, preventing swallowing and eructation; increased pressure on spinal nerves may cause temporary loss of coordination and partial limb paralysis. These side effects usually abate within 48 hours; in heavily infested calves, however, their manifestations may be quite severe, and considerable weight loss may result. Increased local knowledge of grub seasonal history will help local stockgrowers to avoid this critical period.

Another area where questions frequently arise: the economics of grub control. What are the economic advantages of reduced heel fly activity? This is one that most, if not all, researchers have avoided, or negatively reconsidered after a valiant effort. The owner who must handle his cattle during *H. Bovis* heel fly season does so only at times when he can be sure there will be no heel fly activity, because cattle, during periods of *H. bovis* attack are virtually unmanageable.

The wild running and nervousness of cattle at this time, with reduced milk production and weight loss, damaging as they are, are extremely difficult to evaluate.

Do grub-free cattle gain better and more efficiently than infested ones? To answer this question, I have collected 3 different sets of data in 3 different years, on 3 different groups of cattle—and got 3 different answers. The first results indicated that animals freed of their grubs did better than infected ones; the second indicated no significant difference; the third, that the untreated ones did better. And so goes the voluminous literature on the subject. My tests were complicated, in all 3 instances, by the previously mentioned side reactions, induced by killing a large grub mass in the critical esophageal and spinal tissues. In the most severely affected group my treated animals lost an average of 9 pounds per head as a direct result of the treatment, while the untreated group continued to gain. In spite of some of this unfavorable data, I feel reasonably sure that consistently favorable weight gains should be demonstrable in cattle treated at the optimum time. I am certain that some others around the country feel the same way. For example, last fall 2 trainloads of cattle from western Montana were marketed in Omaha. One consisted of 600-700-pound steers, marketed in early September; the other, of recently weaned calves, marketed in early November. Each animal was certified grub treated. Prices received were $1.20/cwt. higher on the steers, and $.40/cwt. higher on the calves than on other, comparable, non-treated cattle.

We have run trials and kept cattle almost free of horn flies. These animals have a different grazing pattern. They spread out over the pasture. The amazing thing is that the cattle would get full and lie down out in the middle of the pasture. When they get hungry, they would get up and go to eating again. Right across the fence there were a group of cattle that were untreated. They spent a considerable part of their time in the shade fighting flies. The USDA publication says that cattle may gain from 10 to 50 pounds more per month if kept free of horn flies, and this is where a lot of this comes in.

You are familiar with the backrubber that is used in many feedlots and in many range operations for the control of lice and horn flies. The backrubber in some situations can do an excellent job of control. The biggest problem, people put them out and expect them to be self-maintained. Gentlemen, these require a little care. The amount of attention you give them will be reflected in the control you get. Location of the backrubbers can be quite an important factor. Cattle can be trained or accustomed to using them. They seem to "know" rubbing on this device helps their "itch". However, some herds must be forced into using backrubbers by putting them across gates, etc. where they go to water or salt. There are several kinds of backrubbers. They can be made out of cable wrapped with burlap. It requires a little more maintenance than the others, but can do an excellent job.

You are all familiar with the dipping vat. This can be used for fly, louse and grub control, and it does a real good job if used properly. The spraying operation works the same way. Grub and louse control requires quite an adequate job of spraying to eliminate these pests. With horn flies you don't have to use high pressure. You don't have to use the volume of material you have to for grub or louse control. The pour-on method has been used and seems to be increasing in use for louse control. We can get a decrease in lice, but it is quite difficult to get elimination of lice with pour-on. It will help some. In the south where they treat for cattle grubs in horn fly season with the pour-on materials quite good horn fly control is obtained. You can stand there and watch those flies fall off. Whether the insecticide kills them or whether this just makes the animal slick and they fall off and break their neck, I'm not sure, anyway you get a considerable decrease in the number of horn flies. In the last few years there has been some increased interest in the incorporating of an insecticide into a mineral or feed as a control of fecal breeding flies. In reality this is birth control for flies. We found in some of our work that this method works, however, daily consumption is quite important.

Another method of horn fly control that we have been looking at, and has gained quite a bit of popularity in the last couple of years are the dust bags. These dust bags may work better under forced use conditions where the cattle are accustomed to using them. This again is similar to the backrubbers. You can use either water, salt or minerals to induce the cattle to use them. Many cattle play with these dust bags and they get a lot of the dust on them, it does a real fine job for horn fly control.

Positioning is quite important on these for face fly control. We have found that you can practically eliminate lice from a herd by using these dust bags during the fly season and on into the winter months. Another method of horn fly control that is attracting quite a bit of attention is the use of aerial spraying. In the feedlot the major flies are usually house or stable flies. The backrubbers and rubbing devices will not eliminate flies from the feedlot. This requires some kind of spray or fog over the entire area. This is one place where much work is needed. There is not a good residual spray available that can be applied to the feedlot and the cattle.

Another method that we have been using recently for range cattle is what we call the ULV or the ultra low volume application of insecticide by airplane. In South Dakota this has received quite a play. As Dr. Scharff will verify you have to use a little discrimination occasionally on getting over these cattle with an airplane. Occasionally some of the animals will become frightened. A small plane should be used in order to avoid as much noise as possible. Most animals tolerate the first pass or two without any "spooking", but the third or fourth pass may really upset them. In fairly open country the cattle can be "hazed" with the plane to a certain extent to prevent going through the fences. Some "cow sense" on the part of the pilot can be a real asset in aerial application. Horn fly control with this type of application is only fair at the best. Fly numbers begin to build up again very soon following treatment. Face fly control is only fair with aerial application. If the entire pasture is sprayed better face fly control is obtained.

Horse fly (tabanids) and stable fly control is quite difficult. It is thought that enough insecticide can be applied to an animal to kill the flies that are feeding. They may go off and die, but they have already taken their "pound of flesh". If the flies are killed off the cattle by an insecticide there are usually plenty more to take their place. There is no good method of control for stable and horse flies at the present time.

I have discussed some of the methods of fly and louse control that are presently being used and included some that are being researched. I hope that I have given you some information that might be of some use in your present operation or will help you do a better job of fly and louse control with less effort. As I pointed out earlier, this could mean the difference between profit and loss in a cattle operation.

ENERGY UTILIZATION IN RELATION TO PRE-CONDITIONING CALVES

by
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Ralston Purina Company

I would like to pose six questions and then discuss them briefly. These questions relate to energy utilization insofar as preparing the newly weaned calf for shipment and represent areas where research is needed. These questions are:

1. What method should be used to evaluate dietary energy and what concentration of energy should the ration contain?
2. What is the best source of energy for pre-conditioning calves?
3. What form should the energy be in when fed?
4. Can rate of passage through the digestive tract of calves be slowed down and if so, would there by any benefit?
5. Can basal metabolism of the calf be reduced and if so, would it reduce the weight loss due to shipment?
6. What is the relationship between energy status of the calf and disease resistance?

These questions will be discussed in the order listed. First we might ask is it important that we know the energy content of the ration? If so, an accurate method of measuring the energy is necessary. The common method used in describing the energy value of a ration is total digestible nutrients (TDN). This method tends to overvalue roughage in relation to concentrates in ruminant rations. In a pre-conditioning program roughage can make up a major portion of the ration. Thus TDN has a serious limitation for evaluating the energy content of such rations.

Drs. Lofgreen and Garrett at the University of California have developed a net energy for maintenance and net energy for production system of evaluating rations. The net energy system allows for the fact that the energy value of a feed is greater when fed at a maintenance level than when fed to produce gain. This system also makes an allowance for size and sex of cattle in regard to energy requirements for maintenance and production. The net energy system takes into consideration energy losses due to heat increment, therefore it provides a more accurate measure of the energy value of roughage than does TDN. This is true because roughages have greater energy loss due to heat increment than do concentrates.

I would like to disgress just a moment and say that energy is the most important single nutrient for the calf, not only from the standpoint that it is needed in the greatest quantity but also from the standpoint that other nutrient requirements are related to the level of energy in the ration and the level of energy intake by the calf. I don't want to leave the impression that other nutrients are not important because we know that the calf has specific nutrient requirements for maintenance and growth and that other nutrients either aid in digestion or in the utilization of energy. A nutritionally balanced ration is of prime importance but the point is that energy quite often is the most limiting nutrient. This may come about due to lack of available feed or the feed available is not acceptable to the calf, or the energy content of the ration to meet its needs for energy. An entirely different problem can arise when the energy in the ration is too high. In this case, digestive upsets such as bloat, founder, scours, etc., can seriously limit performance of the calves.

Dr. Kearl in his presentation yesterday said that it is extremely important that we know what we can expect from pre-conditioning. Since nutrition plays an important part in pre-conditioning, it is therefore important to know what can be expected from the ration being fed. It is important to know the energy value of the ration in order to predict what kind of performance we can expect from it. The net energy system can be used to predict the performance of calves if the ration is nutritionally balanced. The technique requires a knowledge of the net energy values for maintenance and production of the ration being fed, the feed consumption of that particular ration, weight of the calves and the use of Lofgreens table of requirements.

To exemplify how the net energy system can be used to predict performance of calves on a pre-conditioning program, the data from two experiments conducted at the Purina Four Square Research Ranch, Ramona, Oklahoma, are summarized in Tables 1 and 2. In the first experiment, fifteen calves from two-year-old heifers were preconditioned for three weeks. The calves weighed 335 pounds when weaned at 210 days of age. They were vaccinated for BVD, IBR, blackleg, malignant edema, and leptospirosis during the three-week pre-conditioning period. They were also wormed and sprayed for ticks. The pre-conditioning ration was a complete mixed ration in pelleted form, containing 66 megacalories net energy for maintenance and 33 megacalories net energy for production per cwt. Using Lofgreen's tables as a reference, we find that the calves would need 3.63 megacalories net energy for maintenance. The calves consumed on the average during the three week period 12.46 lbs. of the pre-conditioning ration. The feed required for maintenance was 5.5 lbs. This left 6.96 lbs. of feed for weight gain. The net energy required for production was 2.3 megacalories. The expected daily gain, going into the Lofgreen tables, was 1.87 lbs. The observed daily gain was 1.89 lbs.

The second set of calves were also from two-year-old heifers. The calves were weaned at 120 days of age, weighing 155 lbs. A ration with a similar energy level described above was fed for 111 days. Table 2 shows the data and calculations made. The expected daily gain was 1.97 lbs. The observed daily gain was 2.03 lbs. These data indicate that if the energy content of a nutritionally balanced ration is accurately known and the feed consumption of the calves is known, one can come close to predicting what the performance of those calves might be during a three to four week pre-conditioning period.

The second question is related to the best source of energy to use for pre-conditioning calves. The energy sources can be described as:

1. Roughage (fiber), 2. Grain (starch) 3. Molasses (sugars), 4. Fat

Roughage

A high fiber ration is probably the safest ration that can be fed to weanling calves from the standpoint of minimal digestive problems. However, the low concentration of energy in roughage will not allow for optimal performance of calves. The net energy for production will range from about 9 megacalories for very poor qualtiy roughage up to 24 megacalories net energy for production with good quality alfalfa hay containing 24% fiber. Many of the poor quality roughages are not only deficient in energy but also deficient in Vitamin A.

Filling calves with hay prior to shipment is a common practice and has merit in that fibrous feeds are digested more slowly and pass out of the rumen slower than do starches and sugars. This characteristic is most beneficial for calves being shipped long distances. But we must recognize the nutrition limitations and balance these to the best of our ability.

Grain

There is a microbial and possibly a physiological adaptation of cattle to high starch rations. Extremely high starch rations should be avoided in pre-conditioning programs in order to minimize digestive disorders. At the same time some starch is needed to raise the energy level of the ration, so that acceptable performance can be obtained. Present results indicate that a combination of roughage and grain to provide between 30 and 36 megacalories net energy for production would give satisfactory pre-conditioning results, providing all other nutrients are balanced. Further research is needed in determining the importance of having calves already adapted to dietary starch when they are received in the feedlot with intentions of going on a high starch ration and finishing program. When the author was working with Drs. Oran Little and George Mitchell at the University of Kentucky, he found that considerable amounts of starch passed out of the rumen and that the amount became greater as the quantity of starch in the ration increased. It was also observed that the small intestine had a very limited capacity for digesting and breaking down the starch that did escape rumen fermentation. When large amounts of starch did escape rumen fermentation, scouring was a common result. Since scouring is highly undesirable, when calves are being prepared for shipment, it would seem that starch should be somewhat limited in the pre-conditioning program but certainly high enough to provide energy to give adequate gains.

Molasses

Molasses can be used satisfactorily to provide some of the energy and add palatability to a pre-conditioning ration. However, for calves being shipped for long distances, the energy would not be available for a very long period of time. In fact, molasses would be digested in the rumen very rapidly and probably would not offer the best source of energy for the calf on a long haul.

Fat

Fat is a concentrated energy source and can be used to some extent. The fat would have to be high quality and palatable so that the ration would be acceptable to the calf. More reseaach is needed to determine the optimal level and nutrition value of fat in a pre-conditioning program.

The third question relates to the form of ration, whether hay and grain should be ground fine or coarse, or whether the ration should be pelleted, etc. Although there are reams of data on hay and grain processing, there is very little of this data obtained from pre-conditioning studies. We know that when we grind hay fine or pellet it, the rate of passage through the digestive tract is increased. Pelleting poor quality roughage will generally increase the feed intake and also increase performance. Perhaps the most important factor here is having the ration in a form that the calves will accept readily. We feel that it is desirable to have the same form of ration available at the receiving end as the one the calves are preconditioned on. Calves accustomed to eating a particular form of ration will go onto this ration faster than if it were in a different form. In addition, on a short haul—24 hours or less—the rumen microflora would have a minimal adjustment to make. On longer hauls where a large portion of the microflora have been starved, this factor may have limited value.

The last three questions are purely ideas or speculations where research is needed, and will not be discussed in any great length.

Question 4—can rate of passage through the digestive tract be slowed down and if so, would there be any benefit? If feed consumed by the calf just prior to shipment were to pass through the digestive tract more slowly, the length of time that energy is available to the calf during the shipping period would be lengthened. The effect this might have on the ability of the calf to resist stress and disease is not known.

Question 5—can basal metabolism be reduced and if so, would it reduce weight loss of the calf due to shipment? We know that metabolic rate can be reduced by using goitrongenic compounds. Accordingly, the energy needs of the calf should be reduced. However, we don't know what effect this would have on the ability of the calf to resist disease, or what effect it would have on subsequent performance in the feedlot.

Question 6—what is the relationship between energy status of the calf and disease resistance? We know that calves will get sick even on the best of nutrition programs. Adequate nutrition does not completely protect the calf from disease. However, it is known that livestock that are under nutrition stress are more susceptible to disease and parasites than livestock on a sound nutrition program. Research is needed to determine the effect of various dietary energy levels of the calf, on its ability to resist disease when subjected to various disease organisms.

I would like to summarize by suggesting some proven and theoretical characteristics of a pre-conditioning ration. These are as follows:

1. Readily acceptable by the calf.

2. Contain 30 to 36 megacalories of net energy for production per 100 lbs.
3. Be slowly digested for long-lasting effect during long hauls in absence of feed.
4. Effect a slow rate of passage through the digestive tract.
5. Reduce basal metabolic rate of the calf.
6. Support gains that will:
   a. Be profitable to the rancher
   b. Be profitable to the feeder
   c. Reduce susceptibility of the calf to disease.

M. R. Karr

Table 1

Prediction of Weight Gains of Calves Using the Net Energy System[1]

Number of Calves	15
Mean Body Weight, lb.	370
Net Energy Required for Maintenance, Megcal	3.63
Average Daily Feed Consumption[2], lb.	12.46
Feed Required for Maintenance, lb.	5.5
Feed Available for Weight Gain, lb.	6.96
Net Energy Available for Production, Megcal	2.3
Expected Daily Gain, lb.	1.87
Observed Daily Gain, lb.	1.89

1 Calculations are based on values published by Lofgreen and Garrett, California Feeders Day Report, November 3, 1967.
2 Ration contained 66 megacalories net energy for maintenance and 33 megacalories net energy for production. Per 100 lbs.

Table 2

Performance and Predicted Performance of Calves Weaned at 120 Days of Age Using the Net Energy System[1]

Number of Calves	16
Weaning Weight at 120 Days of Age, lb.	155
Average Weight for 111 Day Period, lb.	270
Net Energy for Maintenance, Megcal	2.82
Average Daily Feed Consumption[2], lb.	9.74
Feed Required for Maintenance, lb.	4.27
Feed Available for Weight Gain, lb.	5.47
Net Energy Left for Production, Megcal	1.81
Expected Daily Gain, lb.	1.97
Observed Daily Gain, lb.	2.03

1 Calculations are based on values published by Lofgreen and Garrett, California Feeders Day Report, November 3, 1967.
2 Ration contained 66 megacalories net energy for maintenance and 33 megacalories net energy for production. Per 100 lbs.

"RESEARCH PROGRAMS IN PROTEIN METABOLISM"

Symposium on Preconditioning Cattle
June 26, 28, 28, 1968

By
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In preparing for my part of this confernce, I made the assumption that since the subject is research programs, that I should not spend time discussing those things known to most of us; rather, I should talk about items which we don't know very much about. Before discussing research programs in protein metabolism, I want to emphasize that I think there are other nutritional factors which are probably more important at the preconditioning stage which affect the ability of this critter to withstand shipment and change in ration, and to begin early to consume large amounts of grain.

Probably the most important nutritional factor is achieving consumption of adequate amounts of feed to meet the animal's energy requirement. There is an axiom in nutrition which clearly shows that it is impossible to meet the protein requirement of an animal without first meeting its energy requirement. This is what is really meant by various protein: energy expressions.

Other nutritional factors include control of acid-base balance as cattle are transferred to high grain rations. Vitamin A appears to play an important yet unknown role in this transition period. There may also be a need for replenishing electrolyte balance during or immediately after shipment. Potassium may be especially important in this regard.

Disease, of course, is a highly important vector in the overall outcome of this transition period between the range and the feedlot.

The major research needs in the area of protein metabolism, I feel, deal with disease resistance and adaptation to new protein and non-protein nitrogen sources.

Research work with poultry indicates that protein levels adequate for normal health and maximum production may be inadequate when the birds are challenged with an infectious organism. Recent work at Missouri indicates that the phosphorus requirement of guinea pigs is increased when they are challenged with Salmonella organisms. In general, it is thought that a more than adequate intake of nutrients affords protection against disease situations; however, there are enough examples where this is not true to make any general statement. Bacterial and parasitic infections may be less serious in well-nourished cattle but viral infections may be more of a problem. Therefore, I feel that research should be initiated to determine if currently accepted protein requirement standards or feeding practices are, in fact, adequate to afford necessary disease resistance and/or optimum response to vaccines used to stimulate this resistance.

The second major research area deals with adaptation to protein sources. Results from this area of research would be of value to the range man as well as the feedlot operator. That this adaptation takes place is known primarily from research on the use of urea in ruminant rations. Practical research results indicate that as long as 21-28 days may be required for cattle to adapt to urea when it is placed in the ration. Gains and efficiency during this period are generally less in cattle receiving urea than when cattle are fed a source of preformed protein. Basic research, on the other hand, has shown that urea constantly passes into the rumen by way of the saliva and through the rumen wall from the blood stream. Why, then, should there be an "adaptation period"? Of course, this could be a dosage effect; however, I feel that current estimates of urea transfer from the blood into the rumen are underestimates, since most experiments where this has been determined have actually measured the amount of recycled urea which was utilized by the animal, not the total amount of urea recycled.

One cannot deny, however, the practical results of feeding trials where this adaptation phenomenon is observed. Since economics favor increased use of urea in cattle rations, the nature of this so-called "adaptation" needs to be thoroughly investigated. Urea is used in range supplements as well as in feedlot supplements; therefore, this is why I say that results from research on this point will be of interest to the rancher as well as the feedlot operator.

Since urea may pass into the rumen at all times from the blood stream, and since there appears to be an adaptation period for this nitrogen source when placed in the ration, doesn't this imply that there is a degree of adaptation to all protein sources when introduced into cattle rations? Cattle coming off grass may need to "adapt" to all protein sources used in feedlot rations, and urea just happens to be one we know about, since it has been studied more thoroughly than other protein sources.

In the transition of cattle from the range to the feedlot, various antibiotics are often used at several levels, modes of administration, and at various points during the transition period. Very little research to my knowledge has looked at the effect of antibiotics on the adaptation of cattle to new protein or non-protein nitrogen sources. While antibiotics are antimicrobial agents, each antibiotic has a certain spectrum of organisms for which they are effective. I believe there could be the possibility of certain antibiotics favoring adaptation to certain protein or non-protein nitrogen sources by selective suppression of certain strains of microorganisms. There may be other chemical agents which would be effective in this regard.

As I mentioned in the beginning, I considered by role in this conference to be one of suggesting possible areas of research in protein metabolism related to the transition of cattle from grass to grain. I am impelled at this point, however, to mention what I would call fiscal responsibility for research needed by the cattle industry. I believe that government ıey should be spent for those things which the people ıot do by themselves. Currently, it seems that agriculture animal science are not receiving the same research emsis as they once enjoyed. Research receiving emphasis by eral and state governments over the past century has nged. Agriculture received emphasis early through the sage of the Hatch Act. More recently, health and medicine ve been emphasized through the establishment of the Naıal Institutes of Health. Then came the Atomic Energy mmission, and currently space research is emphasized ough the establishment of the National Astronautics and ace Administration. You may argue that money being spent space research would be better spent on agriculture rearch; however, it is a new area and one which the people this country cannot do by themselves. I'm sure there were ose who argued that the Hatch Act was foolish since we had much land and so few people.

What I'm leading up to is this. I think once an industry is ı a stable basis, it must maintain this position through rearch which it provides for from its earnings. The field of omic energy is a very good example of this. I hope that there will continue to be government legislators and university administrators who feel that there is still much to do in animal research which cannot be effectively accomplished by the industry. At the same time, however, I think the animal industry should take positive steps to channel money directly into research which will benefit the whole industry. At the present time, companies supplying various products to the animal industry spend vast amounts of money for research on their products. This is good and as it should be. Research is needed, however, in many phases of animal science which will benefit the whole industry and, therefore, should be supported by it. This research should be broadly based including basic research as well as applied, problem oriented research.

The swine industry has initiated a system to earmark such money, although too much in my opinion is to be used for the promotion of pork. I think it is time that leaders in the cattle industry consider how they might initiate a program to insure continuation of vital research for the improvement in the overall efficiency of the industry.

Thank you.

"REFEEDING SYNDROME: BLOAT"

lactic acidosis, diarrhea, founder, rumentis, atomic rumen conditions, liver abcess incidence, feed and or water refusal and increased morbidity.

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All of these can be correlated to problems occurring during and after the refeeding of previously starved animals has been initiated. These problems may not only occur during the refeeding of animals that have been off feed for a couple of days after being subjected to severe stress, it can occur in animals that have been maintained on a full feed as well. These problems seem particularly related to high concentrate feeding programs and may occur initially while trying to get the animal on a full feed or it may occur at any stage during the feeding program. I am sure that many of you have noted that in the latter stages of feeding many of these problems listed quite often occur in the best doing animals because the individual animals feeding pattern it is not able to adjust to the management of the over-all group of animals being fed.

Much of the research being done in the refeeding syndrome area is in defining the conditions causing it and developing programs needed for prevention. There are many commonly used treatments for the above listed problems. A few of these are:

Rumen innoculants, feed additives, high energy feeds, stress liquid feeds, steroidhormones.

Most of these treatments have in common that they seem to be of more benefit to the individual doing the treating than they generally are to the animal, particularly in the case of founder, acidosis, and feed refusal. The most effective treatments are related to improved management techniques. The management of the animals during refeeding is of the utmost importance.

It is important to evaluate the animal's previous background prior to putting them on a high concentrate feed, in order to define and design a feeding regime for any given group of animals.

In analyzing the background of a typical group of feeder animals, we find that when the severly stressed and shrunk calf is first offered feed a great deal of caution should be used. The shipping and sale of feeder cattle constitutes a succession of stresses. Listed below are major stressors:

STRESSOR

heat or cold
excessive muscle activity
infections
Toxins
Trauma

In analyzing what happens to the animal when stress is induced, the onset of a stress or series of stresses, is characterized by an increased metabolic rate. An example of the importance of this consideration is that if a fever is induced in an animal, for each degree rise above normal there can be approximately a ten percent greater metabolic rate. This increases utilization of nutrient reserves and if the animal is on feed and is eating normally it utilizes nutrient and reserves at a far greater rate than normal. The pituitary endocrine gland activity is increased adrenal output is accelerated. This brings about a mobilization of nutrient reserves, increased heart rate, increased respiration and increased capacity to burn increased mobilized nutrients, and therefore increased energy utilization. All of this occurs at the time when animals are taken off feed and nutrient intake is drastically reduced. It is no wonder that some severe problems are induced during this phase of marketing a feeder calf.

The following chart summarizes what is necessary for the animal to perform if a stress is maintained on it for any period of time.

If Stress Is Maintained Body Must

1. Adapt as well as possible
2. Maintain ability to produce
3. Maintain higher metabolic rate
4. Increase nutrient intake
5. Maintain fluid Electrolyte Balance
6. Resist Secondary Invaders and opportunists
7. Resist disease producers

At a time when the animal is stressed and has reduced feed intake, additives can be beneficial. At the same time that these physiological stresses are taking place in the animal drastic changes take place in the rumen, the major area of feed utilization in the ruminant.

In the rumen there is a normally large population and variety of microorganisms. Typical protozoa in animals on feed prior to shipping have large storage of starch granules which can be indicated by dark iodine stained sections in them. Protozoa play an important role, not only in slowing down excessive breakdown of starches by storing them, they also utilize some of the excessive acid producing bacteria such as streptococcus bovis and lactobacili and help maintain a balance. These bacteria are implicated in acidosis problems. The protozoa play a role in holding down proliferation of fast growing starch utilizing bacteria.

Protozoa in the rumen after the animal has been off feed for a period of 24 hours are far fewer in number. In addition, when stained similarly as in animals on feed, there is decreased storage of starch.

Studies of bacteria of animals on feed and after being removed from feed indicate far greater number of bacteria present in the animals on feed. In addition to a decrease in number of organisms there are differential losses in these mbers and some of the faster growers can get off to a faster rt when feed is re-introduced into the rumen due to differ-g life cycles and regenerating time. Another factor with fferential loss is that initially a few pathogens may be esent and they can proliferate at an abnormal rate during is period. Under normal conditions they may be no problem.

The next chart summarizes the ruminal changes that occur uring starvation.

uminal Changes During Starvation

1. Fermentative activity and capacity decrease.
2. Rumen protozoa dramatically decrease.
3. Rumen bacteria numbers decrease.
4. Balance between microbial species disrupted.

The fermentative activity and capacity of the rumen is decreased. The rumen protozoa are dramatically decreased. The rumen bacteria numbers decrease and the balance be-tween microbial species is disrupted. There can be abnormal proliferation of different groups of bacteria as compared to the normal population. Thus, the pathogens may be more per-sistent than the beneficial bacteria and their numbers on a percentage basis may increase during starvation. This is an important consideration. The major goals of refeeding methods are to provide a maximum energy input into the animal, to restore its health from stress and to increase disease resistence, which has been considerably lowered, to provide for rapid restoration of rumen function and rapid adjustment to the rations to be provided to the animal and to prevent rumen disfunction. Two methods, high roughage and high concen-trate are used. The effects of refeeding low energy rations are too slow a restoration of a balanced microbial population occurs. One other major disadvantage is that the intake is less than desired and the stressed animal will remain weak and susceptible to disease. One of the common techniques that has been used is to spray the low energy roughage ra-tions with energy sources such as molasses and other types of liquid feed supplements to help overcome the low energy intake. In addition, this is also an area where additives may exert beneficial effects since they can help reduce the patho-genic bacteria which may be present. The next chart lists some of the disadvantages of refeeding a high energy ration.

Effects of Refeeding High Energy Ration

1. Balance between bacteria disrupted.
2. Lactic acid production increased.
3. Volatile fatty acids decreased.
4. Very acid rumen—fermentation stops—rumen wall dam-age.
5. Blood lactate (D) increases.
6. Blood and urine become acid—acidosis.
7. Dehydration.
8. Feed refusal.
9. Metabolic disorders.

The next chart compares the effect of the high roughage refeeding techniques versus high concentrate refeeding tech-niques. Note the increased energy-glucose utilization ability of an animal on a high roughage diet as compared to the high concentrate diet.

EFFECTS OF FEEDING TECHNIQUES ON FERMENTATION[1]

Time after refeeding	Glucose utilization Hay	Conc.	Lactic Acid[3] Hay	Conc.
0 hr.	10	5	0	0
2 hr.	80	55	10	25
26 hr.	60	10	15	142
50 hr.	100	70	12	55

[1] Refeed after 48 hours of starvation.
[2] Values expressed relative to pre-starvation capacity.
[3] umoles/ml

In addition, note the increased rumen lactic acid produc-tion on the high concentrate ration as compared to the rough-age ration. A major consideration in refeeding is to prevent excessive lactate production.

The next chart summarizes some refeeding work that has been done comparing a high roughage diet to a 40% concen-trate diet, to a high-roughage diet with antibiotic.

EFFECT OF REFEEDING TECHNIQUE ON FERMENTATION[1]

Diet	Gas Production with substrate	without substrate	pH
High roughage	65.0	21.0	6.7
40% Concentrate	73.0	28.0	6.1
High Roughage with antibiotic	43.0	3.8	6.9

[1] Refed one week after 48 hour starvation.

The medium range type of a diet with a 40% concentrate elicited higher gas production or more rapid increase of rumen activity after 48 hours starvation than either the high rough-age with antibiotic or the high roughage alone. The anti-biotic usage in this data indicates a slower rumen recovery with antibiotics. This can have the beneficial effect of slowing down the rumen activity until a normal bacteria population is established.

In summary we are subjecting animals to severe physiologi-cal stress when we ship feeder cattle long distances to a feed lot. In addition to the physiological effects on the animal there are additional detrimental effects in the rumen particu-larly as related to rumen microorganism population. The se-lection of refeeding programs should be considered carefully. Additives have been indicated as having some potential role in suppressing proliferation of adverse groups of organism. The use of roughages in refeeding management techniques are advantageous. It is obvious that there are two ways that we can effectively overcome the problem of refeeding:

1. Do not starve animals so that we don't have a refeeding problem.
2. If animals have been stressed or starved, set up a pro-gram where they can adapt gradually to a high con-centrate ration.

There are no magic rumen innoculants or other additives at this time that can overcome the detrimental effects of re-feeding a starved animal. It is necessary to prevent the causes of refeeding problems with high concentrates.

"RESEARCH IN BEEF CATTLE NUTRITION: MICRONUTRIENTS"

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There have been some significant recent developments in research with micronutrients that have implications for beef cattle feeding in the special context of this Conference. There is no doubt that such research has benefitted by advances in instrumentation technology; important among which have been the development and application of fluorometry and atomic absorption spectrometry. Both of these techniques make possible the measurement of trace minerals in very low concentrations, and they avoid some of the problems of interference by the myriad of chemical components in diet mixes and in animal tissues. It should be possible for feedlot operators to take advantage of this improved technology in assuring optimal performance of their cattle.

The need for continued attention to micronutrient problems is emphasized by changes that have taken place in the business of cattle feeding. Dominant among these are the trend towards higher concentrate rations (Neumann, 1965) and the increasing use of "synthetic" ration ingredients, urea being a good example. (The U.S.D.A. has estimated that 300,000 tons of feed grade urea will be used by 1970). The use of high concentrate rations implies a large scale shift of diet ingredients in the course of which some of the traditional sources of micronutrients—such as legume forages—may be greatly curtailed, if not eliminated. The use of synthetic, in place of "natural" materials suggests that further micronutrient sources may be reduced. When one considers these restrictions in trace element supplies in relation to an increased demand occasioned by the faster rates of gain in the modern feedlot, possibly modified by the greater stresses imposed on the animals, the case for continued micronutrient research becomes a strong one, indeed.

The symptomatology following simple dietary deficiency and the biological activity of most of the trace elements is reasonably well-known. Less well understood, certainly, is the nature of the biochemical interrelationships existing among the trace elements, between micro- and macronutrients and between inorganic and organic diet constituents.

Some general observations have been made on the contributions that trace element supplementation can make to performance of fast-gaining cattle. Kansas studies, for example, have shown that feedlot cattle gaining 2 pounds a day responded favorably to trace mineral supplementation, whereas grazing cattle gaining 1 pound daily did not (Koch *et al.*, 1960). Such studies have tended to popularize the concept that trace element supplementation may be helpful to the cattle feeder. Since supply of these micronutrients tends to be governed by local, rather than national, international (or even state-wide) considerations, however, specific study of individual feeding situations is recommended. I am frequently reminded that, in the state of Oregon, for example, we run the gamut from deficiency to excess with several micronutrients, and I am inclined to agree with Frost, who states, "Experience . . . has taught me caution in generalizing about trace elements." (Frost, 1967).

Since the National Research Council, and similar bodies in other countries, has worked hard to accumulate data on the micronutrient requirements of cattle (N.R.C., 1963), it would seem that the continuing research emphasis should be directed toward accumulating data on the micronutrient content of feedstuffs, both concentrate and roughage, and toward investigating those factors which affect the availability of these various contents to the consuming animal. The latter part of this approach, of course, is necessarily involved with the numerous interrelationships between nutrients.

Micronutrient requirements

Perhaps I should not dismiss the topic of micronutrient requirements of cattle so quickly—certainly all the data needed to assess these accurately under the diverse conditions that may apply are not available, although important steps have been made in this direction. The cattle feeder wishes to provide for maximum growth of his animals, but he must do this against a variety of backgrounds. How does a feeder assess the requirements of his cattle for copper or for cobalt, for example, when some of them have come from ranges where the forage is adequate in these elements and some where the forage is deficient? The answer to this question may probably be gained by some direct assessment of the status of the animals in respect to the elements in question. Such assessment is not easy to make, however, since it is dependent upon a number of variables. It is easy to draw and analyze a blood sample and thus gain an approximation of the circulating level of a micronutrient. Most workers in the field agree that blood levels leave something to be desired, since they are not always indicative of the storage levels of the nutrient in the animal body. The latter can be investigated via the liver biopsy technique, but few cattle feeders would be enthusiastic about including liver biopsy in their pre-conditioning program. There is some evidence, provided by Oregon studies (Haag and Adams, 1958) that relationships exist between blood and liver copper levels whi ih allow approximate predictions of storage status from blood data. When plasma Cu levels are plotted against liver Cu levels on a log-log graph, they form two straight lines which intersect at around 33 ppm liver Cu (dry basis). Over this level—from 33 to over 300 ppm liver Cu, plasma values remain at about 0.90 mg Cu/ml, which is considered normal; below 33 ppm liver Cu the plasma values drop off sharply. The possibility exists, therefore, that by spot-checking with the relatively easy blood Cu assay, meaningful data may be obtained on animals' Cu status. It is possible that, since hair is known to respond to dietary Cu, it might be used as an assay tissue which is even more readily available. Some preliminary observations with other species suggest that this possibility should be investigated further (Martin, 1964).

These examples, relating only to the single micronutrient, Cu, suggest that feeders have means at their disposal to indicate whether they are dealing with so-called "normal" cattle or potentially-deficient ones in the groups entering their lots. Data obtained should allow calculation of a meaningful supplementation program.

There are still some micronutrients which appear to play an important role, biologically, but for which no "requirements" have been calculated. Selenium is a good case in point. Our studies, conducted with sheep, suggest that 0.02 ppm Se in the diet dry matter is the critical level between adequacy and deficiency (Oldfield, Schubert and Muth, 1963). Some data show a growth response to Se, when it is added to deficient forage rations (Oldfield, Muth and Schubert, 1960), but it should probably be considered unlikely at this point that feedlot rations, which are usually drawn from several sources, would be deficient in this element although some evidence to the contrary has appeared. (Burroughs and Barringer, 1962). Unfortunately, data on Se levels in feedstuffs are difficult to come by; however, a useful summarization of Se occurrence has been provided by Allaway and co-workers (1964). It may prove possible to assess Se status of animals, and hence to determine whether supplementation is necessary, by a simple blood test using radioactive ^{75}Se. It has been shown that red blood cells from animals deficient in Se will take up more of the labeled element, when incubated with it in an appropriate medium, than will similar cells from normal animals (Weswig *et al.*, 1965). At this point, Se is not recognized as an allowable feed additive by the U.S. Food and Drug Administration.

Micronutrient Levels in Feedstuffs

The National Research Council's Committee on Animal Nutrition has taken a significant step toward consolidating data on feed composition in its Encyclopedia of Feed Composition. This monumental work, now in final stages of preparation led by E. W. Crampton and L. E. Harris, will initially contain entries for some 5500 feedstuffs and will be an invaluable aid in ration formulation. In the case of micronutrients, however, specific data will still have to be added in some cases to take care of important local variations.

Biological Interrelationships

The remaining question I have identified concerns the various biological interrelationships with which micronutrients become involved, which influence their availability to the animal. This is a fascinating field of research, and one that has tremendous possibilities in practical application.

There are a number of pieces of evidence suggesting the existence of micronutrient interrelationships. To cite one example, the demonstration that copper deficiency disorders of cattle occur in many parts of the world on diets widely differing in Cu content suggests that utilization of this element is markedly influenced by diet composition (Mills and Quarterman, 1963). Some idea of the rapid expansion of knowledge in this area can be gained from diagrammatic representations of nutritional relationships among minerals provided by Ammerman in 1965 which listed 16 elements and by Tillman in 1966, which listed 22. Ammerman (1965) in his paper makes a good case for the dangers of considering mineral element requirements in the light of separate and distinct entities.

Copper again provides a useful example of interrelationships. These have been widely studied and are probably better understood than many others (see, for example, Mylrea, 1958). It is generally accepted that simple Cu deficiency does not occur when cattle are given feeds containing 5 ppm Cu or more, on a dry matter basis (Davis, 1960). It is also well-known that cattle will show symptoms that are apparently identical with those of Cu deficiency (severe scouring, depigmentation of hair coat) on diets containing more than this level of Cu. It has been shown that molybdenum levels of around 5 ppm will cause such symptoms, even when the diet contains as much as 5-7 ppm of Cu. Evidence was provided from Australia that inorganic sulphate in the diet is the factor that triggers the interference between Mo and Cu (Dick, 1952).

It would appear that other, as-yet unrecognized factors, probably organic in nature, also affect the Cu status of cattle. We have found differences in the activity of Mo from fresh forage and from hay cut from the same crop, at the same stage of maturity. Nevada workers have shown that certain roughages (alfalfa and "native" hays) are more effective than others (wheatgrass hay) in overcoming previous molybdenosis in cattle (Bohman, *et al.* 1959). Certainly many factors come into play in determining the biological availability of this one micronutrient, copper. This is not an isolated case, since other interrelationships have been found with other micronutrients. Cobalt deficiency, since it affects synthesis of vitamin B_{12} and subsequently of protein, is potentially of great importance to feeders of growing animals. Moreover, Co deficiency reduces appetite and hence feed intake. There is some evidence that Co utilization is influenced by other diet components. Underwood, for example, has indicated that a type of staggers found in animals grazing *Phalaris tuberosa* in Australia is alleviated by Co administration, even though the diet appears to contain adequate Co on the basis of chemical analysis (Underwood, 1956). Some idea of the diversity of interrelationships involved can be gained from the demonstration that Co deficiency appears to influence the population of internal parasites, and the effectiveness of anthelmintics (Pope *et al.*, 1947; Davis, 1958). Both sulphate ions and arsenic have been reported to reduce selenium toxicity (Moxon, 1958); however, their effects of Se utilization at the extremely low levels within which it functions require further investigation.

These have been just a few examples, perhaps more familiar than others, of the many and complex interrelationships that exist among the micronutrients essential to cattle. There can be no question of the value of providing proper supplies of essential micronutrients in rations for cattle. The problem is how to assess the situation accurately through the maze of interrelating factors that exist, within the limitations of time, and perhaps facilities with which the cattle feeder must work. Several possibilities suggest themselves. First, it is axiomatic that the feeder should learn as much as possible about the nutritional background of the animals that enter his lots. Some such information can be gained by questioning previous owners, if the animals have been bought. More can be obtained by relatively simple tests run on the animals themselves, and the value of blood Cu values and their relationship to liver storage has already been commented upon. An interesting alternative is observation of animal response to administration of micronutrients presumed to be deficient. Controlled feeding trials are sometimes difficult in the rigid physical facilities of some feedlots, but a very convenient technique exists, in the case of Co, in the "heavy pellet." (Dewey *et al.*, 1958). By inserting these in the rumens of certain animals, the advantages of Co supplementation may be determined against performance of other, untreated animals in the same lot. This technique might possibly be applied to other trace elements.

When animal status has been determined, there remains the problem of supplementation of the cattle, where appropriate. Feed, or salt, mixes are obvious vehicles for micronutrient supplements; however, the provision of a number of different mixes to meet the diverse requirements of the animals in a large feedlot may be difficult. An alternative, metering the required materials into the drinking water for individual groups of animals, might well be considered. This offers the advantage of flexibility, both among and within lots (it would be possible, for example, to pre-condition cattle from a deficient area at a high level of supplementation, then drop them to a "normal" level) without adjustment of feed mixes. It also might avoid some of the interferences effected by chelation of micronutrients in feed mixes. Such administration has worked well in research—perhaps it is time to try it in practice.

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THE DESIGN OF RATIONS FOR CALVES TO BE STARVED THEN RE-FED.

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Summary The ration should aim to sustain the ruminal microorganisms so that fermentation will subside very little during fasting and re-kindle as soon as possible once re-feeding commences. The ration most likely to succeed in this at present is hay, high fiber hay. This will sustain cellulolytic bacteria. The ration of the future should have a sustained release of sugars and starch in order to maintain viable protozoa. It is my opinion that the basic research needed to design such a ration has been done, and that from now on this is strictly a matter of development.

Introduction Shipping the calf or yearling from its producer to the feedlot imposes a period of food deprivation which lasts 12-36 hours, perhaps up to 72 hours. This period of starvation primarily endangers the bacteria and protozoa in the rumen. The tissues of the calf can subsist, I believe, without difficulty on mobilized body fat, which provides fatty acids for oxidation and glycerol for glucose synthesis. Tissue metabolism will also be supported by absorption of nutrients from the intestinal tract, which derive from the digestion of chyme coming from the rumen. It is in the rumen that trouble brews. We should bear in mind that once ruminal fermentation is established, we are feeding primarily the microorganisms, only indirectly their mammalian host.

Ruminal Fermentation It is now well-known that the various species and strains of bacteria and protozoa differ in their ability to ferment different substrates such as cellulose, starch and sugars. The population changes with the diet; in general the starch fermenters are found in greater numbers when more starch is fed, the cellulose fermenters when more cellulose is fed, etc. (1,2). The next important general point is that the fermentation of sugars and starches proceeds faster than that of cellulose, as judged by ruminal pH and volatile fatty acid concentrations following feeding (perhaps the first to show this was Phillipson, 3). A third relevent principle is that when the feed input into the rumen stops, the microorganisms die out at different rates; the protozoa decline very rapidly, while the bacteria tend to persist (2,4). Finally, after a fast, upon re-feeding, cellulosic rations are slow but safe, while provision of starch and soluble sugars leads to rapid fermentation, acidosis, and a variety of damaging consequences (5). I believe that these basic, well established principles of ruminal digestion provide all that is needed to design a ration which will sustain a calf through a period of fasting and re-feeding.

The present The best present ration for our purpose has to be composed mainly of hay. If fed for a few days before shipment (starvation), the microbial population will adapt to the nutrients provided, and the cellulosic bacteria should persist for 66 hours and probably more (2). Upon re-feeding with the same or similar hay, there should be no danger of the "re-feeding syndrome" or such problems as "cyclic feeding". After 2 or 3 days on the hay, a start could be made to change the ration towards the lower fiber, high starch, sugar and fat which are typical of the feedlot. (A practical situation where this works is in drought-feeding in Australia; the sheep and cattle are fed twice, sometimes only once, a week with roughages, usually rough roughages.) This type of feed sustains the ruminal processes.

The disadvantage of using hay for the present purpose is that it is not a maximal gain ration, and that its use would keep the calf off such a ration for about 6 days. I expect that this would be more than compensated for by the health protection, but this expectation would need to be tested out on a large scale with all the variables finally assessed in dollars.

The future The best ration should provide a sustained supply of starch and sugars as well as cellulose. I believe that the basic scientific foundation for this is available, and that the design depends only on proper development. I would work with pellets containing grains (starch and sugars) and fats as well as ground hay (cellulose). The pellets should be made to vary in size, shape and consistency (hardness). Some would break up and be digested within minutes or hours after ingestion, others would be made to last for several days. (I'm sure that you are all familiar with this general idea from the advertisements of compound pills and "spansules" for human use.) This controlled release should aim to sustain the protozoa in particular. Again this ration should be fed at least a few days before and immediately after shipping (starving). This diversely pelleted ration would serve as a go-between grass and the feedlot ration. It would be standard, so the calf producer and calf feeder would both feed the same ration to the calf.

I suspect that pellet making is quite up to this task, and that the greatest problem in development will lie in obtaining uniform acceptability of different pellets. The calf could easily negate our purpose if, for example, it selectively consumed the short-release pellets in preference to the long-release variety. If I were in the feed manufacturing and selling business, I would be working along these lines to develop a complete, pelleted ration which would sustain a ruminating animal through a lapse of 36-72 hours with no food intake.

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The Calcium Requirement of Calves growing from 400 to 1000 lb in 150 days.

Summary. This requirement has not been determined by suitable experiments. The common "standards" are for calves gaining about 2.2-2.4 lb/day; the American standard (1963) of 20-21 g/day (1) is lower than the British standard of 29-37 g/day (2). Using the factorial approach, it is possible to calculate that the Ca requirement for a calf gaining 4 lb/day would be 60 g/day, following the assumptions of the British group (2). Data obtained on calves in our laboratory suggest a lower efficiency of absorption than was assumed by the British, and if this is incorporated, the estimate for Ca requirement becomes 100 g/day.

Estimator	Gain lb/day	Ca g/day
NRC (1963)	2.2	20
ARC (1965)	2.2	29-37
Present a	4.0	60
b	4.0	100

Note that the estimates for 4 lb/day are projections from data found at gains of 0.7-2.5 lb/day. They are hypotheses which should be tested by experiments on rapidly gaining calves.

Introduction. Our interest in this requirement arose initially from the problem of hind leg lameness which sometimes occurs in rapidly growing bull calves. Several possible causes came to mind, the most likely being a mild form of secondary nutritional hyperparathyroidism. The disease mechanism will be briefly described. A low Ca intake leads to parathyroid hormone release. This brings Ca out of bone to maintain the blood Ca level. The bone becomes less dense, less strong. Subtle primary defects may be covered by an overgrowth of bone, forming exostoses or spurs. These may be associated with inflammation of swelling of the adjacent soft tissues.

In a particular case, on which we consulted, we decided to analyse the feed for Ca and P in order to estimate the daily intakes. Having done this we came up against the problem of the Ca requirement. The calves were being fed 20-25 lb of a complete feed based on corn, plus about 6 lb of mixed legume-grass hay. We found that 22 lb of complete feed would contain 29 g Ca and estimated that the 6 lb of hay would contain 17 g; the total Ca intake would be 46 g/day. Similarly the P intake was 39 g/day. Comparing these to the NRC standards of 20 g/day Ca and 15-21 g/day of P suggested that there is no Ca or P deficit in the ration, at least at first sight. However, the British standards of 37 g/day Ca and 28 g/day P are much higher than the U.S. standards (1,2). Also the British Committee published the method by which its requirements were set, and this enables us to make projections to higher rates of gain.

Methods for establishing Ca requirements. In growing animals, the Ca requirement is often set as the level of intake below which there is a decrease in weight gain. This approach is weak because many factors influence weight gain, and it is obviously not going to be helpful in solving the present problem. However, if we turn the idea around a little, we can see that an inadequate Ca intake may prevent an animal from realizing its full genetic potential for growth.

A better approach to establishing the Ca requirement is the factorial method. The Ca retained in the body and the endogenous body losses in urine and feces are measured. Also the availability of Ca in the ration, i.e. its efficiency of absorption, is measured. The British Committee assembled all the available data and fitted regression equations to obtain what are virtually mean values for various parameters (2). At 600-1000 lb body weight the Ca retained, mainly in bone, is about 5 g/lb body weight. The endogenous loss in the feces and urine is about 7 g. The net requirement to gain 2 lb/day is 17 g Ca. The net requirement to gain 4 lb/day is 27 g Ca. The British Committee assumed an efficiency of absorption of 45%, so the requirements became $17 \times 100/45 = 38$ g/day for 2 lb/day, and $27 \times 100/45 = 60$ g/day for 4 lb/day.

Recent experiments in calves. We have performed combined nutritional balance and Ca kinetic experiments on 3 normal calves 9-12 months old which had gained 1.5-2.5 lb/day over several months. They were being fed 100 g/day of calcium in the form of pellets intended to provide a complete ration. The efficiency of absorption was 27%. If this value is used in the British system (instead of 45%), the Ca requirement becomes $27 \times 100/27 = 100$ g/day.

It may be argued that the lower efficiency of absorption is related to the higher Ca intake. Nonetheless, the two estimates of efficiency (27 and 45%) indicate a range. We therefore postulate that the Ca requirement of the calf gaining body weight at a rate of 4 lb/day is 60-100 g/day.

The future. An unfortunate general problem in research on production animals is that animals with poor production are usually the ones most readily available for investigation. The calcium requirement of *fast-growing calves* ought to be determined by proper experiments. These would cost $75,000 to $100,000. They would ensue that the whole industry would not suffer losses due to bone problems or to growth restriction by inadequate Ca intake. Since the likely benefit of this work would be most directly affecting the beef cattle industry, we would like to recall the remarks of President Carlson and of Professor Preston concerning the need for the industry to provide fiscal support for applied research.

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"PAPER ON PREWEANING AND CONDITIONING OF WYOMING FEEDER CATTLE"

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PREWEANING AND CONDITIONING OF WYOMING FEEDER CATTLE

Until now we have heard about the disease conditions and stress conditions that exist in feeder calves when they are received in the mid-western feed lots. We have heard of the concept of a "Preconditioning Program" and of the economic aspects of such a program. We have listened to the problems of the feeder and have mulled over in our own minds the various factors that contribute to a problem that has in the past and will continue to adversely affect our nations' cattle industry. I think we all are in agreement that there is definitely a problem and when there is a problem we must act to overcome it with the least inconvenience to all parties concerned. We must develop an effective program, agreeable not only with the cattle feeders, but with the producers of feeder calves as well. A program that will not add to the economic or physical burden of either, or to any faction of our nations' cattle industry.

In considering and drawing up my proposal for a workable Preconditioning Program, I have visited mainly with calf producers from the entire state of Wyoming, so my remarks will be from a calf producers point of view coupled with the knowledge that the feeder has an equal if not larger concern with the way in which this problem is handled.

My proposal for a workable program is actually that of no program at all. Now, this is not shocking when I insert here that calf producers in my area are leary of any new development that is called a "program" per se. What I am trying to convey is that we would be in favor of an agreement rather than a mandatory regulation that states what we must do if we are to market our product. This could be realized as an amiable decision if you consider that an agreement between the producer and the feeder does not put an end to one phase of competition between the individual calf producers. It would leave the progressive producer free to carry on a conditioning program, initiated by his own thinking, rather than administering one more regulation on which he will fight or try to cheat. In time, the ranchers with inverse thinking on this subject will see that the feeder favors the conditioned calves and they too will probably "fall in line" with the program.

I am not only worried about the loss of one factor of competition, but so many times before, we have seen an industry impose regulations upon itself to cope with a problem, or to produce beneficial results, and end up having it become a federal regulation. If this would happen with our problem, I sincerely feel that it would drastically cripple the entire livestock industry. I am almost certain that many producers would market their calves at local sale barns to escape interstate restrictions and if this would become a reality—you know as well as do I the chaos that would develop.

I would like to turn now from this rather grim train of thought to another proposal—that of education. Education of both parties involved—the producer and the feeder. I feel we must educate the producer in the "whys" and "hows" of a conditioning program, but we must also educate the smaller feeder whose main source of income is from farming and for an added income buys a few steers in the fall to feed up some of his excess corn. I know from personal experience that many of these farmers create their own disease and stress problems which could have been curtailed if they had been properly educated in some basic veterinary diagnoses. I am not trying to infringe on anyone's profession here, I am simply saying that so many times the small cattle feeder does not spend enough time with cattle to be able to spot disease and stress symptoms and to treat them before they turn into serious cases. Another point to bring up here is the education of these smaller feeders in how to buy calves. Frequently a feeder will read the morning livestock report, call a contract buyer and tell him to buy 100 light steer calves at 28 cents. Probably in our part of the country good, light steer calves are selling for 30 cents (if we're lucky). So for this buyer to make his "dollar-a-head", he either takes the tailend off a large bunch of calves or picks up small bunches of calves at a local auction barn and puts them together for the feeder. In either case, the farmer, by not being educated in the cattle buying business, has bought himself "a hundred head of trouble". So often the farmer blames the producer for not carrying on a conditioning program, when actually the blame should be placed on his own buying program. Education in transportation can also enter into this problem. If the feeder hires a truck driver who "hot rods" into every coffee joint along the road, slams on his brakes, and spends half an hour visiting with the waitresses, then it is not fair to ridicule the rancher when his calves stagger off the truck half starved and black and blue.

I have lightly passed over one aspect of calf buying that I should stress more strongly. The buyer does not need further education to realize that if he sits in a sale barn in Iowa and buys "good-doing Wyoming calves" that have actually been through two or three sale yards on their way to his locality, that any conditioning program that has been carried on by the producer will be of little benefit to him in treating the half a dozen new bugs the calf has picked up along the road. To sum up these ideas, I can lump them into a cliché that should explain my thoughts—"education rather than regulation".

Now I would like to stop generalizing on this conditioning and preweaning problem and get down to some facts from an individual producer's point of view. Since I know my own methods of breeding, raising, and marketing calves in the Rocky Mountains best, I will use my personal operation as an example. I run about 400 commercial breeding cows on about 10,000 acres of primarily deeded land in Albany and Carbon Counties of this state. In the April and May of each year we calve out about 94 percent live calves and in the fall of the year, wean about a 92 percent calf crop. Of the 360 calves, we keep about 50 heifers for replacements and market the rest as feeder calves. Just to explain how close I am to a workable conditioning program, I would like to relate what we administer to these calves to protect them against calfhood disease and to prevent loss and stress at a later date. In late February or early March the cow is injected with Clostridium Perfringins Type C Enterotoxemia vaccine which helps to prevent bloody or purple scours. At the same time the cow is injected with 3 cc of water base vitamin A to be held over and supplied to the calf in the mother's milk. When the calf is born, he is earmarked and his horns are pasted, and replacement heifer prospects are eartagged for later identification. At branding (usually the first of June), he is castrated, vaccinated against blackleg and malignant edema, and given a 5 cc shot of a shipping fever vaccine that I feel is not only a protection against shipping fever, but also a prevention of pinkeye. He is also branded with a hot iron at this time and he is dehorned with scoops if the paste treatment did not take.

Then about 2 weeks before our shipping date, which is usually about November 1, we give the calves a PI-3 shot, dip them for lice and grubs and give a clean-up blackleg-malignant edema vaccination. The cows are vaccinated for vibrio at this time and also dipped for lice and grubs. The calves then are returned to their mothers for 2 weeks and are weaned from their mothers straight into trucks for delivery to the feeder. Now, I must validate my preceding statement by saying that in July or August, when these calves are contracted, the buyer or contract buyer is given the alternative of having the 2-week preshipping conditioning program done at actual vaccine, dip, and labor cost on a per head basis. This usually figures out to run about $2.50 per head. On the replacement heifers that I keep, we wean them, and after they quit bawling we vaccinate them for brucellosis.

Now, if we look at a Certificate of Precondition and compare my program against its immunizations and treatments, you will find that I do not vaccinate for Bovine Rhinotracheitis, mainly because we have none in our area, and I do not want any live vaccine on my ranch if there is no need for it. We do not vaccinate for BVD or Lepto for the same reason. The only worms that we have in our valley are used for fishing, so we find no need for worm treatment.

Now, am I conditioning my calves for the feeder or not? I have always felt that I am carrying on a good program and I feel that I have benefited along with my buyer from it; but, if I use the regulatory Certificate of Preconditioning, I fail to condition my calves because they lack some of the shots and I do not prewean.

Preweaning brings up the largest obstacle on my individual road to an honest preconditioning program. I ranch at an altitude of 7,200 feet. We cannot raise alfalfa economically at this altitude, let alone, oats or barley. If I were to prewean my calves and start them on supplement feed, every sack of grain that I use would have to be trucked in from out of state making the cost prohibitive. The corrals and facilities that I now have built are dry and dusty in the fall and in order to carry on a preweaning program that would not cripple my operation by calf loss, I would be forced to build a separate weaning corral on well-drained sodded ground. The last month that the calves are on their mothers is when I am making about 2 pounds a day on those calves; at this time they are supplementing milk with hard fall grass. One factor that tends to sell more "hard grass Wyoming cattle" is the "bloom" or "blossom" that a calf puts on during the last month of on-the-cow existence. I realize that some experiments have been run that show that a calf will gain back his weaning weight in 3 to 4 weeks. I must say here that I doubt if this can be done economically in my valley with May calves, trucked-in grain, and frost on the ground every other morning.

It would be well for me to admit here that many of the calf producers with whom I have talked in recent weeks from areas of Wyoming that can produce grain crops, can and do economically prewean. This statement only serves to strengthen my proposal of no mandatory conditioning and preweaning program, but instead education of the producers in these areas as to the value of preweaning and conditioning.

In conclusion and summary, I can best emphasize the feelings of the feeder calf producers in our area by explaining the several paragraphs in a resolution adopted at the annual meeting of both the Albany County Stockgrowers Association and the Carbon County Cattlemens Association. In the first paragraphs, the resolution recognizes that the calf producer and the feeder have a problem in the area of conditioning a calf for the feed lot so that there will be less loss to the feeder and consequently more gain to the cattle industry; but the eight-point preweaning and conditioning program would not be economically feasible for all Wyoming calf producers, and most all points in the program, except for the preweaning measure, are presently carried out to a great extent by the majority of the Wyoming calf producers. The resolution goes on to say that statewide and nationwide programs of this type would only serve to force many of the calf producers to market at local sale facilities where stress and disease are prevalent, and education of the feeder in the field of buying cattle, disease prevention and treatment, and cattle producing economics would tend to eliminate a great part of the problem. They then resolved and went on record as opposing any mandatory or regulatory preweaning or conditioning programs; and they are in favor of individual agreements between the buyer and seller which would initiate a program that would cut down on stress and disease in young feeder cattle.

I would like to thank the preconditioning conference committee for giving me an opportunity to present this paper; I would like to welcome you again to Wyoming and sincerely hope that you have enjoyed our great state. Please come again.

Conference On Preconditioning Cattle
University Of Wyoming
June 27, 1968

"DEVELOPMENT OF EFFECTIVE PROGRAMS FOR MARKETING AND PURCHASING CATTLE"

by
Dean Prosser, Jr.
Executive Secretary of
Wyoming Stock Growers Association

Mr. Chairman, Dr. Crenshaw, Ladies and Gentlemen:

It is indeed a pleasure to have the opportunity to participate in this discussion as a representative of Wyoming's great cattle industry.

Before I launch into more serious matters, I would like to take the opportunity to welcome all of those from out-of-state that are in attendance at this Conference, and also to thank Dr. Crenshaw, and any others directly involved, for selecting Laramie as the site for this meeting. We are most happy to have you in our great State and most certainly hope that you can share with us and enjoy some of the many scenic wonders of Wyoming as you return to your respective home locations.

As you all know, the term "marketing" seems to be on the lips of all of us engaged in the livestock business today. We as producers are beginning to realize that we have perhaps spent too much time and attention towards production efficiency and too little time and effort in the broad area of advertising and marketing our product.

As an Association, the Wyoming Stock Growers has approved a three-phase marketing program for a trial period of three years. This program involves (1) listing and circulation to potential buyers of Wyoming Cow Country Feeder Cattle for sale; (2) promotion of Special Wyoming Cow Country Feeder Cattle Sales, and (3) Market News and Information through a telephone reporting service.

In addition to the adoption of this program, we have hired a field representative to help implement this program. Our field representative will be continually on the move, both within and outside our State in an attempt to promote and help sell our high altitude quality cattle. In addition to the efforts of the Wyoming Stock Growers Association, it is interesting to note that the American National Cattlemen's Association is also just now launching a new voluntary marketing program. This program will consist of mainly gathering and disseminating pertinent factual information regarding numbers of cattle on feed, average weights, marketing intentions of those persons owning the cattle, weather information, etc. It is the hope of our industry that by programs such as these we can begin to build marketing information and data that can be used today and tomorrow for the betterment of our business.

All of these programs are conceived and financed on a voluntary basis by the livestock operators themselves. This, ladies and gentlemen, is "free enterprise" at its greatest, and because it has been free enterprise that built this great nation, there are those of us that feel that "free enterprise" is the only way to save our nation during this period of complexity and frustration. We in the livestock business have long been advocates of this general philosophy and we still have faith that this is the "light"—this is the way out of our existing dilemma.

Now to get back to the purpose of this Conference, which in my interpretation is to explore the worthiness and the possibilities of the newly coined term "preconditioning." First let me say that I feel the term "preconditioning" was poorly conceived and arose out of selfish interest. This is not to say that all concerned with this term is wrong, but rather to point up that the general connotation of the term is wrong. This I sincerely believe and will forever defend.

A program such as has been proposed under the term of "preconditioning" *should not* be designed to sell some special vaccine or pharmaceutical product. *Should not* be designed to pass off on to one segment of the industry the responsibilities and failures of another segment of the industry. *Should not* be used as a tool to promote a profession at the expense of the basic industry; and *should not* be used as a "black jack" to force something that is strictly in the experimental stages down the producers' throat. All of these things have been, in my opinion, involved in this proposed new program—and until each segment of this great industry realizes that all the other segments are vital and necessary for the success of the entire industry, then and then only will be begin to make forward progress with a program such as this.

Now it is again my opinion that much of the distasteful attitude towards this proposed program will be erased from the mouth of the basic producer when the other segments interested in the potential, that perhaps lies within the general concept, begin to accept their responsible part in the over-all picture.

You know the basic producer of livestock is caught in a terrific "cost price squeeze"—he has labor problems that you would not believe—he buys at retail and sells at wholesale, and if there is anything left after it is all over he still has to square with "Uncle Sam." The price level of cattle today, 1968, is approximately that of 1948, some 20 years ago. Believe me, his costs of production have skyrocketed and he has been forced to cut back and cut down every place that he possibly could.

Now don't get me wrong, the cattle producer of today is not backward nor unprogressive—in fact he is just the exact opposite. He is now, by necessity, a calculating business man who has a good set of books and knows the value of records and record keeping. He knows that any new program he launches into has got to pay returns to him or else he is not going to do it. He is cool-headed and clear-eyed—those clear eyes can look right through you and say no, and you'd better believe him.

Let me tell you what that basic cow calf man is thinking when the agents from the Extension Service and the spokesmen from the feeders association and the veterinary societies try to say, "You're going to do this and that to those calves you want to sell or nobody will buy them." His first reaction is going to be, "I'll be glad to do if for a price."—Free enterprise at work—*don't knock it.*

His second reaction is going to be—if they don't want to pay the extra costs to do all these things, I'll change my operation. He has heard about vertical integration in this cattle business and he is pretty apt to try it. In my opinion more and more ranchers are going to, one way or another, own their cattle all the way to the packing house, and most of them will do it in a better and more economical way than the average buyer of their cattle does today.

These are the trends of the cattle business today—so I say to the farmer feeder who would hopefully like to have more service built into the product he buys—prepare to pay for it, or quit feeding. You know this great cattle business has been built over the years in a free enterprise system; no one has a corner on anything. Everybody has to meet the competition wherever it is. I sometimes think we worry too much about our immediate problems, because it has been my experience that if you stick around a short while, you will no longer have that problem—but you're sure to have another one or two in its place.

The basic problem with handling these calves seems to be in the long movement—don't worry so much about it because in ten year's time these cattle will not be traveling nearly so much as they do today, and when they do travel they will be in the hands of people that know how to properly handle them. The cattle producers of tomorrow will be feeding his own cattle and the farmer feeder will be raising his own feeders—the commercial feeder will be bigger and he will know how to buy and handle his livestock.

These are the trends, let's not kid ourselves about the true facts. Most of those that fall somewhere in between the three groups *will not be in the cattle business* and I will go one step further and say they *should not be in the cattle business.*

I think by now I have pretty clearly stated the position of the basic producer of these cattle. He's not about to put up with any foolishness in the areas of interstate regulations along these proposed "preconditioning" lines. He is ready and willing to bargain on an individual basis with any buyer that wants special services performed on the livestock he wants to buy. He will continue to attempt to produce better performing cattle, and he will have the records to show how he is doing it. If no one shows up to buy his cattle he will feed them himself and perhaps will do this even if a buyer does show up. In other words, the producer may become the toughest competitor for his own livestock—this will surely happen if the feeding segment of our industry begins to stabilize, as I feel it surely will.

Now I am not sure where this all leaves the fellow that is supposedly demanding all of these "preconditioning" practices. There's something about being up that old creek without a paddle—perhaps that is where he is. My suggestion is that if you want special services performed on the lievestock you buy—be prepared to pay for them.

Another possible solution to those in so much trouble because they don't know how to handle calves is to switch to purchasing yearling steers. They are much easier to handle and stand shipment without complications. Still a third alternative would be to buy from someone who specializes in "preconditioning" the calves for you—here again you will pay for this service. These are the ways of "free enterprise"—these are the proper approaches—the only approaches that are open at this time and I am quite sure the only approaches that will be open in the future.

The basic producer of livestock today is aware that many new trends are going on in the livestock business. At least the successful ones are college graduates that want to and do keep abreast of current trends and changes. When something new comes along that is able to prove its economic worth—this modern producer will adopt the practice—but please don't try to use him for a guinea pig for every bright new idea that someone dreams up, because his comparative position in today's economic structure won't allow him to do much of this. First of all, this modern producer is a business man and is going to become more and more of a business man as time goes on. He knows that he must become more active in the marketing and selling of his product. I feel sure that as time goes on this producer will be adopting more of the proposed "preconditioning" practices as each one proves its economic worth. In time we will no doubt see special sales where these specially treated calves will be offered to the buying public. These changes will come about gradually and as a whole will be good for the entire industry. There is no doubt that the producer will have to stay informed and current or else he will not remain in the business. The commercial feeder will do the same thing for the same basic reasons.

The one that I am concerned about is the small farmer-feeder who perhaps hasn't quite kept up with the changing times. This is the group that needs instruction on how to buy feeder cattle and how to take care of them once he has purchased them. These are lessons this man must learn or the cattle business will go on ahead and leave him behind and out. It is my sincere suggestion that much education and information on how to buy and handle "freshly weaned" calves needs to be disseminated in the midwestern states and other areas where we still have large numbers of small farmer-feeders. I contend that many of these fellows don't know how to properly buy their cattle and don't pay enough attention to them once they have them purchased and back on the farm. The ownership of livestock and the responsibility of the livestock's well being are inseparable—whoever owns them must understand and accept this fact.

As far as I am concerned today I feel that the ways and means are available to us now to purchase livestock of all classes and handle them with only a reasonable (2%) death loss. The difference between the fellow that can do this and the one that can't is education, understanding and management. Those that don't have this education, understanding and management are probably on the way out, and let's don't shed too many tears—however, the least we can do is to launch an informational and educational campaign to show them how it can be done. This should become the responsibility of the Extension Service, the practicing veterinarians and the livestock associations. Together they can do much to educate and help the small farmer-feeder solve his livestock health problems. To this end I assure you the Wyoming Stock Growers Association and the American National Cattlemen's Association are dedicated. The whole thrust of the marketing programs of these two associations is to tell the potential buyer where he can buy quality livestock from reputable producers. There is never an attempt to dictate price or terms—this again is "free enterprise" at work. This is only the beginning of the type of action that we are going to see our livestock organizations engaged in on down the road.

Whatever the programs may develop into, we must always remember that the entire industry must be considered if the program is to be successful. All of those directly involved in the business plus those who make their living as a result of the business, must coordinate their thinking and work together in order to keep pace with the changing world of agriculture.

Thank you.

"DEVELOPMENT OF EFFECTIVE PROGRAMS FOR MARKETING AND PURCHASING CATTLE"

by
M. J. Rice
Livestockman,
Alturas, California

I was introduced to a phase of preconditioning last fall when trading for the sale of our weaner calves. The price that was offered was good; however, we had the choice of PI_3 vaccination or a 2% pencil shrink.

The calves were vaccinated after coming home from our summer range, some two weeks before shipping. The second shot was given after the calves were weighed.

The results of the vaccination were excellent. We kept back 160 heifer calves weighing about 425 pounds and didn't have any trouble whatsoever. The buyer reported similar experience with the calves he received.

In any preconditioning program, I firmly believe that it has to start with a clean cow herd—cows that have had calfhood vaccination for Brucellosis, IBR, BVD, an annual Lepto shot and a positive program to eliminate Vibro. Unless the cows are as free of disease as possible, no program can be effective.

The calves should be properly dehorned, castrated and vaccinated for Blackleg, malignant Edema and in most areas for overeating disease and a first PI_3 shot could be given at this time.

We definitely feel we have an obligation to our buyer to provide him with as healthy and as desirable a calf as is within our ability to give him. We want the calf to go ahead with no lost time, no sickness and as low a mortality as possible. The cost of the vaccination program, I believe, should be borne by the producer.

When the producer can show that a sound program of preventative pre-weaning care has been followed, I believe that then a price incentive can be given, or perhaps a price dockage be made for calves that have not been handled so as to be relatively disease free.

No program can ever be successful if the producer doesn't handle his calves in such a manner to keep stress to an absolute minimum. Stress is more apt to trigger any of the so-called calfhood diseases than probably any other factor.

A few rules that we try to observe when working our calves are:

1. Use as few people as possible.
2. Keep dust to an absolute minimum, even if it means sprinkling the corrals and alleys.
3. Try and work calves when cool.
4. Avoid working calves in inclement weather.
5. This is no time to break a green horse.
6. Inspect the trucks for being properly bedded and cleaned out.
7. When the trucks leave with the cattle, let the driver know that you are calling the buyer as to the time of departure. It helps keep the driver honest and out of every coffee stop.

We would never, unless absolutely forced on us, go for a pre-weaning of the calves. I would like to explain why.

1. We have, to date, borne all the cost of producing a healthy calf.
2. Feed cost for 15-30 days would be a large financial loss.
3. I don't believe we would get back the shrink of weaning in that period of time.
4. It puts the responsibility on the producer's back after the calves are theoretically sold, when it should be on the feeder.
5. The mechanical aspects of building weaning corrals and of purchasing special feed would not justify itself.
6. I know the buyer of my calves has better facilities, more trained men and more experience with livestock than we do. He is better able to doctor and to isolate calves that may be getting sick. In the larger lots a resident veterinarian is usually available.

We will go along with any program that is economically feasible to give our buyer a healthy calf that will go ahead for them. When all segments of cattle business become aware of the value of preconditioning and the lowered morbidity and lowered mortality, I believe we will then realize a better price for our product. Until then, we will have to bear the cost.

"OUR EXPERIENCE WITH PRE-WEANING CALVES ON THE DAUBE RANCHES"

by
Leo Roberts
Manger—Daube Ranch,
Ardmore, Oklahoma

In the fall of 1967, we started on a program of pre-weaning calves on the Daube Ranches. Our operation consists of a large number of cows scattered over a large number of pastures and rough terrain. Our primary reason for handling our calves in this manner was because of the convenience it afforded in shipping. Our shipping program puts from two to three loads of calves at the Thursday Auction in Oklahoma City every week from about the first of July until we finish up in the late fall or early winter.

Along in August, we had already been in most pastures at least one time and this left us with calves scattered from ten head to thirty head in over sixty pastures. So we had a problem of putting together enough calves every Wednesday to make a shipment.

We set up four lots for about fifty calves per group. Two of the lots were at the Mill Creek Ranch near a set of scales, and with well-water and shade in each lot. The other two lots were built at the Rock Prairie Ranch, also near a set of scales and with spring water running through each lot. We started filling these lots on Monday of the first week and had a total of 106 calves in two lots to make up one shipment. These calves were fed a high-concentrate ration twice daily, as much as they would clean up, which in four days amounted to ten pounds per head daily. They were fed prairie hay free-choice. The calves were given a "three-way" shot. Feed consumption dropped off toward the end of the two week feeding period and averaged about 7 pounds daily. It would be hard to figure this exactly, because not all calves were put in the lot at the same time.

At the end of one week, another shipment of calves was assembled to fill the remaining two lots. Then the second week we shipped the first set of calves and filled the lots with a new set. This started a rotation program. We followed this procedure on about six hundred calves. We lost one calf the second day on feed. A post-mortem revealed a collapsed lung; thus this calf was not lost due to the feed-lot program. We lost only one other calf due to an injury. We had no sickness at all among the calves.

Performance records were kept on the first four shipments of calves, or a total of 451 head. These records are a part of this report. (Table 1).

These records show a feeding period gain of 17 lb. for the two week period. The average gain (off the cows to pay weights) was an average of 3.6 lb. We figured we saved 25 lb., based on the 6% shrink we normally get from off the cows to pay weights. This, plus the actual gain from off cow weights to pay weights, averaged about 30 lb. per head. Based on an average selling price of $28.50 per pound for all the calves, this would add $8.55 per head to the calves. Our actual costs per head averaged $3.62. This calculates to be a profit of $4.93 per head per calf.

These figures should excite a man to the point where he would plan on this procedure for shipping from now on. But, I feel we could have been lucky in that we had no sickness. If we got a pen of cattle sick, it might take a good while to get them back on their feet for shipment and could easily mean a sizable loss. Another thing is the acceptability of the calves on the market. They lose their bloom and appeal in this two week period. I could not say they brought less on the market but, I know they did not bring a premium.

Another thing, a lot of feedlot people don't think we are doing enough for the calves. We could be giving a good many more shots at an added expense. Some say we should have them off the cows for at least 30 days, and some have said for 90 days. I think if it ever came to a period any longer than two weeks, we would just go into the feedlot business and feed them out ourselves. So at this point I can't say what our program along this line might be. We'll just have to play it by ear. No two years seem to ever work out the same.

Table 1

Results with Pre-Weaning 451 Calves at the Daube Ranches, Ardmore, Oklahoma

Pen No.	1	2	3	4	Average
Number of calves	106	100	102	143	113
Av. Wt. at weaning, lb.	450	435	463	420	440
Av. Wt. out of pens, lb.	466	457	477	435	457
Feeding Period gain					
Av. pounds	16	22	13	15	17
% of wean. wt.	3.4	5.0	2.8	3.7	3.7
Av. "pay weight" at Okla. City, lb.	452	440	466	425	444
Shrink to market, %	2.99	3.88	2.14	2.48	2.83
Total change in wt. during weaning					
lb.	2	4	2.7	4.8	3.6
%	.4	.9	.5	1.3	.8
Financial Results					
Feed cost/calf	3.97	4.27	3.95	2.68	3.62
Av. selling price	28.27	29.07	28.59	28.19	28.50
Estimated net gain per calf[1]	4.23	4.45	4.51	5.87	4.93

[1]Assume normal shrink on calves shipped directly to market

"DEVELOPMENT OF EFFECTIVE PROGRAMS FOR MARKETING AND PURCHASING CATTLE-FEEDERS"

by
Mr. William R. Phelps
Kossuth County Livestock Feeders Association
Swea City, Iowa

I first became interested in preconditioning cattle about two years ago when within a two-year period I had three outbreaks of parainfluenza. About this time the National Livestock Feeders started an ambitious promotional campaign on preconditioning, and that aroused my interest.

My first experience with preconditioned cattle was last fall when I bought some Montana cattle that had been vaccinated with parainfluenza and rednose two or three weeks before they left the ranch and weaned for three weeks. These cattle came in and started with very little shipping fever and did not have to be retreated several times. The only problem with these preconditioned cattle was that they didn't have the gain ability to make the extra cost of preconditioning worthwhile. So it is not only preconditioning—we have to have the gain ability to go with it before it is worthwhile.

I'll admit, as a few people have already mentioned, that there are a lot of feeders who buy their own trouble when they're bringing cattle in. I had one neighbor who lost over 25% of his feeder calves to BVD, and I'm sure that although he brought them directly from the ranch there were symptoms on the ranch when he loaded them that shouldn't have been brought into the feedlot.

This spring we had some experience with light cattle from east Texas, and this is why I think I was invited here, because we had very good experience with them. They had been weaned for a period of time and carried on winter oat pasture in pretty good gain. There were corrals to treat them in and they were vaccinated ten days before shipment with a parainfluenza shot. We brought several loads of these cattle in and on unloading them we vaccinated them for rednose and parainfluenza again, followed with a BVD vaccination about three weeks later. We didn't lose any of these cattle with the exception of on one load, and this load was rolled over in a truck accident—and I think this caused additional stress! Of the cattle that came in healthy I think out of about 800 head we treated one for any kind of a fever, and he responded readily. These cattle are being fed in a leased commercial yard where all they are getting is sweet corn silage with little grain and protein, and they have done very well since coming in. They were in shape to go on feed.

As far as pre-weaning goes, it is my experience that this is one of the most important phases of preconditioning. I'll admit there are areas where this is not possible, but I am not so concerned whether they're started on grain. All I want to know is that they will eat when they come off the truck, and they've got to know how to eat and drink or you're in trouble. With a calf that hasn't been weaned, it can be quite a strain on it. Our operation at home consists of mostly put together calves and these calves are not vaccinated until arrival. We do vaccinate them off the truck and give them very close attention the first three weeks. We have been able to hold out death loss below a 2% level.

In regard to grub treatment, most of the southern cattle came in too late for effective control. We do treat all of them for grubs regardless of whether or not we think they have been treated, but most of the time we are a little late to get the maximum benefit.

We have also had other problems with cattle that have not been weaned. We vaccinate them off the truck and we think the vaccinations are not effective because of the immunity from the cow. In one bunch last fall we found this to be a problem so we revaccinated a month or so after they were in when we had some sickness, and this immediately stopped our problem.

Another problem we are having, and this has been mentioned, but I don't know the answer. I have dealt with several different trucking firms, and as far as I'm concerned, I don't do any business with the railroad any more, but we're having trouble finding truckers that will give us decent service, and I don't doubt that this is the cause of a lot of our trouble.

As far as paying for preconditioning, when we begin to get results, I'm sure that it will be paid for.

"PRODUCER-FEEDER"

by
Paul F. Engler
Little Horn Land & Livestock Co.
Wyola, Montana

In discussing the development of an effective program for marketing and purchasing cattle from the producer-feeder standpoint, I find it a little difficult to come up with anything new or of a revolutionary nature in addition to what already has been said.

It is a real pleasure to appear on the same portion of a program with a group of men such as Messrs. Prosser, Krueger, Rice and Phelps. I was starting to develop an inferiority complex from speaking at various meetings where I looked over the programs and found that I was the only one that didn't have a Ph.D. degree behind my name. This got to be such an obsession that I finally asked one program chairman to give me a degree designation. He said that he would be glad to—what was it. I told him D.D.C., Dumb, Damned Cattleman.

Seriously though, I believe that a producer-feeder enjoys a unique situation as far as preconditioning is concerned. When I speak of a producer-feeder, I am talking about a producer who has integrated his operation to include the finishing of his own feeder cattle for slaughter. Whether it is in his own feedlot or whether he avails himself of the services of a commercial feedlot.

I sincerely believe that this arrangement presents a theoretically ideal situation which is equitable inasmuch as all of the benefits of preconditioning and all of the expense accrue to the same person.

Speaking as a producer, it is a little difficult for me to reconcile myself to a situation which involves not only considerable expense and management problems, but a great deal of risk to perform a service which will accrue to the benefit of someone else who is generally unwilling to pay for it. If I am forced to do this to remain in a competitive position to merchandise my cattle, this is another thing, but to do this on a voluntary basis in the hopes that some cattle feeder will thank me is a horse of another color.

Speaking as a feeder, which incidentally is a major part of our business activity, I am reluctant to put out cold cash on a premium basis for something that is in such a gray area as to its actual value as preconditioning. I believe that I would have to take the same attitude as Jack Winegar's buyer in that the rancher is going to look at his additional weight gain during the post weaning period as his compensation for his preconditioning work.

Being fully cognizant of some of our own problems in getting these various bacterins and biologicals administered in the proper manner by our own experienced personnel, we are more than a little apprehensive about the kind of job that someone totally unknown to us has done. We are apprehensive to the point that not only are we unwilling to pay him for it, we are also going to immunize them again upon their arrival in our yards.

Now, in getting back to what I was supposed to talk about, the development of effective programs for marketing and purchasing cattle, I can certainly foresee situations or arrangements where preconditioning can be used as an effective marketing tool which could be mutually advantageous to both the feeder and producer.

Dr. Pope mentioned yesterday that in his area he predicted that there would be more long-term direct purchase contracts between producers and feeders. I can realistically see situations where a corn belt feeder might come to our ranch during the summer and contract our calves, for not only fall delivery, but also on a preconditioned basis, and not only the cost of which, but also the specifics of the program could be mutually negotiated upon at that time to the mutual satisfaction of both parties. As producers we would be willing to negotiate on this type of basis at this time, fully cognizant that we were going to be compensated for it. As a feeder, we have already done this on a limited scale on some of our feed yard purchases. We have even worked out arrangements where we have furnished the feed from our feed mill for a portion of the backgrounding phase of the program.

However, I think we are whistling in the dark to expect the rancher to proceed with a full preconditioning program not knowing that he is going to be adequately compensated for it on a prenegotiated basis but that he is going to be at the mercy of the market in determining how much he is going to receive for doing their services. I don't think that the prudent rancher will be willing to assume the risk, unless he is forced to.

Now, in summarizing, I would like to go back to one of my first statements, the producer, in order to utilize preconditioning to the fullest extent should give serious consideration to continue in an ownership position through the finishing or fattening period of his cattle.

This situation is somewhat similar to the rancher who is committed to some type of performance testing in his breeding program. I firmly believe that if he is going to realize the full potential of his program that he is going to have to vertically integrate to include the fattening of his cattle either in his own operation or in a commercial feed yard.

The same is true for preconditioning.