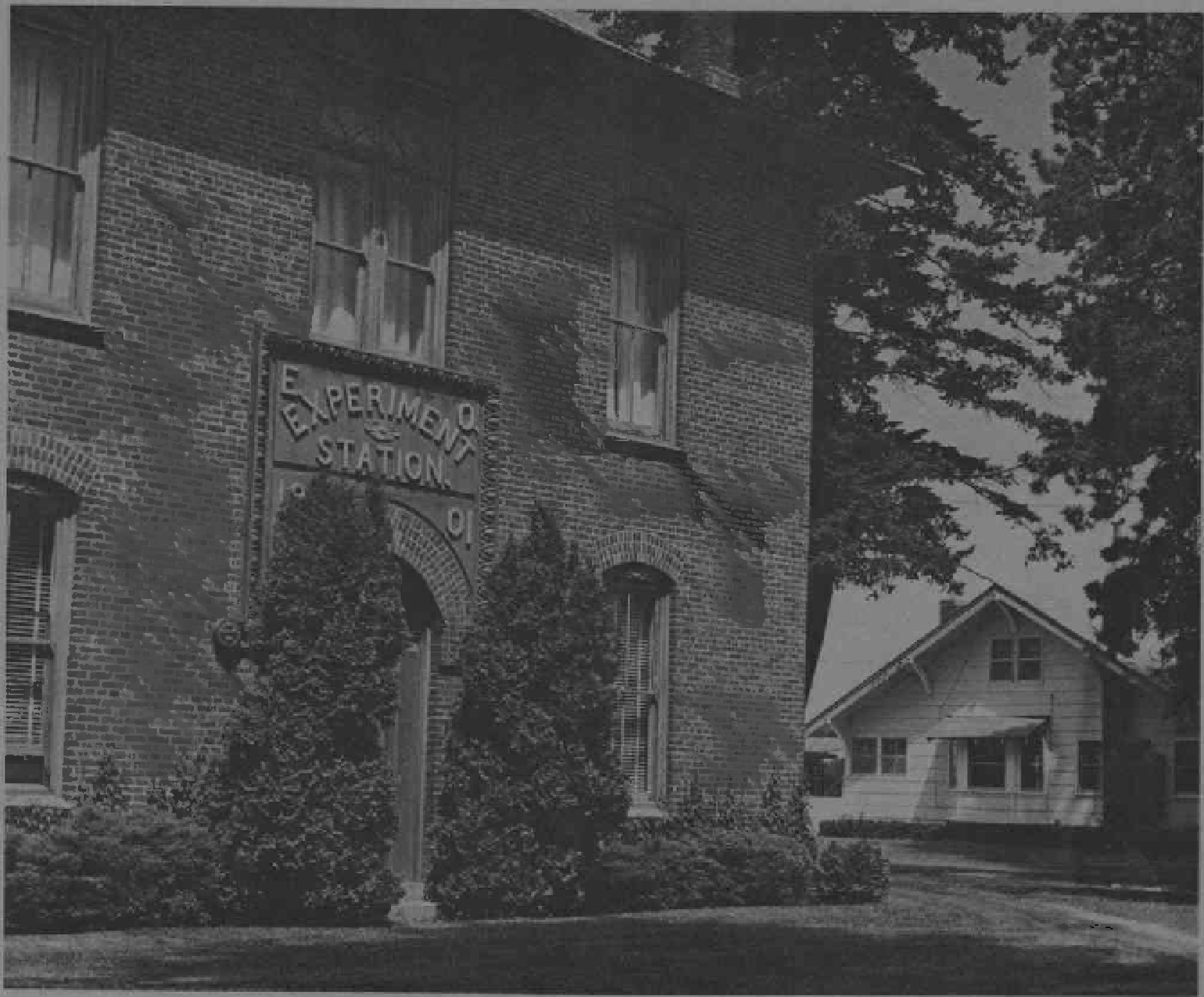
15th Annual Beef Cattle Day Report



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IMMUNIZATION FOR BOVINE VIRAL RESPIRATORY DISEASES

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Lack of understanding of the cause of bovine respiratory disease as it is affected by management practices has in the past and probably will continue in the future to plague the veterinarian and the cattle industry. Research has thus far failed to determine the exact roles of various viruses and bacteria in bovine respiratory disease of which shipping fever is the most common.

Viruses that have been associated with respiratory disease of cattle are many including parainfluenza type 3 (PI_3), infectious bovine rhinotracheitis (IBR), bovine virus diarrhea (BVD), herpes viruses, rhinoviruses, enteroviruses and other viruses. Chlamydia which are virus-like organisms have also been incriminated in cases of pneumonia.

Of all bacteria isolated from bovine pneumonia cases, *Pasteurella spp.* are thought to be most commonly involved. *Pasteurella multocida* has been associated with shipping fever on many occasions. In more recent years, *Pasteurella haemolytica* also has been shown to be important as a bacterial infection. *Mycoplasma spp.*, a form of bacteria, are also commonly present in cases of respiratory disease and their role in the disease process is being studied.

A generally accepted theory is that the cause of shipping fever is stress plus viral infection, plus bacterial infection. This will continue to be a hypothesis until it is learned through research exactly how to assess the effects of various management practices on the health status of cattle and how the practices relate to the effects of virus and bacterial infection in cattle. Various attempts to duplicate clinically stressed cattle in controlled experiments have been equivocal.

Effects of feed and water deprivation of cattle have been studied with results indicating reduced rumen bacterial and protozoa counts, decreased volatile fatty acid production, catabolic metabolism and negative nitrogen and water balance. The adaptation period of rumen microflora to change in feed is of considerable duration. A much longer period is required after prolonged feed and water starvation. This may explain, even in the absence of disease, the loss of weight and the period necessary to regain pay weight after entering the feedlot.

Changes in feed and water, temperature fluctuations, overcrowding, faulty ventilation, anxiety during the weaning period and in transit, and fatigue are all factors generally considered to cause stress on the animal.

Concepts of Viral Immunology

Considering the many interrelating factors involved in initiating respiratory disease, it is readily understood that control of the condition is complex. Reduction of stress through proper management is a basic requirement necessary for the success of any control program. This factor has probably been the underlying cause of most of the controversy surrounding the so-called "preconditioning" programs. These facts notwithstanding, however, a major contribution to the control of bovine respiratory disease has been the development of vaccines against the more common viral infections.

The development of vaccines for the prevention of viral-induced bovine respiratory diseases has been consistent with fundamental concepts of viral immunology. Stated in brief, these concepts involve the inoculation of a selected variant strain of a pathogenic virus by an unnatural route to stimulate the production of antibodies that will protect against a virulent strain of that virus. The practical application of these concepts in preventive medicine is based however, on the following criteria: (1) the selected strain of vaccine virus must not cause disease when inoculated by the unnatural route, and must not be disseminated as a pathogen to susceptible individuals in contact with vaccinates; (2) the vaccine virus must stimulate adequate production of antibodies that are capable of neutralizing not only the vaccine virus but the virulent virus as well; and (3) the vaccine virus must be administered to the host far enough in advance of exposure to virulent virus to allow adequate production of neutralizing antibodies.

The traditional application of these concepts to bovine respiratory viruses has been the administration of vaccine viruses by the intramuscular route rather than by the natural mode of infection--the respiratory tract. There are, however, limitations imposed by this approach to immunization against diseases of the respiratory tract. These limitations may be summarized as follows. First, there is a critical balance between the safety and immunogenicity of selected, modified strains of virus. That is, a strain of virus sufficiently modified so that it will not cause disease if administered by the respiratory route may not be adequately immunogenic when inoculated by the intramuscular route, and vice versa. Second, the virus administered intramuscularly is subject to immediate dissemination throughout the body by means of the circulatory system, before any defensive response can be mustered by the vaccinated animal. In the case of some viruses, such dissemination in the pregnant cow can result in fetal infection, with ensuing fetal death and mummification or abortion. Finally, intramuscular injection of vaccine virus, while eliciting humoral (serum) antibody production, does not elicit host defense mechanisms capable of providing more immediate and direct, short-term protection against viral infections during a critical period.

Mechanisms of Defense Against Viral Infections

It is now recognized that the production of humoral (serum) antibodies is but one of several antiviral defense mechanisms available to an animal. Other mechanisms operational at or near the site of infection include the secretory or so-called "local" antibody system, cell elaboration of interferon, and a rather ill-defined "cellular immunity."

The secretory antibody system produces antibodies that are elaborated in secretions of mucous membranes such as exist in the respiratory and gastrointestinal tract and in excretions from the lacrimal (tear), salivary and mammary glands. These antibodies are synthesized in the mucous membranes and are of a slightly different type than those that predominate in the serum.

Interferon synthesis or release is known to be one of the earliest responses to viral infection. The interferon mechanism is activated by a number of different types of inducing agents, the major ones being nucleic acid components of viruses. Interferon released from an infected cell acts on surrounding noninfected cells by initiating an intracellular chain of events that causes the noninfected cell to become incapable of supporting the replication of virus. This refractory state applies not only to the virus that initiated interferon production, but to many other viruses as well. The principal role of interferon, therefore, seems to be the prevention of rapid and overwhelming virus replication during the early stages of infection, prior to the appearance of specific antibodies. Inasmuch as the action of interferon is not directed solely against the inducing virus, the host is furnished a degree of protection against infection by other viruses during the early, critical period of viral infection.

Virus Vaccines

Many biological companies are in the market for producing vaccines against PI_3, IBR and BVD viral infections. These virus vaccines are available singly or in combination and are often combined with *Pasteurella spp.* bacterins. Basically the vaccine viruses are of two types -- inactivated (killed) virus or attenuated (modified-live) virus. The inactivated vaccine virus as the name implies, has been killed, usually by some type of chemical agent so that the virus remains only as an inert substance which when injected into an animal stimulates an antibody response. On the other hand, the attenuated virus is actually a live virus which has been modified by some means, such as a large number of successive passages in tissue culture cells or by inoculation into and successive passage in unnatural host animals. In this way the characteristics of the virus are changed so that when inoculated back into the original host it no longer causes disease. In this case the virus actually multiplies in the vaccinated animal and in this way stimulates an antibody response.

Because of the virus proliferation associated with the attenuated virus vaccine, the degree of antibody response is generally greater by this type of vaccine than by the inactivated virus vaccine. For this reason, it is usually necessary to administer two injections of the inactivated vaccines, at an interval of 14 to 21 days, to obtain immunity from infection. The duration of immunity is probably not so long in these animals as in those vaccinated with the attenuated virus. An advantage of the inactivated virus vaccine, however, is there is no shedding of the virus by the vaccinate, thus there is no possibility of this animal spreading the vaccine virus to other animals. Another related aspect is that with the inactivated virus vaccine there is no danger of fetal infection with the vaccine virus. It is well known that in pregnant cows the attenuated IBR virus vaccine is capable of causing fetal infection and death. It has been shown by experimentation that the viruses of BVD and PI_3 are also capable of causing abortion when inoculated into pregnant cows or into the fetus, however the attenuated vaccine viruses have not been incriminated.

An important consideration when vaccinating unweaned calves against IBR is the immune status of the dams. It has been conclusively demonstrated that nasal shedding of vaccine virus does occur from calves that were administered the attenuated IBR, and PI_3 viruses by the intramuscular route. Thus exposure of the suckling dam to the vaccine virus is probable. This would constitute no hazard of respiratory disease to the nonimmune dam, since the virus is attenuated, however if the susceptible dam is pregnant the possibility of abortion exists.

In recent years attenuated virus vaccines administered intranasally have become available. The rationale for development of this type of vaccine was two-fold. The discovery of the "local" antibody system led to the belief that this system played a primary role in protection against respiratory infection. It was felt that even though an animal had a high serum antibody level it would not necessarily be immune to respiratory infection without the presence of the antibodies in the secretions in the respiratory tract. It was felt that these local antibodies could be stimulated more rapidly and to a greater degree by direct introduction of the vaccine virus into the respiratory passages. More recent information indicates that the local or respiratory antibodies are stimulated to a comparable degree by either intranasal or intramuscular administration of vaccine virus.

The second impetus behind development of the intranasal vaccines was the nature of the interferon response. This defense mechanism is active within 48 to 72 hours following exposure to the virus and persists for approximately 10 days. The time required for antibody production is approximately 10 to 14 days with peak antibody levels occurring at about 28 days. Intramuscular administration of vaccine virus elicits only antibody production. It does not stimulate the interferon system. Thus animals vaccinated intramuscularly are still susceptible to infection for a period of nearly 2 weeks post vaccination.

Administration of an IBR intranasal vaccine has been reported to provide very rapid immunity to infection. Animals exposed to the virulent virus 72 hours after vaccination failed to develop signs of the disease. There has been skepticism as to the safety of this vaccine virus, attenuated by serial passage in rabbit kidney cells, for use in pregnant cows. Experimental and field studies however, indicate that the vaccine is safe.

Thus the intranasally-administered vaccines do have an advantage over intramuscular vaccines in providing more immediate protection, and in the case of IBR, safety for pregnant cows. However the long term immunity of the intranasally- and intramuscularly-administered vaccines are comparable.

The considerations which will in the end govern the type of vaccine administered are: (1) the immune status of the cow herd; (2) the rate at which the protective immunity to infection is required; (3) the convenience of administration; and (4) the cost of vaccination.

ACUTE PULMONARY EMPHYSEMA OF CATTLE

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INTRODUCTION:

Acute Bovine Pulmonary Emphysema (ABPE) is a major cause of livestock loss to many ranchers throughout the Intermountain West. The annual economic loss was estimated in Wyoming (1955) to exceed one million dollars. The occurrence of emphysema is quite unpredictable and varies from year to year, but the annual impact on Oregon's economy greatly exceeds that amount. The monetary loss mounts rapidly when one considers death loss, treatment costs, shrinkage in cows and calves, loss of grazing lush summer and fall pastures, and predisposition to other diseases.

Management practices inaugurated to increase beef production tend to magnify the occurrence of ABPE. Pasture seeding, fertilization, irrigation and genetic selection are examples of management changes which seem to increase the incidence and compound losses. Although the specific cause of emphysema is unknown, experienced managers can usually inaugurate handling methods known to reduce the incidence of the disease.

Acute emphysema of cattle is known by many synonyms: summer pneumonia, grunts, cow asthma, grass pneumonia and others. Emphysema in some form is known in all species of animals, but there is no evidence that any other species is susceptible to the type of acute emphysema seen in cattle.

PATHOLOGY:

In 1962, 50 head of susceptible Hereford cows were introduced to lush meadow emphysema-prone pastures in Wyoming. Five cows were slaughtered each day for 10 days. Specimens from each were obtained and studied by electron microscopy. Considerable insight was gained regarding the sequence of events which led to this pulmonary disease and death.

The avleolar epithelium and capillary endothelium were first affected. These cellular elements became swollen and would frequently rupture. Accumulation of cellular debris including blood would restrict expelling alveolar air. The basement membrane between the alveoli and vascular system would frequently rupture. As a result, air was forced into the interalveolar space and throughout the lymphatic system of the lung. Cattle which survive may be observed to have air under the skin of shoulder and back regions.

OCCURRENCE:

The incidence of emphysema may range from 10 to 50% of the mature adult cows entering a critical meadow area. The mortality of those showing signs of disease may range up to 50%.

ABPE is usually associated with a feed change (movement from dry, sparse summer range to abundant aftermath meadow pasture). This circumstance is not always true and cattle have been observed to develop emphysema after foraging in the same meadow pasture or range area for two months. Available plants appear to undergo a chemical change in composition as they mature which incites the disease.

Emphysema is known to occur in cattle grazing meadows containing a variety of native and domestic plant species. Legumes, both domestic and native, appear to be more hazardous than grasses; however, they are often the predominant plant species, especially in improved meadows.

Irrigated meadows are most likely to cause emphysema; most years this practice provides a greater abundance of feed and accentuates the nutritional change encountered when cattle enter aftermath meadow pasture. Likewise, the application of commercial fertilizers increases forage production and seems to compound the incidence of emphysema.

In a study of Oregon ranches in 1972, it was interesting to note that emphysema did not occur on a number of ranches when sulfur was included in the fertilization program. Soil scientists at Oregon State University advise me that sulfur is marginal to deficient in those areas experiencing losses to emphysema. I do not suggest a sulfur deficiency is manifest in the ruminant animal but only that this element may influence the microbial environment of the rumen. The possibility exists that inexpensive salt mineral supplements containing sulfur may limit this disease.

THEORIES OF CAUSATIVE MECHANISM:

Many theories have been proposed as to the cause of emphysema observed under range conditions: (1) Ingestion of specific plants, weeds, or moldy feed; (2) Existance of allergic reactions as indicated by skin sensitivity tests and presence of antigen-antibody complexes; (3) Presence of bacterial toxins; (4) Metabolites absorbed from the amino acid tryptophan.

Under natural conditions, most theories have been discarded except the tryptophan theory. This research is being carried out by scientists at Washington State University, Schools of Agriculture and Veterinary Medicine. Their efforts were assisted in Oregon in 1972 by providing test cattle on two ranches where ABPE commonly occurs. Some promising features of their efforts are:

1. Tryptophan is a common ingredient of most plants; which correlated with field observations that a variety of plants can produce the disease.

2. Tryptophan given orally can produce the disease. Intravenous or intraperitoneal injections do not produce emphysema. III Methylindol, a metabolite of tryptophan, when given intravenously causes emphysema.

3. Rate on a sulfur-deficient diet are more susceptible to emphysema and produce more III Methylindol than those on a sulfur-adequate diet.

SUSCEPTIBILITY:

It appears from my observations and others that selecting cattle for production has spontaneously contributed to the emphysema problem. Large cows which produce the heaviest calves give the most milk and consume the most feed, and are most likely to be affected.

In addition, research evidence suggests certain breeds of cattle and blood lines within a breed vary in the anti-trypsin enzyme in their system. This enzyme affects an individual's susceptibility to respiratory disease. This concept is derived from research on human family lines and its validity in the bovine species is under investigation.

RECOGNITION AND PREVENTION:

Emphysema may occur any time of year, but serious herd outbreaks are most likely in late summer and fall. The disease usually occurs within 10 days following a radical feed change. Mature pregnant cows nursing calves and older bulls are most likely affected. A moderate disease episode one season enhances the susceptibility and severity of this disease the following year.

Clinical signs are those of respiratory distress. Sick cattle will have a rapid pulse with a shallow occasional cough. If severe expiratory distress occurs, it is usually accompanied by a short grunt. Temperatures may vary from 101^{o} to 104^{o} F. The respiratory embarrassment causes cattle to remain standing. Forced exercise can contribute to immediate death. Sick or dead animals should be examined by a veterinarian to determine specific cause and limit future losses.

Should a herd outbreak occur, carefully remove the cattle from the inciting pasture area and place on supplemental feed.

Experienced ranchers and veterinarians find a number of management techniques helpful in reducing the incidence of this disease. These practices are directed toward minimizing the nutritional shift encountered when cattle are introduced to aftermath meadow pastures. They include:

1. Introduce cattle gradually onto pastures that contain young, green forages. Particularly dangerous is a pasture containing regrowth following a frost or patches of regrowth or new growth hidden beneath mature plants. Limit access to such a pasture to less than 1 hour the first day and gradually increase the time, taking at least 1 week to reach unrestricted use. If this practice is impractical or if cases of ABPE still occur, mow and windrow some of the green feed or else intersperse bales of dry hay throughout the field. If all these practices fail in a particular field, one may have to further limit its use for grazing.

2. A salt-mineral-grain supplement used as cattle are introduced to meadow pastures is helpful. Use sufficient salt to limit grain consumption from 3# to 5# daily. A mixture of 15-25% stock hay salt will usually control grain intake.

3. Carbohydrate feed sources such as molasses will reduce the occurrence of emphysema. Molasses barrels can be placed in the meadow area where cattle congregate.

Until research efforts offer more specific detail as to the cause of APBE, ranchers having losses should initiate one or more of the management techniques believed to limit losses.

RELATIONSHIP OF RANGE FORAGE AND CATTLE MANAGEMENT PRACTICES TO DEVELOPMENT OF ACUTE BOVINE PULMONARY EMPHYSEMA

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Acute bovine pulmonary emphysema (ABPE) is a disease in cattle occurring in several areas in Oregon with seemingly increasing severity. The specific etiology of the disease is unknown but symptoms have been produced in the laboratory by several methods. Research conducted in the School of Veterinary Medicine, Washington State University, has implicated the amino acid tryptophan as a possible causative factor. Occurrence of the disease in the field is believed to be directly involved with forage consumed by the stricken cattle.

The occurrence of ABPE varies but is generally associated with changing cattle from one pasture to another. The peak season for ABPE extends from mid-August through October. Typically, symptoms appear 2 to 10 days after cattle are moved from dry, sparse upland rangelands to lush meadows and pasture. Morbidity and mortality rates vary but may increase if cattle are placed under stress during the first two weeks on the new pasture. Affected animals may suffer serious lung damage for a period of time before outward symptoms are noticeable. Reserve oxygen capacity decreases as soon as tissue destruction commences; exertion may kill an animal displaying no symptoms.

ABPE appears to be a selective disease, striking lactating cows in larger proportion than steers, young cattle, or dry cows. This apparent selectivity may be related to the fact that the lactating cows consume more forage than do dry cows or young stock and thus ingest greater amounts of some, as yet unknown, ABPE-inciting substance. Bulls also contract the disease and possibly are as susceptible as wet cows. However, they are not as numerous in the herd and, therefore, the incidence of ABPE in bulls is less common than in cows. Additionally, bulls may have been removed from the herds prior to moving on to the lush meadows and pastures at the end of the summer, and thus, may not be exposed to the same ABPE-inciting agents.

Beginning in the summer of 1972 the Rangeland Resources Program, in cooperation with the Departments of Animal Science and Veterinary Medicine, participated in a broad based ABPE research program. The contribution of the Rangeland Resources Program to the ABPE project was to attempt to establish relationships between forage plants available, those eaten, livestock management practices and development of symptoms of ABPE. The assumption basic to our participation in the research program is that a relationship exists between what cattle are eating and development of symptoms of ABPE.

During the summer of 1972, research was conducted in an attempt to characterize the disease through:

(1) identifying specific cattle management practices.

(2) identification of range and pasture types contributing to development of symptoms on ranches having a history of ABPE.

(3) identification of diet of cattle on pastures where the disease developed.

(4) formulation of a more specific plan of action for the 1973 field season.

Plans for the 1973 field season include additional work to further quantify cattle grazing patterns via measurements of degree of utilization in various plant communities, quantification of livestock diet by plant species on inciting pastures, and specific information on plant species ingested, including phenological stage, chemical composition, observed relative palatability, and type and condition of local environment. Observations will also be continued on cattle behavior and grazing patterns in both dry summer range and ABPE-inciting fall pastures. Forage samples representative of cattle diets will be collected. Samples will be separated by species and analyzed for tryptophan and protein.

Data will be evaluated and interpreted in an attempt to relate forage ingested by cattle and development of symptoms of ABPE. If a relationship between specific plants consumed by cattle and development of the disease can be established, economically feasible management practices can be developed to effectively prevent development of symptoms.

MODERN TRENDS IN THE BEEF INDUSTRY

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Modern beef production resembles a factory more than a livestock operation (Table 1)*. As in all factories, one must consider input costs and output returns if one is to operate successfully. Most modern trends in beef production involve these input-output factors and how they can best be managed to maintain a viable and successful operation.

First, consider the feeder cattle input. Currently there is a world shortage of feeder cattle. This, more than anything else, explains the rapid increase in feeder cattle prices during the last few years and particularly the last year. Why this shortage? Any rancher will tell you it costs to produces a feeder calf and it is only since the price has gone up during the past few years that he is getting a fair return. Table 2 illustrates this, showing the energy cost to raise a 400-pound feeder animal. Compare this expenditure of energy to that listed in Table 3 which shows the energy needed to fatten an animal on to 1000 pounds. It takes a great deal of energy to maintain a mother cow, to grow her replacement heifer and to support the bull that services her. There are ways to reduce these costs, such as twinning, shortening the time between calves, and weaning at an earlier age. This is illustrated in Table 4. However, any real increase in the number of feeders available to the beef fattening industry will require careful evaluation of energy costs and management procedures.

One system that is being tried by several feedlot operators in the Southwest is drylot production of feeder animals. I am sure most of you

*This, and other Tables, are available separately.

have seen some of the experimental work published by Texas A&M and the Universtiy of Arizona on this method of managing cow-calf operations. The secret to the success of drylot calf production is first, an economical source of roughage; second, the management of the cow so that she does not have free access to feed but rather is limit-fed to her energy needs. This is illustrated in Table 5. Note that during the dry cow phase (180 days), the cow is maintained on a minimum maintenance energy intake. The amount of energy is then increased 80 days before calving to physiologically prepare her to calve and to breed back. The calf is left with her for only 105 days rather than the usual 6-8 months. This saves a great deal of energy formerly expended by the cow to produce milk over the longer period. Several of the feedlots using this procedure of feeder production now maintain a cow-calf unit as an integral part of their feedlot.

Consider now the feed input of a modern beef factory. It is not my intention today to discuss this in great detail. I would like to mention several important points. Tables 6, 7 and 8 show the chemical composition of several grains, some by-products and two roughages that are commonly used in feedlot rations. Particularly note the differences in protein, fiber and starch in these various feed ingredients.

The nutritional requirements of a fattening beef animal fall logically into two general categories.

1. Nutrients - including proteins, vitamins and minerals
2. Energy

It is obvious that, when we are assigning a quality value to a particular ingredient, we are assessing the contribution of that ingredient to these two categories of nutritional needs. From an economic point of view, energy is the most important, since supplying it costs 80-90 percent of the total cost of the ration. This points out the importance of grain in the fattening ration.

How do we measure quality of a grain? Most of us use government standards which take into account looks, extraneous material and bushel weight. Since grains are fed primarily for their energy content, is bushel weight a good criterion of quality measurement? In order to test this we took representative samples from 25 consecutive loads of milo grain delivered into one of our plants in Arizona. Bushel weight, protein and starch determinations were made in all these samples. The results are plotted in Tables 9, 10 and 11. From these charts it is apparent that there is very little, if any, relationship between bushel weight, protein and starch content. This means that most of us are buying grain without any sound basis for making a quality determination on that grain. Since grain constitutes a major part of a fattening ration, a quick and accurate method for determining quality is sorely needed.

Another current trend in the modern beef factory is the use of linear programming techniques to calculate ration composition. This is illustrated in Tables 12 and 13. The effective use of linear programming requires an accurate knowledge of the quality and chemical composition of each ingredient used. Perhaps this is the greatest deficiency of the system, since there are great differences in quality between different samples of the same ingredient. Assuming, however, that this information is available, one need merely set the nutrient requirements of the ration, couple that with the limitations on ingredient usage (Table 12) and the ration solution is rapidly forthcoming, as shown in Table 13. Used in this way, linear programming will give the least-cost combination of ingredients which will satisfy the nutrient requirements.

Let us now turn to one of the outputs - the beef produced. While it is not considered good public relations to talk about the fat content of beef, we submit to you that when beef animals are finished there is an increase in the fat content of the carcass. This is shown in Table 14. The amount of fat deposited depends upon time on feed, energy level of the feed, energy intake on a daily basis, and the genetics of the animal. This is again illustrated in Table 15. This latter table also points out another modern trend in beef production - the increasing popularity of cross-breed and exotics, rather than feeding only the English beef breeds. We can argue about the quality of beef, and many old-timers feel that a carcass has to be primed, containing 30 percent fat (or more), before it is really good. However, consumers have clearly indicated that if meat is tender and juicy they desire less fat. This has greatly influenced the kind of cattle currently being fed. We are also finishing animals younger and at a lighter weight. To do this, animals are fed which will deposit less fat in the carcass at the time of finish. I am sure that most of you are familiar with the California system of energy evaluation. An abbreviated table of the energy interrelationships used in the California system is illustrated in Table 16. Younger, lighter animals are more efficient, both from a maintenance and cost of gain point of view.

What is meant by the quality of a feeder animal? We submit that it really means gain potential. This is illustrated in Table 17. We all recognize that an acceptable carcass must be produced. However, assuming that, there is little wonder that the livestockman equates feeder quality to potential rate of gain.

Let us now turn to the second category of outputs - the pollutants that are liberated into the environment. Table 18 shows the composition of manure that comes from a slatted-floor facility where all of the waste material has been collected. Many of us feel that pollution is the biggest single problem facing the industry today. Society currently is demanding that we manage cattle in a way which prevents pollutants from being disseminated into the environment and that all pollutants are collected and are managed in a manner which is not objectionable from an odor and sanitary point of view. Current estimates are that about 4 pounds of waste material (dry-weight basis) accumulates from each animal in an open-type feedlot. There is approximately twice as much material (dry-weight basis) coming from a slatted-floor facility. It is not that animals on slats produce more waste, but rather that some of the waste is disseminated into the environment in a dry open-type lot.

Why all the fuss about animal waste now? I think there are two answers to this question. The first is that we are rapidly concentrating greater numbers of livestock into a single unit. All too often these units are located some distance from where proper disposition of the waste material can be made. Second, people are more conscious about the environment. Certainly, as the population increases, both man and animal, this will become even a greater problem.

Are the old methods of disposal no longer acceptable? It is obvious that some of the manure is still being used in the same way that it has in the past. But, because of the increasing concentration of livestock, concentration in areas away from farmland indicates that the old methods of disposal will no longer suffice. Whenever it is feasible to transport the manure to the fields, it will be used as fertilizer and some may even be recycled as feed. During the past several years there has been a great deal of interest and many popular and scientific articles published regarding recycling manure as feed. However, we feel this has limited application, not only from an esthetic and health point of view, but also because manure has questionable value as a feed (Table 20). Manure contains relatively high amounts of lignin, cellulose and other organic compounds difficult to decompose. Lignin, particularly, is not appreciably decomposed in an anaerobic environment. It must be recycled oxidatively, hence not only will it accumulate by repeated recyclings in the feed but it has little, if any, nutritional value.

I am sure that the fertilizer value of manure is greater than the sum of its mineral nutrients, as shown in Table 21, but it is questionable whether farmers will pay for the added value since the cost of organic fertilizer is generally compared to that of commercial fertilizer. The $3.50 value in this table will barely cover the cost of collecting, let alone transporting the manure to an area where it can be effectively used.

The environmentalists claim that we should "let nature take its course." This is illustrated in Table 22. We submit that nature's way is wasteful, smelly, unsightly and is unsatisfactory from almost any point of view. The smell coming from a large feedlot after a rain is "nature taking its course." Rather, the environmentalists want a "controlled nature's way," as illustrated in Table 23. We desperately need a method of handling animal waste which captures some of the value, such as the energy content, and prevents the general pollution problem. Several companies have proposed that manure be used as a source of energy for growing microorganisms. The microorganisms are subsequently harvested and used as a source of energy and protein in animal feeds. We now have the technology to recycle waste (plant and animal) material without contributing to the pollution problem. However, this will cost money. What we truly need is an economic solution. Hopefully, before long, an economic plan will be developed to accomplish this objective.

The pollution problems connected with conventional feedlots will not be solved even though we find an economical method of handling pollutants. The design of our present day drylots permits the dissemination of some pollutants into the environment. As stated before, we feel that one of the requirements for future feeding operations will be the collection of all pollutants and the handling of them in a manner which is consistent with environmental needs. Perhaps slatted-floor, confined facilities will be the answer.

Just how extensive a facility is needed? We feel that on a minimum basis the animal must be kept dry and protected from extreme temperatures. We do not advocate a confined climate-controlled facility in which the temperature is maintained in a narrow range. As long as the daily fluctuation is not excessive, animals will perform equally well in the vicinity of the minimum critical temperature as they will in the vicinity of high critical temperature. It is important that the animal be kept dry and protected from the wind, since wetting and wind shift the critical temperature values. Our experience indicates that the better health and the better performance experienced in confined, slatted-floor units more than offsets the added cost of investment.

Our purpose in today's discussion was to review some of the trends that the modern beef businessman is using to improve his operation. A beef feedlot is really a beef factory. The successful operator must carefully evaluate all input-output factors towards developing procedures that will best manage them.

RANGE BEEF CATTLE MANAGEMENT

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My remarks will be primarily concerned with the cow-calf area of range beef cattle management and production. However, in reality certain segments of the beef cattle operation cannot be separated. Decisions and research must be concerned with the total picture of beef production, from "conception to consumption" if you will. A beef cattle management system must take into consideration the interactions and reactions that will in some way affect the outcome. These include the cattle, the range, feed crop production, the feeder, the market, the consumer, the environmentalist and the ecologist, the banker, and above all the rancher's abilities and desires for management as well as a host of other factors.

I think we should ponder the position, which came first - the grass or the cow? The answer is obvious and the only practical way to market the grass or convert it to a consumable food product is via the grazing animal. It more or less dictates, then, that range cattle management should be based on relating forage quality and quantity to specific needs of the animal for various phases of production. This means a more thorough knowledge of forage quality changes of different species during the grazing season as influenced by specific rainfall levels and elevations.

Forage is an everchanging product, starting out with young growth being high in protein and utilizable energy and decreasing as the plant goes to maturity. Yearling cattle grazing this forage on our semi-arid western rangelands will gain 2 - 2 1/2 pounds daily during May and June, 1 1/2 pounds during July, less than a pound during August and relatively no gain if left on range after September 1. Other classes of cattle exhibit this same pattern. Higher elevation ranges follow the pattern except range readiness is later and quality holds up later in the season. By manipulating our cattle to take advantage of this knowledge we can increase weights on yearlings or weaner calves.

There are three major management programs that are profoundly affected by the forage resource and managing ability and desire that we are concerned with at the Squaw Butte Station. These are fall versus spring calving, early weaning and length of the breeding season.

Fall vs Spring Calving. It should be pointed out that in order to take advantage of one program or the other the operator must be willing and capable of changing and usually intensifying certain areas of management. For example, suppose we develop a cross bred animal capable of gaining 5 pounds per day but the quality or availability of feed is only capable of producing 3 pounds daily gain. We haven't taken advantage of an opportunity. Often some of these opportunities are already available under a rancher's present scheme but he cannot or does not wish to take advantage of them.

Fall calving offers an opportunity for intensifying management of range cattle that in many cases is not possible with spring calving. Work at the Squaw Butte Station has shown that spring-born calves go on range weighing about 100 pounds and make very little direct use of the early season high quality forage. When the calf is old enough to effectively utilize the forage the forage quality and milk production is reduced to a point where the calf derives little benefit from it. Fall calving provides an opportunity for creep feeding the calves during the winter, while they are in confined winter pastures, and a larger calf is turned on range that is capable of direct utilization of the forage at peak value.

Breeding under more confined conditions during the winter will probably result in an increased conception rate for the fall calving cows in comparison to breeding on "open" range for the spring calving cows. Artificial insemination can be readily employed under the more confined winter breeding conditions if desired. Levels of winter feed needed for the fall calving cows are under study. The major criterion for winter nutrition is conception rather than milk production since the calf can be fed directly more economically than the cow can be fed to produce milk for the calf. To date fall calf weaning weights are 50% higher than spring calf weaning weights, or approximately 175 more pounds. The increased cost of the fall cow-calf pair over the spring cow-calf pair, under current feed costs, is about $25.

Early Weaning. The decision of when to wean is usually based on when it fits the ranch operator's schedule, which is usually when cattle come off range or when they are switched to a winter feed program. Traditionally calves in our western range country are dropped in March and April, are turned on range in April and are usually weaned sometime after mid-October and often as late as December. Work at the Squaw Butte Station has shown that calf gains drop off to less than a pound per head per day by August and make zero to 1/2 pound per day gain after the first of September, depending on the year and quality of feed. A look at this data shows that about 80% of the gain is made during the first half of the time the calves are on the cows. In research at Squaw Butte early weaning has been an economical practice. Once the quality of forage drops to a level where it will not support a gain of at least one pound per day for the calf it is questionable if we can afford to leave them on the cow. However, to wean early means changes in management and labor patterns and advantages and disadvantages must be considered.

Length of the Breeding Season. The estrus or heat cycle of the cow is about 21 days. Theoretically if the cow is in an adequate state of nutrition, free of disease and other stress factors, she should conceive with one exposure to a fertile bull. Why then, should the breeding season be extended for long periods of time? Advantages of the shorter breeding season are increased weaning weights, more uniform calves that bring higher prices, ability to identify cows of low production, and the opportunities for achieving greater efficiency from feed resources through more intensive management. Calves born in March and April were 160 pounds heavier at weaning time than calves from the same herd dropped in May and June.

The shortened breeding season (about 60 days) should be timed so the suckling calf can take maximum advantage when forage quality is high. Smaller pasture and more intensive breeding management can be used in the shorter breeding season and conception rates as well as weaning weights should increase. The uniform calf crop from the shorter breeding season will bring more dollars on the market and provide a group of calves that can be put on a single management and feeding program at weaning time.

A proper culling program, geared to about a 60-day breeding season, timed to fit utilization of high quality forage, should increase weaning weights by 15 to 20% and calving percentage by a similar amount. This, coupled with the other associated benefits makes it imperative that we take a long hard look at our present programs.

FALL VERSUS SPRING CALVING

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In beef cattle production in eastern Oregon both spring and fall calving are practiced. Various reasons for using one practice rather than the other have been advanced by proponents of the systems. Probably the main reasons given for switching from spring to fall calving are:

1. The possibility of weaning a larger calf.
2. Reduction in calf scours and pneumonia problems associated with wet spring weather.
3. Better utilization of range forage.
4. Better calving conditions.
5. More suitable breeding conditions while the cows are confined in winter pastures.

Because the cattlemen of this area have had varying success with this practice, the Eastern Oregon Experiment Station set up an experiment to compare the two practices as related to the range conditions of northeastern Oregon.

Perhaps some of the varying success attributed to the practice is related to what is "fall calving" or "spring calving". At the Eastern Oregon Experiment Station "fall calving" means calves are born primarily in October and "spring calving" means calves are born in March and April. It should be pointed out that considerable summer range in northeastern Oregon is on forested land. At the present time, where such ranges are controlled by the U.S.D.A. Forest Service, turn-out time each year is usually in June. There is no doubt that in the Blue Mountain area forage availability in the spring is several weeks later than in such areas as the high desert of southeastern Oregon or the semi-desert between the Blue Mountains and the Cascade Mountains. Many ranchers in northeastern Oregon have no early spring pasture.

In the experiment at Union, fall calves were creep fed third cutting alfalfa hay. The fall calving cows were fed the best first cutting alfalfa-grass hay available on the station at a rate of 30 to 35 pounds per head per day. Spring calves received no creep and spring calving cows were wintered up to calving on alfalfa-grass hay which is usually at least one year old at the rate of 25 pounds per head per day.

The following tables show some of the preliminary data collected over three years at the Union Station.

Table 1. Incidence of scours in percent of spring and fall calves.*

Year	Spring	Fall
1970	49.7	85.7
1971	3.8	16.7
1972	48.3	82.7

* The figures in this table are based on the number of treatments as a percentage of the total number of calves in each herd.

Table 2. Average weight of cows in December of each year.

Spring calving cows	1,178 lbs.
Fall calving cows	1,265 lbs.

Table 3. Average birthweights, average weaning weights and average daily gain of fall and spring calves.

	Spring Calves	Fall Calves
Birth weight, lbs.		
1970	76.6	81.4
1971	75.9	76.6
1972	75.9	74.7
Adjusted 185 day weight of steer calves, lbs.		
1970	415.8	375.6
1971	414.3	388.1
1972	412.6	349.4*
Average daily suckling gain, lbs.		
1970	1.87	1.58
1971	1.92	1.69
1972	1.83	1.54**
Average age at weaning (days)	185	250
Average weight of steers into feedlot, lbs.	485.5	556.9
Average age into feedlot (days)	240	267
Final wt. in feedlot, lbs.	1001.2	985.9
Avg. daily gain in feedlot	2.46	2.30
Days on feed	210	185
Age at slaughter (days)	450	452
% carcasses grading choice	37	15

* Actual weight on 4/10/73 at 178 days of age.
** Gain as of 4/10/73 at 178 days of age.

Further Comments.

In severe winters at the Union Station it was observed that the fall calves did not do well. This was probably caused by a lack of suitable windbreaks for the animals and the lack of a high energy supplement in the calf creep.

The incidence of scours in the calves was highly associated with wet cold weather and the number of animals per acre. In two years out of three in this study, the weather was more conducive to scours in the fall.

In December the condition of fall calving cows was considerably higher than the condition of spring calving cows. This condition difference was most noticeable in early July when fall calves were weaned. Fall calving cows do not appear to put on much additional weight due to condition after their calves are weaned. After the spring calving cows have their calves weaned in early September they continue to better their condition score even though they are grazing on range forage which has been deteriorating in nutritional value since July.

Actually, under the cattle management system at the Eastern Oregon Experiment Station, the fall calving cows have had the preferred treatment. They are the first ones to get out on spring pasture, the first ones brought in from summer range to graze irrigated pastures, and they receive the choicest hay during the winter months.

There appears to be no difference between fall and spring calving cows in conception rate, calving percent, or interval between calving. The breeding season for both groups was limited to 42 days. A slight problem was noticed in two years out of three in breeding the fall cows. Usually in December and January the pastures are frozen and may have a covering of snow or ice. When this condition is present, bulls may stifle themselves while mounting the cows. We had one bull so badly stifled he had to be sold and another bull that was slightly stifled and had to be replaced in the breeding group.

The birthweight of calves was slightly higher for fall born calves. Although fall born calves are heavier at weaning than spring born calves, they are also approximately two months older at weaning time. Their average daily suckling gain is lower than spring born calves. This is probably due to inclement winter weather with little or no shelter from cold winter winds.

The spring and fall born calves were marketed from the feedlots at approximately the same day of age. The spring calves entered the feedlot approximately 25 days younger than the fall calves and remained in the feedlot about 25 days longer than the fall calves. It was found that the carcasses from the fall born calves were about 1/3 of a grade lower than those from spring born calves. One other problem was associated with the fall calves. When sold at approximately 1,000 lbs. in late February many warble pupae were embedded in the loin area. The animals had been sprayed with Co-ral the previous fall.

The data in these tables are preliminary and have not been analyzed statistically at this time. There is still one group of fall calves to be fed in the feedlots.

EARLY WEANING OF BEEF CALVES

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Early weaning of beef calves is another tool a cow-calf producer may use to adapt his operation to a particular environmental condition. Normal weaning in northeastern Oregon takes place when the cows and calves are rounded up and brought into winter quarters after having spent several months grazing summer range. It is quite normal for the calves to be up to 9 months of age.

Preliminary data collected on cow-calf pairs grazing the summer range at the Eastern Oregon Experiment Station (Hall Ranch) indicated after August 15 the calves made an average daily gain of less than one-half pound. This was probably caused by the rapid deterioration in nutritive value of the available forage and a lack of persistancy in the milk production of the cows. Most young beef animals under favorable conditions are capable of gaining more than one-half pound per day. To try and maximize the growth potential of young calves at the Union station, an experiment was designed to collect data on weaning calves at approximately 150, 180 and 210 days. Calves were weaned from their mothers while on summer range at these approximate ages and were brought back to the main station to graze irrigated hay meadows.

Two or three cuttings of hay had been harvested from the meadows during the year. The calves had access to bloat blocks to control bloating. Whenever the alfalfa in a hay meadow was utilized to a height of about 10 inches the calves were moved to a new meadow. Hay meadows that had been grazed by the weaner calves were subsequently grazed by dry pregnant cows which had returned to the main station for wintering.

When the steer calves were approximately 8 months of age they were put into the feedlot and fed to slaughter weight.

The following table shows the data which were collected over a three-year period.

Table 1.

Treatment	Weaned at Approximately 159 days	Weaned at Approximately 187 days	Weaned at Approximately 216 days
Weaning wt of calves (lbs)	387	438	466
Avg. daily suckling gain (lbs)	1.91	1.90	1.79
Avg. wt. into feedlot (lbs)	462	486	483
Number of days from weaning to feedlot	92	64	35
Avg. daily fall pasture gain (lbs)	.81	.74	.46
Final avg. wt. in feedlot (lbs)	970	1001	983
Avg. daily gain in feedlot (lbs)	2.41	2.46	2.39
Days in feedlot	210	210	210
% of carcasses grading choice	25	37	27
Avg. cow weights in December (lbs)*	1202	1181	1186

* Two years' data

The first year of the study the calves were weaned September 1, October 1 and November 1. It was realized that September 1 was not early enough and November 1 was too late. Therefore, for the last two years of the study the weaning dates were moved up two weeks to August 15, September 15, and October 15. Also, after the first year of the study was completed it was found 189 days in the feedlot produced too many under finished carcasses as 90 percent of the carcasses graded good. The second year the steers were fed for 196 days in the feedlot but this also was not long enough. In the third year the steers were fed for 224 days and the carcasses graded 75 percent choice. Because in two years out of three the carcasses were under finished, the percent of carcasses grading choice in the table is rather low.

The data presented in the table have not been statistically analyzed. However, it is possible to make some inferences.

It appears weaning calves at 6 months of age may over the years prove to be a satisfactory practice to follow. In some years, when summer pasture becomes rather scarce or its nutritive content becomes low, it would pay to wean calves at an even earlier age. The data presented indicate the 5-month weaned calves had the highest suckling gain and the best post-weaning pasture gain. Such a weaning date would probably work very well for raising replacement heifer calves.

The feedlot data also indicate the age of the calf at weaning in this study had little effect on its performance in the feedlot.

Unless good pasture is available even though summer range is no longer providing the nutrients needed for maximum calf growth, early weaning may not be the solution to your problem.

Another benefit was derived from early weaning. The December condition grade of the cows from the earliest weaning treatment was highest of all treatments. This benefit would be important in years when winter hay supplies may be short. With the cows in high condition going into the wintering period it would be possible to stretch the winter hay supply by using inferior roughage such as certain grass or grain straws.

In many years when forage on summer forest range is in short supply or the nutritive content has fallen below the levels necessary for milking cows, it would be possible to keep the cows on the range a little longer by weaning their calves at an earlier age than is normally done. Cows with no calves at their sides are much better rustlers as they will go to parts of the range which have been under utilized during the season.

SHORT BREEDING SEASON FOR COW-CALF PRODUCTION IN NORTHEASTERN OREGON

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Sixteen years ago the beef cattle breeding season at the Eastern Oregon Experiment Station was about 105 days long. This caused a large variation in calf ages and weights at weaning time. It was apparent these calves were not very suitable for management research studies. Over a period of three years (1957 to 1959) the breeding season was reduced by 21 days each year. By 1960 a breeding season of 42 days was obtained and this length of breeding season is still used today. During the period 1957 to 1959 all cows not diagnosed pregnant each fall were sold. Actually, during this time total breeding cow numbers were not reduced but rather increased because of the number of pregnant replacement heifers added to the herd.

Since 1960 all cows and yearling replacement heifers at the Union station diagnosed non-pregnant each fall are culled. It is interesting to note that this severe culling program on non-pregnant cows and yearling heifers may have been a factor in influencing the fertility of the cow herd. In 1961 and 1962 we were able to get 66% of our yearling replacement heifers settled in a 42 day breeding season. This percentage has continually increased until today we do not think it is uncommon to have 90 to 95% of our yearling heifers diagnosed pregnant each fall. Under this same short breeding season the other young and mature cows are now consistently diagnosed 96% pregnant. This figure rose from about 90% pregnancies under a 105 day breeding season. With this short breeding season, improved management and nutrition of the beef cattle herd at the Union station, we now are able to produce enough suitable weaned calves to meet our research needs.

A short breeding season in a cow-calf operation has several advantages for a rancher. It is possible to produce a more uniform set of weaned calves. Average weaned calf weights can be increased because "tail-ender" numbers are reduced. Slow breeders and cows with a longer than normal calving interval are readily identified and can be culled from the herd. The management of the herd should be easier and their nutrition probably improved because both the cows and the calves are more uniform.

It should also be pointed out that a short breeding season may have some pitfalls for some operators. With such a short breeding season it is necessary that bulls are in good breeding condition and that they have good libido and fertility. At the Union station in 1972 we were rather short-handed and did not fertility test all our bulls before they were turned out. When we examined our pregnancy test data in the fall and finished calving in the spring we found one 3-year-old bull used with one mature group of cows and one yearling bull used with yearling heifers had settled less than half of their breeding groups. The 3-year-old bull had been a successful breeder in 1971 so it was taken for granted he would be all right in 1972.

There was not a complete loss from the inability of these two bulls to settle females because we use an Angus bull as a cover for 18 days after the normal breeding season is completed. This year we have more crossbred Angus x Hereford calves than normal and we will have to be careful in culling cows that have come up with black calves.

In starting to shorten a breeding season of 3 to 4 months to 42 days the operator may have to go rather slowly. He may have a large percentage of his cow herd as slow breeders or with longer than normal calving intervals. Unless he is willing and able to take a quick reduction in his cow herd number he will have to gear cow cullings each year to the bred replacement heifers he has available. During the culling process and after, when a short breeding season is operative, it is almost a must that pregnancy testing be incorporated into the ranch management system. Remember also that for heifers and cows to conceive each year they need the proper plane of nutrition.

MANAGEMENT OF FORESTED GRAZING LANDS IN NORTHEASTERN OREGON

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Introduction

Extensive areas in Northeastern Oregon, Washington and Idaho are forested lands in private ownership. Most of these lands serve the dual purpose of timber harvest and livestock grazing. Big game habitat and recreation are added uses. The 2,000 acre Eastern Oregon Experiment Station Hall Ranch is typical of this type of land.

Since 1956, cooperative research between the Union station and the Rangeland Resources and Forestry Departments at Oregon State University has been conducted on the Hall Ranch near Union. Results obtained have management implications for similar rangelands in the Northwest. Data presented in this paper represent the work of many scientists and graduate students.

Manipulating Stock, Improvements and Land

Improved stock distribution and forage utilization can be accomplished by developing water facilities, drift fences and cattle trails; correct salt placement; and manipulation of the class of stock to fit the vegetation and topography. Cross fencing, so that a planned grazing system can be used, will also help improve the use of these ranges. Total animal-unit-months (AUM's) of grazing on the Hall Ranch for the five year period 1956 through 1960 averaged 560.6 per year. The two year average for 1971, 1972, after 15 years of a planned program of range improvement, was 1243.5 AUM's.

One of the biggest factors in livestock distribution is the accessibility to water. Generally cattle should not have to walk more than 1/2 mile to water in rough forest terrain if good dispersion of stock is to be maintained. Good watering holes can be "Cat" excavated ponds in moist level areas or a developed spring using a trough on steeper slopes.

By placing salt away from waterholes and on ridgetops, cattle can be effectively drawn to areas otherwise lightly used. As with water placement, salting areas should be adequate in number.

Forested rangelands are often steep and contain a dense stand of timber on north slopes. Often these north slopes can prove to be effective barriers to livestock movement. To facilitate animal movement through such areas it is sometimes feasible to cut trails through the timber. Drift fences may also be used to direct livestock movements through these areas.

Pinegrass is the dominant herbaceous species on many forest sites. Utilization of pinegrass by livestock drops considerably as the grazing season progresses. Pinegrass ranges are best utilized if grazed early by young growing stock or late in the fall by dry pregnant cows.

Matching the correct type of stock to specific pastures helps improve utilization. Yearling steers or heifers will use a rough, heavily timbered pasture better than cows. Dry cows are the next most feasible class, with cow-calf pairs the least feasible. Cows with young calves are reluctant to climb steep slopes and move through heavy timber. The most level open areas are best suited for them.

Early weaning of calves is another management tool to improve utilization. The cows can be turned back on the range after their calves have been weaned. They will then forage in areas where they would not take their calves.

Meadow improvement by brush clearing, fertilization and reseeding may improve carrying capacity of meadowlands. However, complications may result. On an improved meadow on the Hall Ranch elk use increased to the extent that overgrazing by elk nullified the gains made by improvements.

Use of a planned grazing system may help to maintain or improve range condition. Deferred rotation has worked well on the Hall Ranch. Pastures are grazed early one year and late the next. This allows the grasses to mature and produce seed every other year. Under this system of rotation it has been possible to utilize the forage more heavily than would normally be recommended, and at the same time cause little permanent damage to plant survival.

Logging and Forest Grazing

Because of the variation in slope exposure and soil depth, timber growth and logging vary greatly by site on forested lands. Sites with northern exposures and deep soils have dense stands of timber and are considered to be first priority sites for timber production and secondary sites for cattle grazing. Southern exposed sites with shallow soils are low timber producing sites and may be primary grazing sites. The type of logging operation can have serious consequences on livestock grazing following timber harvest.

In 1960 a selective sanitation-salvage cut was accomplished on a mixed-conifer site on the Hall Ranch. Heavy cutting pressure was put on grand fir and light cutting pressure on ponderosa pine, western larch and Douglas fir. After the logging operation it was found that grand fir production was enhanced instead of reduced. Herbage production, for grazing, was increased where sunspots were enlarged or new ones created. However, areas were taken out of production where severe soil disturbances occurred or where large accumulation of slash or cull trees prohibited livestock movement. The presence of slash and cull logs was the biggest factor in decreased utilization of the entire area. Slash and cull logs restricted livestock movements to open areas and hindered their movements from one open area to another or up and down slopes. If grazing is to be maximized, following a selective cut, slash should be controlled and cull logs aligned at right angles to the slope. Skid trails should be seeded and left open to facilitate livestock movement.

In 1963 a similar site was clearcut. The slash was broadcast over the area and cull logs were aligned at right angles to the slope. In 1964 the clearcut area was burned in July. Fifteen acres of the 30 acre clearcut was divided into three 5-acre exclosures. One 5-acre exclosure was fenced with an 8-foot game proof fence. The other two 5-acre exclosures were fenced with a cattle fence. In September the area was seeded to selected single species of grasses and a mixture. Blue wildrye and mountain bromegrass were the single species used and the mixture was orchardgrass, tall oatgrass, Manchar smooth brome, timothy, and white Dutch clover. In 1965 two and three-year-old seedlings of ponderosa pine, Douglas fir, western larch, and western white pine were planted at the rate of 880 trees per acre. Additionally, grand fir Engelmann spruce, and lodgepole pine seedlings were planted to bring the total up to 1,000 trees per acre.

In 1966 yearling heifers began grazing the three 5-acre exclosures at the rate of 5 head per exclosure for one month. Heifer gains averaged 1-1/2 to 2 pounds per day as opposed to 1-1/4 to 1-3/4 pounds per day for yearling steers grazing the selective cut.

Average conifer seedling height and tree survival are listed in Table 1. Rep I was the 5-acre exclosure where only heifers grazed and big game were excluded. Reps II and III were grazed in common by big game and heifers. In June of 1968 seedlings in rep I were considerably higher than those in reps II and III. However, the difference in height had decreased by June of 1970. The increased vigor of the trees in reps II and III at the later date may be attributed to the lack of competition between trees and other plant species. Survival percents of conifers were slightly higher in reps II and III.

Production per acre of other plant species for 1970 and the percent utilization are listed in Table 2. The pounds of production of both herbage and browse are quite high in both reps I and II. However, in rep I where big game are excluded the browse production is considerably higher than that in rep II. Cattle alone are apparently not sufficient to control browse growth. In 1968 conifer seedlings had not suffered from severe competition because browse production had not reached a critical stage. By 1970, however, the results of competition were beginning to show by the decreased tree growth in rep 1. (Table 1).

Tree mortality is listed in Table 3. The data are presented as percents of the total mortality. There were no big game in rep I, thus cattle caused more mortality in this rep than in other reps. Most damage due to ungulates in reps II and III, which were accessible to both cattle and big game, was caused by deer and elk. However, mortality in all reps was primarily due to other causes. Tree survival has been exceptional and as a result thinning to the desired 350 trees per acre will be required.

Results from the 1963 clearcut were incorporated into a management plan for an additional 55-acre clearcut. The 55-acre tract was clearcut in 1969. Again the slash was allowed to remain on the ground for one year before burning. After the burn the entire area was seeded by helicopter to the forage mixture previously mentioned. The 55-acre cut will be allowed to reforest naturally as no trees have been planted. This clearcut area has not been fenced separately from the 500-acre pasture of which it is a part. Whether or not clearcut areas can be managed as part of a larger grazing unit is one of the experimental goals.

Dr. William Krueger, Rangeland Resources program, O.S.U.; Dr. William Wheeler, Forestry, O.S.U.; Dr. J.A.B. McArthur, and Dr. Martin Vavra, Eastern Oregon Experiment Station, are the principal researchers working on this project.

Table 1. Average Conifer Seedling Height in Inches.

Species	Ponderosa Pine		Douglas Fir		Western Larch	
Rep	I	II & III	I	II & III	I	II & III
April 1965	4.7	6.0	4.4	4.7	3.1	3.1
June 1968	11.4	8.8	12.9	9.8	16.1	13.6
June 1970	22.0	20.6	23.6	22.6	31.1	34.1
Survival % July 1970	60	62	65	66	28	34

Table 2. Forage Yields - 1970.

	Rep I			Rep II		
	Ungrazed lbs/acre	Grazed lbs/acre	% Util	Ungrazed lbs/acre	Grazed lbs/acre	% Util
Herbage	770	253	67.1	525	346	34.1
Browse	815	623	23.5	385	72	81.3
Total	1585	876	44.7	910	418	54.1

Table 3. Causes of Seedling Mortality Expressed as a Percent of Total Mortality (as of 1970).

Species	Ponderosa Pine		Douglas Fir		Western Larch	
Rep	I	II & III	I	II & III	I	II & III
Deer, elk	--	32	--	32	--	7
Cattle	16	5	23	7	5	7
Rodents	13	5	8	8	12	4
Missing seedlings	10	16	19	17	10	9
Other physiological disease drought defective seedlings	61	42	50	36	73	73

FEEDING GRASS STRAW TO WINTERING BEEF COWS

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Grass straw, a by-product of the grass seed industry, has had little value in the past. New laws restricting burning will necessitate removal of the straw from fields by some other means. If grass straw could be fed to wintering dry pregnant cows, grass seed growers could recover the cost of removal from fields and beef men may find a cheap source of roughage.

Past work at the Eastern Oregon Experiment Station by McArthur and Eller has shown that barley straw can be effectively incorporated into cow rations. They fed three rations: 1) 25 to 27 pounds of alfalfa-grass hay; 2) 15 pounds of alfalfa-grass hay, chopped barley straw ad lib and one pound of supplement; 3) 7 pounds of alfalfa-grass hay, chopped barley straw ad lib and one pound of supplement per day. The supplement consisted of 50% rolled barley and 50% cottonseed meal. The results are listed in Table 1. All three rations were effective in maintaining weights of wintering cows. Calf birth weights among treatments were similar. There was no treatment effect on the cows' conception or date of calving the following year.

When grass straw became available in 1972, preliminary samples were chemically analyzed for crude protein, fat, crude fiber, NFE, calcium and phosphorus. Turf Hard Fescue straw (strain C26 Scott Seed Co.) and Merion Bluegrass straw were donated by Bill Howell, Imbler, Oregon. The results are listed in Table 2.

On a percent basis, Hard Fescue straw did not meet the National Research Council (NRC) requirements for 1,200 pound dry pregnant cows for protein content, calcium or phosphorus. Merion Bluegrass straw had sufficient protein and phosphorus but was low in calcium.

A preliminary digestion trial with yearling steers was run to estimate intake and digestibility. The results of the steer trial and the chemical feed analyses were incorporated into establishing the cow rations which were fed during the winter of 1972. Hard Fescue and Merion Bluegrass straw were fed so that a portion of the ration remained after each day's consumption. Alfalfa-orchardgrass hay was fed at the rate of 25 pounds per head per day and served as the control ration. Hard Fescue and Merion Bluegrass straw were supplemented with 1.30 and 0.50 pounds of cottonseed meal, respectively. All groups of cows received free choice salt containing iodine and a calcium and phosphorus supplement.

On November 29, 1972, 20 cows were allotted to each of the three treatments. Cows were fed the hay and straw in bunks in drylot. The cows were pregnant Herefords and ranged from 4 to 10 years of age. The cows were fed until January 30, 1973; a total of 63 days. On January 1, 1973 two pounds of rolled barley per head per day were added to the protein supplement of cows receiving Hard Fescue straw. It was felt that the increased energy intake might alleviate the problem of compaction that was encountered in one cow.

The results of the feeding trial are listed in Table 3. The cows receiving Merion Bluegrass straw consumed more than did those receiving Hard Fescue straw. Consumption of Hard Fescue straw was also lower in the steer trial. Cows in all three groups gained weight. The Hard Fescue straw fed cows gained the least. Also, Hard Fescue straw fed cows had the greatest weight loss from January 30 to April 13, 1973. Average birth weights of the calves from straw fed cows are very similar but the average birth weights of calves from the control cows were heavier.

Several problems occurred in the Hard Fescue straw group. One cow became compacted after one month on test and had to be taken off the test and treated. On January 16 a cow died from unknown causes. The cow had been off feed for several days and was down. Posting of this cow indicated some compaction of both the rumen and the large intestine. Her calf fetus had just died but appeared normal. The liver appeared abnormal in color. On January 16 another cow was noticed off feed and was removed from the experiment. This cow appeared to be in a stupor. She was unsteady on her feet and weak. Her temperature was 105°. This cow, with medication, subsequently recovered and gave birth to a normal calf. One calf was born very weak and could not stand or suckle. This calf died after three days. Another calf was born with a thin, rough hair coat suggesting a vitamin A deficiency. This calf was given a vitamin A shot and is presently in the herd.

Other researchers have reported problems when cattle have grazed fescue pastures. Certain species and varieties of fescue contain large quantities of alkaloids; a common poison to cattle. Fescue grasses, when mature are attacked by a fungus that produces substances toxic to cattle. Cattle grazing some fescue species have developed "Fescue Foot." The exact toxin causing "Fescue Foot" has not been isolated. Sub-clinical toxicosis may also inhibit livestock gains.

The NRC requirements for wintering dry pregnant cows are listed in Table 4. Also listed in this table are intake estimates for crude protein, total digestible nutrients (TDN), calcium and phosphorus. Based on observed intake and digestibility values, Hard Fescue straw would not meet the NRC requirements for protein, calcium and phosphorus without supplementation. Therefore these three constituents were supplemented. Merion Bluegrass straw met the requirements of all the constituents considered on an intake basis. However Merion Bluegrass straw fed cows also received a protein supplement, and calcium and phosphorus in the salt mixture because of insufficient knowledge of intake at start of the trial.

Date of rebreeding and conception rate of the experimental cows will be measured in 1973.

Data from this feeding trial will be evaluated and changes made before the 1973 trial starts. Tentative areas of change are:

1) Discontinue protein supplement to Merion Bluegrass straw fed cows.

2) Re-evaluate Hard Fescue straw feeding.

3) Incorporation of vitamin A in the supplement to both straw rations.

This report is preliminary and is based upon a limited amount of data.

Table 1. Data from cow feeding trial using barley straw.

	Ration 1	Ration 2	Ration 3
Avg. wt. on test	1135	1146	1138
Avg. wt. prior to calving	1250	1234	1202
Daily gain	1.64	1.26	0.91
Avg. birth wt. of calves	76	77	78
Cost of ration per day	33.1 cents	28.1 cents	24.3 cents

Cost of Feed:

Hay	$25.00/ton
Chopped barley straw	$15.00/ton
Supplement	$65.00/ton

Analysis of Feed:

Hay	9 - 13%	C.P.
Barley straw	4 - 7%	C.P.
Supplement	27%	C.P.

Table 2. Preliminary chemical analyses of Hard Fescue and Merion Bluegrass straw.

	% Crude Protein	% Fat	% Crude Fiber	% NFE	% Ca	% P
Hard Fescue straw	3.74	2.26	40.67	43.34	0.05	0.09
Merion Bluegrass straw	6.50	2.45	21.16	57.52	0.11	0.21

Table 3. Results of feeding Merion Bluegrass and Hard Fescue straw and Orchardgrass-Alfalfa hay to pregnant cows during the winter 1972-73.

	Daily Consump-tion lbs.	Wt. on Test 11-29-72 lbs.	Wt. Off Test 1-30-73 lbs.	Avg Daily Gain lbs.	Wt. On 4-23-73 lbs.	Wt. Loss From 1-30-73* to 4-13-73 lbs.	Calf Birth Weights lbs.
Merion Bluegrass Straw	29.5	1176.5	1294.5	1.87	1217	77.5	76.5
Hard Fescue Straw	22.5	1179.5	1225.5	0.73	1120	105.5	76.5
Orchardgrass-Alfalfa Hay	26.0	1186.0	1275.5	1.42	1185	90.5	80.0

* Weight includes loss due to calving.

Table 4. Maintenance requirement of 1,200 lb. dry pregnant cows and estimated values for Hard Fescue and Merion Bluegrass straws (lb/day).

	Intake	Crude Protein	TDN	Ca	P
Requirement (NRC)	17.6	1.0	8.4	.03	.03
Hard Fescue Straw	22.5*	0.8	11.0**	.01	.02
Merion Bluegrass Straw	29.5*	1.9	20.3**	.03	.06

* intakes observed in trial
** based on 48.9% and 68.8% digestibilities for Hard Fescue and Merion Bluegrass respectively, obtained from the steer digestion trial.

THE PERFORMANCE OF STEERS AND INDUCED CRYPTORCHIDS

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Recent Food and Drug Administration research has implicated Diethylstilbestrol (DES) as a carcinogenic agent. Adding DES to livestock feeds for oral consumption was banned last year and its use as an implant has just been prohibited. Therefore there is a need for research on DES substitutes or alternative methods of male calf management to replace the advantages in gain that were produced by using DES.

The present grading system for bulls will change July 1, 1973. Beginning July 1, carcasses from young bulls will be graded on the same basis as those from steers. However, the bull meat will carry the stamp "bullock". These grading changes may stimulate more bull feeding.

It is well known that bulls will out-gain steers. Previous work at the Eastern Oregon Experiment Station has indicated bull carcasses are satisfactory for block beef. However, bulls may have trouble attaining sufficient marbling to grade choice at 1,050 pounds. Bulls also have been undesirable due to the development of secondary sex characteristics.

This study was undertaken to evaluate induced cryptorchidism as a means of altering bulls. Cryptorchidism may cause a delay in the development of secondary sex characteristics while still maintaining the growth potential of bulls. Suckling gain, feedlot performance and carcass data of cryptorchids are being evaluated and compared to steers and to steers receiving a DES implant.

Grade male calves of the 1972, 1973 and 1974 calf crops are being allotted to five treatments: (1) made cryptorchid at birth, (2) steer at birth, (3) steer at birth and 6 mg. DES, (4) steer at 60 days and (5) cryptorchid at 60 days. The DES implanted steers also receive 15 mg. implants at 60 days of age, when entering the feedlot, and after 80 days on feed in the feedlot.

Data collected thus far on the 1972 calf crop are presented in Tables 1 and 2. The calves were weighed at 60 days of age (Table 1). Steers receiving the DES implants were the heaviest and had the most rapid gain. When the calves were weighed at weaning, the cryptorchids had suckling gains equal to the implanted steers. Group 5 calves weighed the same as the implanted steers and Group 1 calves were 10.0 pounds lighter. Steer calves receiving no implants (Groups 3 and 4) were the lightest and had the lowest suckling gains. The presence of testicles did not enhance gains at 60 days of age probably because they were not developed sufficiently by this time. However, it appears that by weaning time testicle development was sufficient to stimulate gains so that gains of intact animals equaled those of the implanted steers.

After weaning, the calves were put on alfalfa-orchardgrass pasture that had been previously hayed. Weights and daily gains during this period and the feedlot period are listed in Table 2. In the feedlot the animals were fed a ration of rolled barley ad lib with hay restricted to 1 pound per head per day and 1 pound per head per day of an O.S.U. supplement. The implanted steers were the heaviest going into the feedlot and the nonimplanted steers were the lightest. The cryptorchids are presently gaining as rapidly as the implanted steers. The nonimplanted steers are gaining at the slowest rate.

Data presented in this progress report are preliminary and are based on a limited number of animals.

Table 1. Average weight and average daily gain of calves at branding (60 days of age) and weaning (185 days of age).

	Branding 5-8-72		Weaning 9-5-72	
Group	Wt. lbs.	ADG lbs.	Wt. lbs.	ADG lbs.
1. Crypt at birth	171.4	1.64	404.0	1.83
2. Steer + DES	190.3	1.91	414.0	1.88
3. Steer at birth	165.4	1.63	376.2	1.72
4. Steer at 60 days	167.0	1.51	381.8	1.67
5. Crypt at 60 days	176.4	1.65	414.9	1.88

Table 2. Average weight and average daily gain of calves at beginning of feeding period and on April 4, 1973.

	Nov. 15, 1972 Post Weaning Gain		April 4, 1973 Feedlot Gain	
Group	Wt. lbs.	ADG lbs.	Wt. lbs.	ADG lbs.
1. Crypt at birth	482.5	1.10	896.8	2.96
2. Steer + DES	500.2	1.21	880.9	2.72
3. Steer at birth	432.8	.79	739.5	2.19
4. Steer at 60 days	459.3	1.09	760.2	2.15
5. Crypt at 60 days	475.8	.85	857.3	2.72

RECENT BEEF CATTLE RESEARCH PUBLICATIONS

Improvement of Beef Cattle Through Breeding. 1972. R. Bogart, J. H. Landers, Jr., W. D. Frischknecht. Extension Bulletin 802. Oregon Agricultural Experiment Station.

Two Methods of Antibiotic Supplementation During the Growing Period and Their Subsequent Effect upon Steer Performance. 1972. A. T. Ralston and T. P. Davidson. Special Report 347. Oregon Agricultural Experiment Station.

Use of Readily Available Carbohydrate Values in Formulating Finishing Rations for Steers. 1972. D. C. Church. Feedstuffs 44:37.

Beef Progeny Testing Report 1971-1972. A. T. Ralston and T. P. Davidson. Umatilla Branch Experiment Station, Hermiston.

Heterosis Among Inbred Lines of Hereford Cattle for Preweaning and Weaning Traits. 1973. P. E. Humes, R. Bogart, K. E. Rowe and P. E. Schilling. Journal of Animal Science 36:466.

Partitioning Lactation TDN Consumption in Herefords Between Maintenance, Gain and Milk Production. 1972. W. D. Hohenboken, E. R. Hauser, A. B. Chapman, and L. V. Cundiff. Journal of Animal Science 34:152.

Fourteenth Annual Beef Cattle Day Report. 1972. Oregon Agricultural Experiment Station Special Report 356.
The Use of Antibiotics and Hormones in Beef Production - A. T. Ralston
Mineral Problems in Beef Cattle Nutrition - J. E. Oldfield.

Urea in Finishing Rations for Cattle. 1972. D. C. Church. Feedstuffs 44:40.

Research in Beef Cattle Nutrition and Management. 1973. Squaw Butte Experiment Station, Burns, Special Report 380.

Research in Beef Cattle Nutrition and Management. 1972. Squaw Butte Experiment Station, Burns, Special Report 352.

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