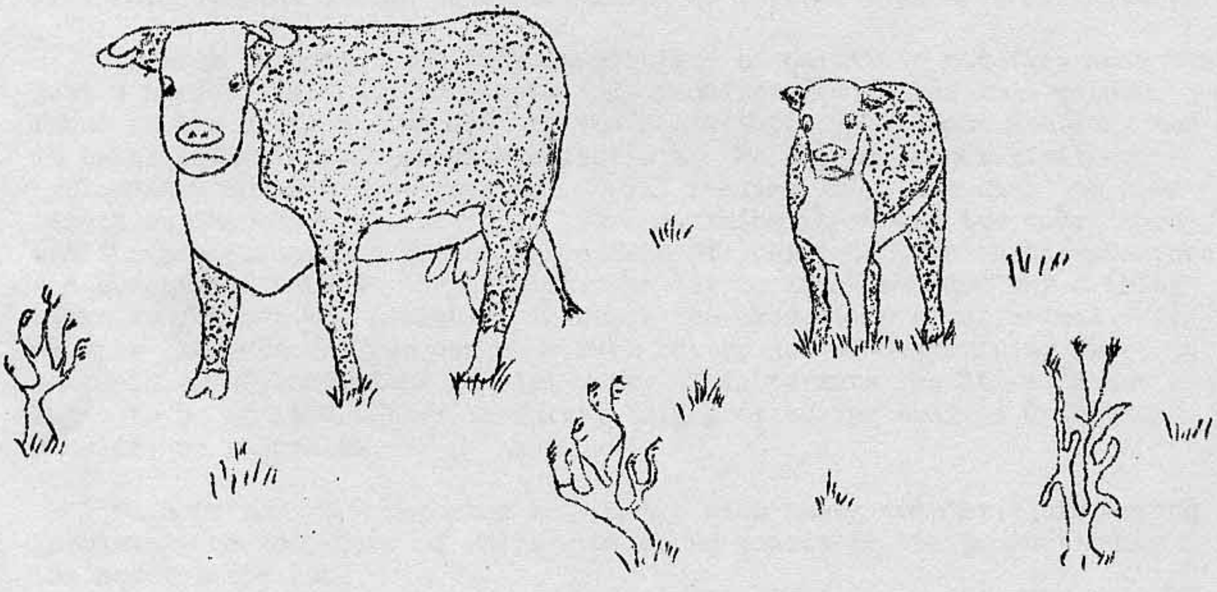
BEEF CATTLE RESEARCH

AT THE

SQUAW BUTTE STATION



LIVESTOCK FIELD DAY ON

MARCH 28, 1960

FOREWORD

Cows are wintered quite differently now than they were 25 years ago--so much so that the term "tailing them up in the spring" is almost a forgotten term. Better wintering and general better management has made an 80% + calf crop the rule rather than the exception; whereas, 25 years ago a 60% crop was the general thing.

There was little difficulty in obtaining and seeing spectacular improvement from feeding more hay and some protein supplement. Both the cows and the cowboys knew that the cows' rations were short. Yes!--real progress has been made in southeastern Oregon in the last 25 years.

Unfortunately, progress creates new problems. The new problems arising from better wintering of range cattle are many and varied. Back in the days of "tailing up cows in the spring" whoever heard of a cow suffering from phosphorus deficiency, trace mineral deficiency, or vitamin A deficiency? She was just plain hungry--so these things didn't matter. On short-feed no nutritional problems existed except short feed. Her calf just "growed up" like Topsy and didn't bother to worry about iron, copper, or antibiotics.

As a result of better wintering and higher production, the above and many more complex things became limiting to further increases in production.

To work on these more complex problems of nutrition requires more than just a meadow field and some cows. It requires facilities such as are found on the Section Five unit of the Squaw Butte Experiment Station, and it takes well-trained research scientists. We can no longer limit our exploration to such questions as: "Will feeding 'this and that' to cows result in increased production"? For one thing there are too many 'this and thats'. Also, the production effect of 'this' depends on the presence and quantity of 'that' in the diet. We try to learn how and why a thing works to improve the health or increase the production of an animal. If we know "how and why" we can do a much better job of determining where and under what conditions it will work. This permits results at Squaw Butte to be applied either in Harney Valley or as far away as Colorado, Florida, or Australia.

Much of the work reported here deals with these complex, interacting problems--the solutions of which are adding pounds to the production of the Squaw Butte herd.

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CANCER EYE IN RANGE CATTLE

Cancer eye in range cattle is generally considered more troublesome on ranges of the southwest; however, serious economic losses resulting from cancer eye are widespread. Affected animals generally undergo a loss in weight and condition if left untreated. Also, the producer suffers a price reduction when these animals are sold. In some cases carcasses may be totally condemned as a result of eye cancer.

Although many aspects of the cancer eye problem in range cattle remain unsolved, the following factors have become fairly well established:

(1) At least to a certain degree, the susceptibility to cancer eye is inherited in range cattle.

(2) Lack of pigmentation around the eye may be a contributing factor to the development of cancer eye. This probably explains why cancer eye occurs more frequently in Hereford cattle than in any other breed.

(3) The incidence of cancer eye increases with age. Cattle under 5 years of age seldom develop cancer eye.

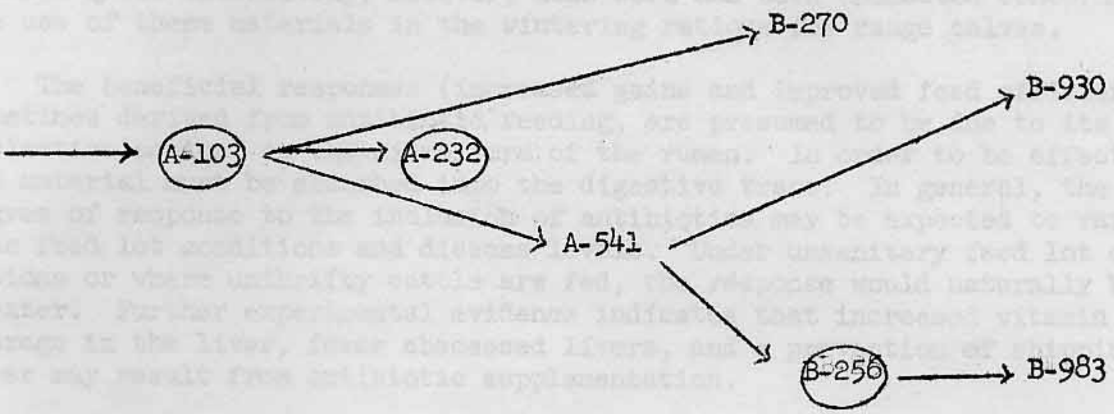
In view of the hereditary aspect of cancer eye in range cattle, a study was conducted on the ancestry of affected animals within the Squaw Butte herd. Since cows within this herd have been bred in multiple-sire groups, no sire records were available. This meant that only cow-family relationships could be obtained for these animals.

The purpose of this investigation was first--to determine whether cancer eye had occurred more frequently in certain cow families than others, and second--to accurately determine the incidence of cancer eye within the Squaw Butte herd.

Records on 268 head of Squaw Butte cows, born from 1946 to 1957 and retained in the breeding herd until at least 3 years of age, showed that 15 head, or 5.6%, have developed cancer eye. A more striking figure perhaps is that 15% of the total number of cows studied that have been sold or died were affected with cancer eye. The incidence of 5.6% found in the Squaw Butte herd is slightly higher than was found in somewhat larger scale studies in Montana and California.

The average age at which cancer eye developed in the Squaw Butte herd was 6.8 years. Only one animal became affected at less than 5 years of age. Cows that were sold or died prior to reaching 3 years of age were not considered in this study since cancer eye would not be expected to occur in animals of this age.

Ancestry records of the Squaw Butte herd revealed that 6 of the 15 affected animals (or 40%) were directly related (either daughter or granddaughter) to cancer-eyed cows. In the Montana study almost 20% of the affected animals were monther-and-daughter pairs. The following diagram illustrates the occurrence of cancer eye within one cow family in the Squaw Butte herd (encircled numbers represent affected animals):



As a result of these investigations a strict policy has been adopted in which offsprings from cow families that have had a high incidence of cancer eye are omitted as possible replacement heifers. For instance, animals B-930 and B-983 illustrated in the diagram were culled from the herd as long yearlings this past fall, although both were prospective animals for the breeding herd.

Ranchers in doubt as to possible precautions against cancer eye in their herds could adopt these practices:

(1) Select replacements from old sound stock or from clean family lines.

(2) Never select as a herd sire any individual with a history of cancer eye in his preceding generations.

(3) If a young cow of high merit develops eye cancer, she could be retained in the herd after removal of the affected eye. Certainly it would not be advisable to keep as a replacement any offspring from such an individual. Eye removal should be considered in other cases also since this will usually increase the salvage value of an affected animal.

(4) In a selection program, consideration might also be given to pigmentation around the eye.

These practices are by no means "fool proof" but are suggested only as a means of keeping the incidence of cancer eye at a minimum within a herd. A purebred breeder would be in a better position to follow a strict selection program against cancer eye and naturally should do so.

ANTIBIOTICS IN THE WINTER RATION FOR WEANER CALVES

The use of antibiotics in fattening rations for beef cattle has been studied quite extensively; however, less work has been conducted concerning the use of these materials in the wintering rations for range calves.

The beneficial responses (increased gains and improved feed efficiency), sometimes derived from antibiotic feeding, are presumed to be due to its "selective'action" on the microflora of the rumen. In order to be effective, the material must be absorbed into the digestive tract. In general, the degree of response to the inclusion of antibiotics may be expected to vary with feed lot conditions and disease levels. Under unsanitary feed lot conditions or where unthrifty cattle are fed, the response would naturally be greater. Further experimental evidence indicates that increased vitamin A storage in the liver, fewer abscessed livers, and a prevention of shipping fever may result from antibiotic supplementation.

Feeding trials designed to evaluate the effectiveness of including antibiotic in the winter ration for weaner calves have been conducted at the Squaw Butte Station. Calves used in these studies received a full feed of meadow hay, 2 pounds of barley, and 1 pound of cottonseed meal as a basal ration. Calves receiving antibiotics were fed 75 milligrams per head daily which is the recommended feeding level. At current prices the daily cost of providing the antibiotic was less than 1 cent per head. The antibiotic used was terramycin since this material was provided to the station as a research grant.

In general, results of these trials showed that antibiotic supplementation increased both weight gains and feed efficiency, particularly in the first few weeks following weaning. For example, in an 112-day study the weaner calves daily gain was increased 12% and feed efficiency improved 4% while in a 42-day study, daily gain was increased over 20% and feed efficiency improved 10% as a result of antibiotic supplementation. At the end of the 112-day trial animals fed antibiotics appeared to have better hair coats than those receiving no antibiotics.

In some cases, a temporary reduction in feed consumption may occur when cattle are first placed on feed containing antibiotic; however, this was not evident in the Squaw Butte studies.

The following methods of supplying antibiotics to calves were studied in the Squaw Butte trials:

(1) Mixing antibiotic in the protein supplement (cottonseed meal).

(2) Providing the material in a loose salt mix.

(3) Mixing a soluble form of antibiotic in the drinking water.

All of the methods were successful. However, under our conditions mixing antibiotic in the protein supplement was most effective.

MORE WEIGHT ON YEARLING FEEDERS

A large number of commercial cattlemen in eastern Oregon and adjoining areas concentrate their ranching programs around the production of long yearling feeders. The weight accumulated by such feeder animals following weaning occurs during a relatively long winter feeding period and a comparatively short summer grazing season. Although these conditions prevail, many ranchers tend to "rough" weaner calves through the winter hoping that extra summer gain will have a compensatory effect towards a high total selling weight. Their belief is that winter gains on calves are extremely costly and also that if a calf gains over 0.50 to 0.75 pound per day during the winter, his summer gain on grass is apt to be depressed.

Several factors have raised questions as to whether the prevailing practice is the most economic:

(1) The summer grazing period in this area is quite short, consequently a high rate of daily gain through the summer may not result in a great total gain.

(2) The weaner calf is at a stage in its growth cycle where it can make more efficient use of nutrients than will ever be possible at a later period in its development.

(3) Seven years of experimental evidence from the Squaw Butte herd indicates that over a rather wide range (0.4 to 1.6 pounds per day) winter gains have little effect on summer gains. The decline in rate of gain on summer range was noted when animals gained over 1.6 pounds per day during the winter period.

A full feed of meadow hay supplemented with 2 pounds of barley and 1 pound of cottonseed meal per day has proved very satisfactorily for wintering calves in the Squaw Butte herd. Calves fed this ration gained approximately 1.3 pounds per day during the winter and gained as well on summer range as those wintered at lower levels. At current feed prices our winter gains cost from 14 to 15 cents per pound. On the basis of these figures, one can easily see that wintering calves to gain at this level (approximately 1.3 pounds per day) would be profitable except in cases of extremely high feed costs or where the price of feeder animals declines to around 16 cents per pound or lower.

Calves wintered on meadow hay alone are restricted to little if any winter gain since their ration is used almost entirely to meet their maintenance needs. The average daily hay consumption for weaner calves (whether supplemented or not) is approximately 10 pounds per head through the wintering period. If we assume that a calf wintered on meadow hay alone gains 0.3 pound per day and use a value of $20 per ton for meadow hay, the cost per pound of gain is 33 cents. In other words, the cost per pound of gain for calves wintered on hay alone is over twice the amount shown for calves receiving barley and cottonseed meal as a supplement to the hay.

Supplementing a native hay ration for weaner calves with a minimum amount of properly selected concentrates can result in a more rapid and efficient gain during the winter, a weight advantage that is easily retained through the summer, and finally more weight and higher condition at selling time as long yearlings.

Results of Squaw Butte research show that in order to reach a heavier weight on long yearling feeders, ranchers must capitalize on both the winter feeding period and the summer grazing season. More specifically, these data indicate that ranchers should strive to promote an optimum rate of winter gain on weaner calves that will not have a depressing effect upon their gain on grass the following summer.

WINTERING RANGE CALVES ON PELLETED, WAFERED, OR CHOPPED MEADOW HAY

Farm equipment manufacturers are working diligently on the development of field pelleting and wafering machines. By the time such machinery becomes practical for rancher use, we hope to have many of the answers regarding the nutritional value of pelleted or wafered native meadow hay.

Through the process of pelleting or wafering hay, problems related to handling, storing, and feeding the hay are greatly reduced. Pelleting a weedy or unpalatable hay renders it more acceptable to beef cattle. The main disadvantages for the processed hays are the added costs of grinding and pelleting or wafering along with the transportation costs to and from the feed mill. Naturally these costs will vary from ranch to ranch.

Changing the form of hay from loose hay to a pellet or wafer doesn't necessarily increase its feeding value when comparisons are made on a pound for pound basis. The increase in performance resulting from feeding hay in a pelleted form is due to increased consumption. Feed efficiency appears greater on pellet-fed animals since proportionately more feed is consumed for gain rather than maintenance. When a calf is fed chopped hay alone, the nutrients are used almost entirely to meet the maintenance needs of the animal, therefore little gain is made.

Feeding trials conducted at the Section Five unit of the Squaw Butte Station showed that calves consumed from 35 to 50% more on a pelleted meadow hay ration than similar calves fed the same hay in a coarsely chopped form. Calves fed wafered hay consumed only slightly more than those fed chopped hay. Consequently, rather marked increases in calf performance were obtained where hay pellets were fed in place of chopped hay and only slight differences in performance were noted between calves fed wafered and chopped hay. In these studies no supplement was fed to the animals receiving the different forms of hay. The amount of hay refusal (or waste) varied considerably between the 3 forms of hay. Percentage figures representing waste were: Chopped hay - 18.7%, wafered hay - 13.5%, and pelleted hay - 2.7%.

A digestion trial was conducted to compare the pelleted and chopped forms of native hay. Cellulose digestion was lower and crude protein digestion higher in the pelleted hay as compared to chopped hay. The fact that finely ground pelleted hay passes through the digestive tract more quickly than chopped hay, and is thereby exposed to less fermentation in the rumen, probably accounts for its lower cellulose digestion. TDN and digestible energy values were similar between the two forms of hay.

THE STUDY OF RUMINANT NUTRITION

The contents of the rumen are made up of several types of bacteria and protozoa as well as feed components and large amounts of saliva. Considerable work has been conducted on various rumen studies but even with our present day knowledge the function of the rumen holds many secrets within each microbe that makes up the large microbial population of the rumen.

The various characteristics of the ruminant have made them extremely valuable for the utilization of new crops as well as a variety of by-products. It is due to the characteristics of the rumen that we are able to feed the types of forages and various by-products that are fed today. As more light is shed on the mechanics of the rumen it will be applied to the utilization of new crops and more and newer by-products. Basic rumen research holds the key to this storehouse of treasure.

The study of the operation of the rumen covers an extremely broad area. For the animal husbandman this has generally been summed up as ruminant nutrition and physiology. However, within these phases one must study the microbial action as well as the physical and biochemical reactions of the ruminant and of the bacteria themselves. It has often been stated that when we feed the ruminant we are feeding bacteria and not the cow. The rumen is likened to a large fermentation vat comprised of various species of bacteria, the feed consumed, and saliva. The saliva of ruminants, unlike that of non-ruminants, contains no enzymes to aid in the digestion of starches or similar material. Its major role appears to be to neutralize the fatty acids produced in the rumen and thereby maintain a suitable media for the bacteria. It appears that there are no enzymes secreted in the rumen and therefore all chemical changes occurring here are due to the action of the microorganisms. This partially digested mass then moves to the true stomach where digestion processes, like those of non-ruminants, are carried out.

With this basic information before us let us discuss the methods of studying this vast field of ruminant nutrition. Methods have been developed to study the action of the rumen artificially (in vitro) and naturally, or in the living animal (in vivo). One can understand that detailed work with the living animals would be costly and much more time consuming. It would require having several animals equipped with rumen fistulas that require considerable care and attention. By using the artificial rumen technique numerous tests can be made rather inexpensively and one needs only enough fistulated animals to supply the rumen inoculant.

The Squaw Butte Station has been using the artificial rumen technique to evaluate various types of forage plants as well as the effect of fertilizer on the cellulose digestibility of the forage. This technique will extend itself to a study of the digestibility of the various nutrient components of animal feeds. It also affords a means of studying the relationships of one feedstuff as fed with different types, and in different ratios with other feedstuffs.

This method offers an inexpensive, not too laborious, method of testing and screening different feeds, and feed additives, and determining their value in livestock nutrition. However, after these feeds have been screened they need to be further tested in the feed lot to find their true value.

Let me cite an example of how several feed additives could be screened by the artificial rumen technique, and then the most promising tested by application in the feed lot. For example, urea has been used for several years in ruminant nutrition to substitute for part of the protein supplement. Urea could then be mixed in various proportions with the protein supplements (i.e. cottonseed meal, soybean oil meal, linseed meal, etc.) and the resulting digestibility values evaluated. Then, for example, if a mixture of 1 part urea to 10 parts cottonseed meal and another mixture of the same rate of urea to soybean oil meal gave digestibility values quite closely related and significantly superior to the other mixtures, these would be tested in the feed lot to determine their comparative value. This would make it necessary to compare only the better combinations with the more expensive feed lot method rather than comparing the multiple combinations tested by the artificial method.

The artificial rumen technique has been used at the Squaw Butte Station to compare the digestibility of meadow hay raised on unfertilized meadows with that raised on fertilized meadows. There is a wealth of information to be gained from the study of ruminant nutrition and it is our aim to utilize these techniques more fully and thereby come up with information that will enable the livestock man to produce more efficiently.

TRACE ELEMENTS FOR RANGE CATTLE

Beef cattle require rather large amounts of calcium and phosphorus for vital body functions, bone development, and normal growth. Smaller amounts of sodium, potassium, and chlorine are needed for important roles in the fluids and soft tissues of the animal body. Other minerals are also required but only in minute quantities. These minerals are referred to as trace elements or trace minerals. Elements such as iron, copper, sulfur, iodine, cobalt, molybdenum, and certain other elements fall into this category.

Trace element deficiencies have been found to exist in certain areas of the United States and other countries. Within these areas, feeds grown on soils that may have been depleted of certain elements through leaching and/or cropping do not supply the animals requirement for these elements. In such cases it is usually necessary to supplement rations with the deficient mineral (or minerals) to maintain thrifty animals.

The interrelationships among certain trace elements in feeds and in some cases an over-abundance of one or more of these elements may present special problems in some areas. For example, it is known that beef cattle require a small amount of molybdenum, but an excess tends to disrupt copper utilization and may increase the requirement for copper. Likewise, a selenium deficiency may result in a condition known as white muscle disease while an excess is highly toxic.

Iron and copper in very small amounts are required for hemoglobin formation. Australian experiments indicate that copper also has certain other basic roles in the animal body. In most areas, animal feeds (except milk) contain a sufficient quantity of iron. Therefore, the problem of iron dificiency is generally not pronounced in beef cattle. Anemic conditions may, however, occur in young calves depending solely on milk. On the other hand, copper deficiencies appear to be more widespread. Symptoms of copper deficiency include depraved appetite, loss of condition, anemia, stunted growth, rough hair coat, suppressed estrus, and diarrhea.

Copper analyses of native hay from the Squaw Butte meadowland show a range of 2 to 3 ppm while the requirement of cattle for copper falls between 4 and 8 ppm. To further complicate the trace element picture, our native meadow hay contains a moderately high level of molybdenum as well as a high content of sulfur. Under these conditions it is quite conceivable that impaired copper utilization could occur in cattle. Trace element information on range forages in this area is incomplete, but here too there is evidence of marginal to low levels of copper.

Squaw Butte cattle wintered principally on native meadow hay and fed no supplemental copper have shown difinite sub-normal blood and liver copper values. Experiments have shown that by supplying copper to the animals (either an oral supplement or an injection) their blood copper content and liver copper storage could be readily restored to a safe range.

During certain years weaner calves from the Squaw Butte herd have developed a severe scouring condition. This condition has occurred during the winter months when calves were being fed primarily on native meadow hay. The trouble was first diagnosed as coccidiosis infection, but affected animals failed to respond to the sulfa drug therapy prescribed. When the scouring condition reoccurred the following year, an addition of copper sulfate to the animals' diets proved very effective in correcting the situation. It seems logical to assume that the interrelationship of copper, molybdenum, and sulfur in the meadow hay was a contributing factor to the development of the scouring condition.

In several Squaw Butte trials, copper supplementation to weaner calves has failed to result in any real advantage in increasing weight gains. Some investigators, however, contend that weight gains in young calves do not constitute a sensitive criteria for copper deficiency. A long-time study is now underway at the Squaw Butte Station in which the production of cattle receiving an adequate supply of copper over a long period will be compared with that of cattle receiving no copper supplementation. Calving percent, percent calves weaned, weight of calves at weaning time, and longevity of production are factors that will receive primary consideration in this work.

Other current trace element research at the Squaw Butte Station include:

(1) A long-term study designed to determine the influence of continued cobalt supplementation to range cattle.

(2) A study to determine the influence of iron and copper injections on hemoglobin formation and subsequent performance in newborn range calves.