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Wm. A. Schoenfeld, Director
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SAVING OREGON'S EWES AND LAMBS

Pregnancy Disease of Ewes

by

O. H. Muth and J. N. Shaw,
Department of Veterinary Medicine,
and
D. E. Richards
Eastern Oregon Branch Experiment Station

Introduction

The purpose of this circular is to make available to the sheepmen of Oregon general information concerning pregnancy disease of ewes gained by several years of observing the disease in bands and flocks containing many thousands of ewes, experimental work at the Oregon Agricultural Experiment Stations, and from the study of the reports of other workers with this subject who are stationed throughout the world.

Pregnancy disease of ewes was recognized as a distinct condition by American and European workers some fifty years ago. Since then it has been the object of much speculation and a considerable amount of investigation. Much of the early published material has been the result of speculation based on superficial observation, resulting in widespread erroneous beliefs and a general confusion of the subject. Some early explanations of the cause were heavy feeding, infection by so-called hemorrhagic septicemia bacteria, infection of the bile ducts, toxemia of pregnancy (a condition occurring in humans), degeneration of the liver, ketonemia, acetonemia, and degeneration of the nervous system. With these various explanations of cause were presented various names for the condition, some of which were: staggers in pregnant ewes, ketonemia of pregnant ewes, ketosis of pregnant ewes, preparturent paresis of ewes, lambing paralysis, and pregnant ewe paralysis. The name pregnancy disease of ewes is now quite generally accepted and is considered sufficiently descriptive to justify its use.

Pregnancy disease is beyond a doubt the most important disease of Oregon ewes, resulting in greater economic loss than any other one disease. While it is difficult to estimate the total annual loss, observation has shown a frequent loss of 10 percent and an occasional loss as high as 20 percent in some flocks and bands. Even on a basis of a 2 percent loss, this would amount to nearly one-half million dollars annually for the state of Oregon at the present value of sheep.

This disease has been recognized for many years as one of the outstanding problems of Oregon sheepmen. Because of lack of facilities and financial support, however, work prior to 1937 was limited largely to observations on the disease occurring in privately-owned flocks and bands and to the study of naturally-occurring cases presented to the laboratory by sheep owners.

Animals Affected

The occurrence of this disease is widespread. It is found wherever sheep are raised. Ewes over four years of age and carrying more than one lamb are most frequently affected. Ewes in all stages of fatness are affected, the amount of fat carried apparently having no influence on the disease, however, most of the trouble occurs in thin ewes.

Symptoms

Although there are slight variations in symptoms, the following is typical.

When ewes are observed closely, the first irregularity that is noticed is refusal of feed and drink. At first the ewe will accompany the rest, but it soon stands by itself, remaining in one position for considerable periods of time. The ears droop and it assumes a picture of general inactivity. Nervous symptoms soon develop, first consisting of grinding of the teeth, twitching of the ears, salivation and apparent blindness. The ewe becomes unresponsive and pays no attention to approach. It gradually becomes worse and ultimately goes down. Some will stand for a time when assisted, but this power is soon lost and the ewe lies, frequently on its side. At this time there may be almost constant leg movements, or the ewe may simply lie in a comatose condition.

The length of the course of the disease varies but usually extends over several days. In fact, it is not uncommon for a ewe to lie about for a week before finally dying.

Recovery is rare. Ewes have been seen to exhibit slight symptoms and refuse feed for a day, appearing normal thereafter, but this occurs infrequently. Occasionally when a ewe is attacked by this disease she will abort or lamb normally. Although some of these ewes live, they give little or no milk and thus do not produce good lambs.

Autopsy Findings

On autopsy the finding of multiple pregnancy (two or more lambs) and a markedly yellow liver are characteristic. The abnormal color of the liver is due to the replacement of normal liver tissue with a large amount of fat. The liver tissue is easily broken and has a distinctly greasy consistency.

Experiments

Work at the Eastern Oregon Experiment Station during the past five winters has consisted largely of setting up comparable lots of ewes and feeding different rations to the different lots in an effort to study the effect of these rations. For the most part, rations similar to those fed by practical sheepmen were used. In a few instances the rations used were somewhat out of line with ordinary practice in that more than ordinary amounts of concentrates were given.

Five hundred eighty-eight cross-bred ewes, comprising 15 different lots, from three to eight years of age were used. Lots to be compared were made up of ewes of similar age in order to remove the influence of the age factor. During one season ewes of eight and three years of age were used in an effort to determine satisfactory rations for ewes of different ages.

Yards of approximately 90 x 21 and 129 x 60 feet, providing 157 and 250 sq. ft. respectively per ewe, were used. These were kept clean and dry by the liberal use of straw. No shelter other than a single board fence at the extreme windward side of the lots was provided.

No effort was made to provide exercise except in one instance when the effect of forced exercise (1.3 miles per day) on one lot was compared with a similar lot receiving no exercise.

Feeding periods during which observations were made ranged from 30 to 41 days before lambing. Ewes were fed twice daily, the ration being given in two equal feedings. All feed was weighed before each feeding and weights were also made of all feed refused.

The alfalfa hay used in the feeding of the ewes under observation for pregnancy disease was either first or second cutting. It had a good green color, and was put up so that there was a high percentage of leaves on the stems. It was free from "cheat" and "mold." Both long and chopped hay were used during these experiments.

The grain hay used was either beardless barley or wheat hay, cut in the soft dough stage. It had some green color, and would have been considered good average grain hay.

The grain fed was Trebi barley, or soft white wheat. It was fed rolled to the older ewes.

The molasses used was both beet and Hawaiian cane.

Weights were made of ewes at the start of feeding and periodically during the period. Lambs were weighed when dropped.

During some of the trials records were kept of water temperatures and consumption. Running water was provided at all other times.

The ewes had access to half-ground salt at all times, and records were kept of salt consumption during one season.

Urine was periodically drawn from ewes by use of a metal catheter (at weekly intervals except when the occasion justified otherwise) and tested for ketones. These substances, of which acetone is the principal one, are the result of incomplete fat utilization, and when present can be demonstrated in the urine by a simple color test. This test has received considerable attention as an aid in diagnosis and can be made by any veterinarian.

Treatment of Individual Animals

Several treatments have been tried both at Corvallis and the Eastern Oregon Experiment Station, as well as on privately-owned sheep in the surrounding localities.

Since affected animals refuse all feed and drink, treatment was administered by force. Treatments tried have consisted of intravenous and subcutaneous injection of various substances including calcium chloride, calcium lactate, calcium gluconate, glucose, insulin, liver extract and thiamine hydrochloride (vitamin B₁). Ewes were also treated by administering, by means of a stomach tube, solutions of commercial sugar, corn syrup and molasses. These were given in from one-half to one pound doses dissolved in a gallon of warm water. Skimmed cows' milk in one-gallon doses was also given to one animal.

Results

There were no difficulties experienced either before or during lambing in ewes from well-fed lots which included those receiving all of the good quality of alfalfa that they would clean up and one-third pound of grain or its equivalent. These ewes had good appearance and were strong and active. Their wool was long and had a good luster. They developed large udders before lambing and had a good flow of milk when their lambs were dropped. These well-fed ewes also had a motherly attitude for their lambs, "licking" them as soon as dropped and following "like a dog" when the lamb was picked up and carried to the shed. The lambs were strong, soon found the milk supply, filled up and went to sleep. They were really on the way to market lambs.

It was a tough job to lamb the ewes from the poorly-fed lots. That is, the ewes fed grain hay and no grain or molasses. These ewes were thin and weak, and their wool was "dead" and short.

These ewes' udders were small and they only had a very little milk at lambing time, some had no milk at all. When these ewes lambed, it was very difficult for them, for they did not have strength - many of them needed help. When the lambs were dropped, they were also weak - some 2 to 3 pounds smaller than the lambs from the well-fed lots. After the ewes had lambed, they did not pay much attention to the lambs - they were too weak to be interested. Very few of these ewes had sufficient milk to raise two lambs, and some of them did not raise one lamb. Although the ewes from the poorly-fed lots were well fed after lambing, they looked "hollow," and it was a long time before they developed strength.

The alfalfa hay was always preferred by the ewes. They would eat or consume some 4 to 4½ pounds of good alfalfa hay per head per day before lambing, and would make a monthly gain of some 15 pounds.

When the alfalfa hay was fed chopped and in self-feeders so they had fresh hay before them at all times, they would consume more than they would of long hay, and make larger monthly gains.

The ewes on grain hay would only eat about 3 pounds or less per head per day, and made only slight gains, or just maintained their weight.

Barley, wheat, beet molasses and Hawaiian cane molasses appeared to give similar results when fed on equal weight basis.

Forced exercise (1.3 miles per day) had no effect on well-fed six-year-old ewes when compared with similarly-fed ewes kept in a small yard.

Water consumption was slightly greater in ewes fed molasses as a concentrate than it was in ewes fed a similar weight of barley. It was considerably greater in ewes fed alfalfa hay and molasses than in ewes fed grain hay only.

Salt consumption was somewhat less in ewes receiving molasses than in other ewes. Ewes consumed about one-half ounce of salt per day during these trials.

The urine of all ewes which developed symptoms of pregnancy disease gave strong positive reactions when tested for ketones. The urine of many ewes which did not develop other symptoms of pregnancy disease also gave from weak to strong positive reactions, but these ewes were mostly among those receiving poor rations. Ewes on a good ration which was suddenly changed to a poor ration gave strong positive reactions within a week following the change in ration, and some developed symptoms of pregnancy disease. Conversely, the urine of ewes on a poor ration for which was substituted a good ration changed from strongly positive to negative for ketones within a week after the good ration was given. The general appearance and activity of these ewes also improved markedly and they were able to lamb quite normally.

There occurred during one feeding season one week during which the temperatures at Union were somewhat lower than those of the preceding and following weeks. During that week of low temperatures an increase of ketones was found in the urine of many ewes. As soon as temperatures again rose there was a decrease of ketones in the urine.

A few ewes have recovered following the administration of dissolved sugar, corn syrup, or molasses by use of a stomach tube when treated in the early stage of the disease. No treatment proved of any value after animals had refused feed for several days.

Discussion

One cannot have an understanding of pregnancy disease in ewes without first having some knowledge of the physiological processes involved.

When an animal takes in feed in excess of its body maintenance, the excess is stored as a fat reserve to be drawn upon when feed is not so plentiful. Thus ewes approach lambing carrying varying amounts of fat. Those which have been well fed during the fall and early winter will be in the best condition, but even ewes appearing quite thin carry considerable stored fat.

As lambing approaches the development of the young increases the maintenance requirements and if sufficient nutrients are not provided the ewe will draw upon her stored fat. It is a well-established fact that in order to completely utilize this fat a certain amount of carbohydrate must be available, otherwise the fat is only partially used and the remaining part accumulates in the blood and body tissues. These remaining substances, known as ketones, are poisonous to the animal and when present in sufficient concentration, produce the symptoms observed in pregnancy disease.

Normally there is stored in the liver a considerable amount of carbohydrate in the form of glycogen. This glycogen aids the liver in its function of eliminating poisonous substances from the body and furnishes energy for ewe and lambs. When a shortage of carbohydrate intake occurs, the glycogen of the liver is quickly exhausted and is replaced by fat from fat deposits in the body. This impairs the liver in its ability to remove poisonous substances from the body and accounts for the fatty liver observed at autopsy.

One might wonder why this condition occurs so commonly in ewes and is not observed in other pregnant animals. Consideration of the fact that a ewe containing a pair of fast-developing twins and growing a heavy fleece at the same time probably has greater maintenance requirements than most other species helps to explain this. In a hundred-pound ewe carrying twins the weight of the uterus and its contents is about 25 pounds at the time of lambing. If the total gain in weight during the last two months before lambing does not increase at least this amount in a ewe carrying twins, she draws seriously on her body reserve. Shortly after lambing the ewe is expected to be relieved of an eight or nine pound fleece.

These two items constitute a relatively high percentage of the body weight and it can readily be seen that the weight of the body proper, which is called upon for this production, is relatively small. No other animal on the ranch is expected to produce in this manner. Per pound of body weight, the ewe is the hardest working animal on the ranch.

As has been stated, ewes five years of age or older are most frequently affected. Twinning is common to ewes of this age and they lack some of the vigor of younger ewes. They probably do not handle their feed as efficiently and apparently require more and better feed than do younger ewes.

While exercise has been recommended by some as treatment for this disease, no experimental evidence has been produced that this is an important factor. Moderate exercise may better physical condition, resulting in more efficient utilization of feed, but this has not been proven. The following observations were made on one band suffering severe losses. About two weeks prior to lambing, the band of 2200 ewes, having consumed the hay where they had been kept, were moved approximately 12 miles to the home ranch. Four days after arriving there was an onset of pregnancy disease which resulted in the loss of 50 animals. These ewes had been fed entirely on alfalfa hay. Losses stopped after molasses ~~was~~ included in the ration. In this instance, the additional nutritional requirements of 12 miles of forced exercise may have actually contributed to the onset of the trouble.

Much pregnancy disease occurs in Western Oregon when ewes are on pasture. At times the forage is decidedly green and abundant; sometimes it is not very abundant. As is well known, the grass during the rainy period has a high water content (about 80 percent) and a relatively low nutritive content. Not much is known about the biological or feeding value of grass under such conditions, but what little evidence is available indicates that it does not possess all the qualities of grass grown during the spring and summer. These cases of pregnancy disease developing when ewes are running on pasture cannot be attributed to lack of exercise. It has further been shown in other experimental animals that exercise increases the ketones in the blood.

Trouble is frequently encountered when ewes are brought in from the range and put on feed during the last month before lambing. The trouble cannot always be accounted for on a basis of insufficient available feed, but investigations have shown that any interruption in the feeding of ewes during the last month of pregnancy is dangerous unless the change in feeding is such that intake of nutrients is increased. Sheep, like many other animals, are sensitive to changes in environment and will not feed as well when first brought in from range as they will after they have been in for some time. During the critical last month before lambing, once the appetite is lost it is very difficult to get them to consume a sufficient quantity of even the best feed.

Water consumption may at least have an indirect influence on the disease. A liberal supply is necessary to promote digestion of feed and elimination of waste products when sheep are on dry feed. Without sufficient water, the intake of dry feeds is limited even though a good quantity and quality are offered.

Salt is very important in influencing feed intake in that it increases water consumption. Since it would take considerable time for the ewe to consume $\frac{1}{2}$ ounce of salt per day from a solid block, the use of half-ground salt would seem to be indicated.

Severe weather is thought to be an important factor in bringing about this disease. Since the past five winters have been relatively mild, there has been little opportunity to study this factor. However, the finding of increased concentrations of ketones in the urine during cold weather substantiates this. Cold storms do interfere with feeding and water consumption of animals, and increase body maintenance requirements.

While many ewes not exhibiting symptoms of pregnancy disease pass urine containing ketones, the presence of these substances in the urine are an indication of insufficient carbohydrate intake and will disappear from the urine if the carbohydrate intake is increased. Examination of the urine during the last four weeks of feeding could be used as a guide in feeding. If during this period ketones were found in the urine, the addition of more carbohydrate to the ration would be indicated.

Although investigations carried on by the authors of this paper, as well as by several other investigators in this country and abroad, have shown that pregnancy disease of ewes is primarily a nutritional disease, other factors are undoubtedly involved to a lesser extent. Organic dysfunction of physiological processes in the ewe brought about by other diseases may produce a similar condition. In most instances, however, only a small percentage of ewes would be involved and response would not be effected by increasing carbohydrate intake.

While the administration of sugar in the manner mentioned will save the lives of some ewes treated in the early stages of the disease, this method of control should not be relied upon when trying to operate a profitable enterprise. A far better method would be the feeding of a little additional good quality alfalfa hay and grain or its equivalent in the form of molasses or some other concentrate during the last month of pregnancy. Even in ewes not subject to pregnancy disease, the giving of this additional good feed cannot be considered a loss. Well-fed ewes drop stronger, better lambs and are able to provide more milk than those ill-fed. Lambs should be strong, soon able to get up, follow the ewe and nurse. Early gains in lambs, the result of big strong lambs receiving plenty of milk, characterize a profitable sheep enterprise.

Conclusions and Recommendations

Pregnancy disease of ewes is primarily a nutritional disease resulting from insufficient intake of feed during the last six weeks of pregnancy. The feeding of four pounds of good quality alfalfa hay and one-third pound of barley or its equivalent per head per day, especially to ewes five years of age or older, is recommended where ewes are lot-fed during this period. Where ewes of varying ages are involved, it is recommended to divide the younger and older ewes, giving extra feed to the older ones. In cases where ewes are brought in from the range for lambing, it would be well to bring them in early enough so that they are on full feed at least four weeks before lambing.

This feeding should be carried out with regularity and ewes should be so handled as not to interrupt their feeding habits. Access to half-ground salt and free access to good water should also be provided.

In Western Oregon, where ewes are run on pasture during the winter months, it should be remembered that the grass at that time contains approximately 80 percent of moisture and does not maintain ewes satisfactorily during the latter part of pregnancy without supplement. The amount of supplement required will of course vary with the condition of the pasture. In many instances pasture supplements should approach the recommended ration for lot-fed ewes.

Inasmuch as ketones can be detected in the urine before other symptoms develop, it is suggested that this may be used as an indication of insufficient carbohydrate intake and steps taken to remedy the situation.

Treatment should not be depended upon to control this disease. However, the lives of some affected ewes can be saved if treatment is started when the first symptoms develop. The recommended treatment consists of the administration by means of a stomach tube of one-half pound of commercial sugar, corn syrup, or molasses dissolved in one gallon of warm water. This treatment should be repeated daily until the ewe again feeds normally.