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PREGNANCY TOXAEMIA OF EWES

By C. R. TOOP, B.V.Sc., Chief Veterinary Surgeon.

With the approach of the lambing season, losses from pregnancy toxaemia are frequently sustained by sheep breeders. This disease has a world-wide distribution and has been described under a wide variety of names, the most common of these probably being “twin lamb disease,” “pregnancy disease of ewes,” and “pregnancy paralysis.” It would perhaps be more appropriate to describe the disease as ketosis of pregnancy since there constantly occurs in the blood of affected animals an accumulation of toxic substances known as ketone bodies.

Pregnancy toxaemia affects ewes which are heavy in lamb. The losses are almost wholly confined to the last three or four weeks of pregnancy and few animals recover after the symptoms have become well established. Ewes carrying twin lambs or triplets are most frequently affected, hence the popular name “twin lamb disease” but ewes with single lambs may also develop the disease.

The outstanding feature at post-mortem is the extremely fatty appearance and pale yellow colour of the liver. The exact cause of the disease has not yet been determined but there is abundant evidence to show that it is nutritional in origin and that it is associated with under-feeding and loss of condition during late pregnancy.

In Western Australia pregnancy toxaemia occurs throughout the agricultural areas but it has not been reported from the pastoral districts. The annual losses are extremely variable, and during some seasons mortalities may be numerous and widely distributed. In others, for reasons not well understood, they may be of comparatively rare occurrence. Similarly, losses in individual flocks are subject to considerable fluctuation. In some cases they may be small and insignificant but in others they may reach serious proportions, and in isolated instances have been known to approach the high figure of 50 per cent.

THE SYMPTOMS

Ewes of all ages and breeds are susceptible to the disease but due to the greater tendency towards twinning and multiple pregnancies, mature ewes are most frequently affected. The losses are almost entirely confined to the last three or four weeks of pregnancy but the disease may appear as early as six weeks before the due date of lambing. The affected ewe becomes dull, ceases to feed and separates itself from the flock. It appears dazed and stupid and pays little heed when approached. It is often possible to approach within a few feet of the animal or even touch it before it will attempt to move away. When so disturbed the animal moves off slowly and aimlessly, proceeding for a short distance only before

Fig. 1.—A ewe suffering from severe pregnancy toxaemia. Soon after this photograph was taken the animal became unable to stand and lapsed into a comatose condition.

(Photograph University of Illinois, Agricultural Experiment Station.)
coming to a halt. In many affected animals there is complete blindness, while in others vision is seriously impaired. Grinding of the teeth and the presence of a thick mucus discharge from the nostrils are almost constant symptoms.

When driven, affected ewes frequently show a stiff, unsteady gait and may collapse after proceeding for a short distance, falling to the ground sometimes with the hind limbs extended behind the body. From this position the animal is usually unable to regain its feet without assistance. Later the ewe goes down and is unable to rise, lying in a comatose condition until death occurs. Affected animals may linger from a few days to a week or more from the first appearance of the symptoms. Few affected animals recover and the mortality rate is in the vicinity of 90 per cent. Should lambing occur in the early stages, recovery is possible but when the symptoms have become well advanced lambing does not influence the course of the disease and recovery at this stage is unlikely. Ewes which have already lambed do not become affected.

During the course of some outbreaks of pregnancy toxaemia, certain of the ewes, while remaining apparently healthy themselves, may give birth to dead or weak lambs and this occurrence is considered by some observers to be a further manifestation of the disease.

THE POST-MORTEM APPEARANCES —FATTY LIVER

At post-mortem the principal and frequently the only abnormality will be found in the liver. This organ, as the result of a heavy infiltration with fat, will appear somewhat enlarged and characteristically pale yellow in colour. Sometimes similar though much less marked changes occur in the kidneys, which may in consequence appear paler in colour than normal. In a high percentage of the cases two or more lambs will be found in the uterus.

THE PRE-DISPOSING FACTORS —UNDER-FEEDING.

Until fairly recently, the opinion was held that pregnancy toxaemia was associated with overfatness and lack of exercise during late pregnancy but this view now finds little support and is neither borne out by the field nor the experimental evidence. Experimentally it has not been found possible to produce the disease by feeding pregnant ewes to overfatness, and at the same time confining them in pens in which they have been able to obtain little or no exercise. Moreover when fat ewes become affected in the field, it is often possible to find evidence of under-feeding, though this may have been suddenly imposed and of comparatively short duration. On the other hand the opinion that the disease is associated with under-feeding and loss of condition during late pregnancy is strongly supported by both field and experimental evidence. It has been re-produced experimentally by continued under-feeding or by subjecting ewes to a period of sudden starvation. Furthermore in such cases there is evidence of an accumulation of ketone bodies in the blood and urine of the same order as that which is found in the naturally occurring cases of the disease. Ketone bodies cannot be demonstrated in the blood of fat ewes which are receiving an adequate ration.

Under field conditions, outbreaks of pregnancy toxaemia may occur when forward-in-lamb ewes are trucked long distances by rail and are, as a consequence, completely deprived of food for long periods. Similar outbreaks resulting from a period of enforced starvation may also be associated with prolonged yarding.
When mortalities from the disease have been investigated in this State, it has generally been found that the feed available has not been adequate and the ewes have shown evidence of loss of condition and in some cases they have been in poor condition. One mortality can be recalled which involved the loss of nearly 50 per cent. of a flock of full-mouthed ewes. The animals were in extremely low condition, the paddocks were bare and hand-feeding had not been practised.

Under West Australian conditions, unless measures are taken to prevent it by hand-feeding, it is almost inevitable that ewes will suffer from under-nutrition during the latter half of pregnancy and that this will become progressively more acute as lambing approaches. In the majority of flocks, lambing will be timed to commence during May, being preceded by a prolonged, and for the most part, dry summer season. During this period extending from October to May, the available grazing steadily deteriorates, becoming reduced in quality and often in quantity. It is quite inadequate to maintain the condition of the flock and unless hand-feeding is practised on an adequate scale, loss of condition is certain to result. Pregnancy toxaemia commonly occurs under such conditions.

During certain seasons, widespread mortalities have occurred following upon the opening autumn or early winter rains, especially when such rains have fallen at a time when lambing is about to commence or when the earlier lambs have already been dropped. For several weeks following these rains a period of acute feed shortage usually exists. The available dry feed is spoiled and the sheep walk the paddocks eagerly seeking the short and scanty green shoots. Until the green feed becomes well grown, under-nutrition together with loss of condition is inevitable. It has been observed that mortalities occurring under these circumstances have ceased when green feed has become plentiful or when it has been possible to turn the flock on to an early sown green crop.

When the disease appears amongst ewes which are in good condition and are being adequately hand fed, the possibility cannot be overlooked that certain of the less aggressive animals do not succeed in obtaining their full share of the ration and may in reality be falling off in condition.

It thus becomes apparent that ewes whether in fat, poor or indifferent condition may become affected with pregnancy toxaemia if they are under-fed or are suddenly deprived of food during advanced pregnancy.

**CAUSE**

The exact cause of the disease has not been determined. In all affected ewes, however, the presence of toxic ketone bodies may be demonstrated in the blood and urine by chemical means. Moreover, the blood sugar falls to a level far below normal. It is suggested that the development of ketosis is associated with a low carbohydrate intake which occurs when the ration is inadequate. Carbohydrates are represented by such substances as starches and sugars, and are the main source from which the animal derives its energy requirements. In the animal body carbohydrate is stored in the liver in the form of glycogen. In the pregnant ewe this reserve store of glycogen is drawn upon to meet the increased requirements of the mother and of the rapidly developing lamb which stores glycogen in its own liver in quite large amounts. In a twin pregnancy the demands upon the glycogen reserves in the liver of the ewe are especially heavy, and they consequently become depleted and sink to a low level.

If in addition to this the carbohydrate intake is low as the result of under-feeding, the ewe is forced to draw upon its fat reserves in order to obtain its energy requirements. Fat is transported from the
fat deposits of the body to the liver where the first stage in its combustion or oxidation takes place. The liver in consequence, becomes heavily infiltrated with fat. When fat is completely burnt or oxidised in the body the end products are water and carbon dioxide, which are excreted and are harmless. When, however, there is a deficiency of carbohydrate, the oxidation of fat cannot proceed to completion. The process becomes arrested at an intermediate stage, wherein the fat has become converted into products known as ketone bodies which accumulate in the blood and make their appearance in the urine. Ketone bodies possess toxic properties and the symptoms observed in pregnancy toxaemia are attributable to their presence.

It must, however, be emphasised that the actual cause of the disease still remains rather obscure, and that certain of its features still require an explanation. Quite a number of theories have been advanced to account for its occurrence, but further research will be necessary before a clear understanding of the condition is finally obtained.

**TREATMENT**

No satisfactory method of treatment is known and after the symptoms have become well established, recovery rarely occurs. Good results have occasionally been claimed from the administration of sugar or molasses at the rate of 1 lb. to 1½ lb. daily, dissolved in water and given as a drench and from the intravenous injections of solutions of the sugar, glucose. The results of treatment however are generally so unsatisfactory that it must, in the majority of cases be regarded as hopeless.

**PREVENTION**

Supplementary Feeding.—The prevention of the disease appears to be largely a matter of feeding and management. Under-feeding, together with loss of condition, is the principal predisposing factor, and steps must be taken to prevent this occurring during late pregnancy. To ensure that ewes will at least maintain their condition during this period, hand-feeding will be necessary on the great majority of properties. The period at which hand-feeding should commence will depend upon the amount and quality of the grazing available in the paddocks and the condition of the sheep and will call for a good deal of discretion on the part of the individual sheep-owner. In general, however, hand-feeding should commence not later than eight weeks before the due date of lambing, with a tendency towards increasing the ration during the last month. The supplements available for hand-feeding will generally consist of wheat, oats, barley, chaff, hay and occasionally silage. Experiments carried out by the Animal Nutrition Officer of this Department have shown that, with very poor grazing available, pregnant ewes are more than able to maintain their condition on any of the following daily rations:—½ lb. wheat, ¼ lb. wheat plus 1½ lb. silage or ¼ lb. wheat plus ½ lb. chaff. From this information the recommendation may be made that hand-feeding be commenced in early or mid-summer with a daily allowance of ¼ lb. of wheat per head increasing to ½ lb. per head daily about six weeks before lambing is timed to commence. A daily addition of ½ lb. hay or chaff to the grain ration will be advisable if the grazing is scanty. Barley, which is similar in feeding value to wheat, should be fed in the same amounts.

The feeding value of oats is three-quarters that of wheat, and where oats are being fed, an adjustment will need to be made on the basis that 100 lb. of oats will replace 75 lb. of wheat in the ration. Chaff, hay or silage alone will not provide the full requirements of the animal.

Although no definite scale can be laid down, the above figures will serve as a guide to sheep breeders, concerning the amounts of the different food supplements it will be necessary to make available. These rations should be sufficient to meet requirements during normal seasons but under drought conditions they would probably need to be somewhat increased during the last month of pregnancy in order that losses might be avoided. Quite apart from the aspect of disease prevention, however, feeding on this scale is desirable if the flock is to be carried through the summer and autumn months in satisfactory condition.
Green Crops.—The value of young nutritious green feed as a preventive has long been recognised, and when available it probably provides the most effective means of prevention and control. Early-sown green crops will be found of especial value in preventing those mortalities which may occur during the period of feed scarcity which follows the opening rains. Such crops will usually be well grown, and in a fit condition to allow of grazing quite a considerable time before the natural pasture is sufficiently advanced to fully satisfy the requirements of the sheep. The growing of crops for early green feed is a procedure which might with advantage be more generally adopted as a precautionary measure. In any case, it is a sound farming practice which will later provide the rapidly growing lambs with an abundance of feed.

Exercise.—Almost all of those who have investigated the disease are agreed upon the beneficial effects of exercise. In order that this may be obtained, droving in some instances will be necessary, in which case the flock should be travelled slowly for a distance of about a mile daily. Hand-fed sheep will be compelled to take exercise if the feed is distributed in a different part of the paddock each day or if conditions are so arranged that it will be necessary for them to travel to water.

Periods of sudden starvation during late pregnancy, such as would result from trucking or yarding for unduly long periods, should be avoided.

MEASURES NECESSARY TO CONTROL AN OUTBREAK

When an outbreak of pregnancy toxaemia occurs, the application of the preventive measures detailed above will be necessary in order to check the mortality. In most, if not all outbreaks, evidence of under-nutrition will be found, and this must be corrected. Hand-feeding on the above recommended scale should be commenced immediately, or if the scale of feeding has been found inadequate it should be increased to at least that level. Better still, the flock should be turned on to a young green crop if this is available. Daily exercise should be combined with these measures.

FOOTROT IN SHEEP
Quarantine Regulations Ignored

On several occasions recently, sheep from properties in quarantine for footrot have been forwarded for sale without reference to the Department.

The removal of sheep from a property in quarantine and their subsequent sale by auction to other graziers whose flocks are free of the disease is a serious offence for which a heavy penalty has been prescribed under the Stock Diseases Act regulations. Flock owners are warned that it will become necessary to take legal proceedings should this practice be continued.

When any property is found to be affected by footrot, quarantine restrictions are imposed as a precaution against the further spread of the disease to other properties and this quarantine is maintained until the flock has been freed of the infection.

Permits for the sale of sheep for the purpose of immediate slaughter at Midland Junction from properties affected by footrot, may be obtained upon application to the Department either direct or through any of the livestock agents.
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