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Pregnancy toxaemia of ewes

J. Craig

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RECENT research has thrown new light on the essential nature of the disease of ewes known as pregnancy toxaemia. That it was basically a nutritional disease was well established, but it is now known to be primarily a brain disorder caused by a decrease in the quantity of blood sugar supplied to the brain.

The highly fatal metabolic disease has a world-wide distribution, occurring wherever sheep-raising is carried out, and has been known by a variety of names, the most common of which are "twin-lamb disease," pregnancy paralysis and pregnancy ketosis. British breeds and cross-breeds are possibly more likely to be affected than Merinos, due no doubt, to the higher twinning rate in the former.

In Western Australia, pregnancy toxaemia occurs most commonly throughout the agricultural areas, but is not likely to be so prevalent in the pastoral districts. The annual losses are extremely variable, and during some seasons such as the present one, where a long excessively dry summer was succeeded by a delay in the onset of autumn rains, mortalities may be widespread and severe. Not only must the loss of valuable flock ewes be considered, but the further potential value of unborn lambs and consequent lowered lambing percentages, must be taken into account. Thus, the overall economic loss involved makes pregnancy toxaemia one of the most important diseases of the sheep industry.

Losses from pregnancy toxaemia are almost wholly confined to the fifth (last) month of pregnancy, but the disease may appear as early as six weeks before the due date of lambing. It affects mature ewes mainly, particularly those carrying twins or triplets, hence the popular term "twin-lamb disease," but ewes carrying single large lambs may also develop symptoms of the disease.

**CAUSE**

The blood sugar (glucose) must be maintained at certain required levels in order to meet the normal metabolic requirements of the ewe; these energy
requirements are usually met by the carbohydrates and to a lesser extent, by the proteins and fats in the diet.

The blood sugar level of ewes that are heavy in lamb falls rapidly if they are starved or underfed, even for short periods. The resultant fall in blood sugar (hypoglycaemia) may be such that the amount of glucose reaching the brain via the blood stream may be insufficient to keep the nervous tissue functionally normal, and brain damage (encephalopathy) results. The higher nervous centres (cerebral cortex) of the brain which are responsible for preserving consciousness have the greatest sugar needs and are therefore the first to be affected. The symptoms seen in a ewe affected with pregnancy toxaemia can thus be related to the degree of the brain damage sustained, most of these symptoms being associated with depressed consciousness.

PREDISPOSING FACTORS

Under-nutrition and starvation are the main predisposing factors as far as pregnancy toxaemia is concerned.

Under Western Australian conditions, it is almost inevitable that ewes will suffer from under-nutrition during the latter half of pregnancy, unless measures are taken to prevent this by hand-feeding. In the majority of flocks, lambing will be timed to commence during May, this being preceded for the most part by a prolonged dry summer period. From October until May, the available grazing steadily deteriorates both in quality and often in quantity; eventually it is quite incapable of maintaining in-lamb ewes at an adequate nutritional level.

The growth-rate of the developing foetus is especially rapid during the last month of pregnancy; consequently, the nutritional demands of the foetus upon the pregnant ewe are extremely high also, and this is increased by the added requirement of twins or triplets.

When pregnancy toxaemia appears among ewes which are apparently in good condition and are being hand-fed, it is likely that either the scale of hand-feeding is not sufficiently high, or that certain of the less aggressive ewes may not be getting a full share of their ration and are in reality, beginning to fall off in condition.

Other important predisposing factors include the forwarding of in-lamb ewes for long distances by rail, and prolonged yarding; in both instances, the period of enforced starvation may be such as to precipitate an outbreak of pregnancy toxaemia.

It is recognised that ewes, whether in fat or poor condition, may equally show symptoms of pregnancy toxaemia provided the necessary predisposing factors are present. However, the stress of a sudden check in the feeding level is likely to be more acute in the case of fat ewes which have been kept on a reasonably
Fig. 3. — Graph showing growth rate of the unborn lamb (foetus). In the first 100 days of pregnancy, the foetus only makes one-quarter of its growth (2 lb.). During the next 50 days it makes most of its growth and increases to 8 lb. in weight. This rapid development imposes a severe strain on the ewe's metabolism.

The temperature remains normal throughout the course of the disease, and affected ewes may linger up to a week from the first appearance of symptoms. Should lambing occur in the early stages of the disease, recovery is possible, but once the symptoms have become well advanced, recovery is unlikely. Ewes which have already lambed, do not of course, become affected with pregnancy toxaemia.

POST-MORTEM

The most characteristic post-mortem feature is seen in the liver, which is almost invariably enlarged and yellow in colour. This is due to fatty infiltration. Sometimes similar but less marked changes may occur in the kidneys which appear paler than normal. Commonly too, a white flecking of the abdominal and kidney fat is apparent. In many cases, twin lambs or triplets within three weeks of the due lambing date may be found.

high plane of nutrition, than with poor-conditioned ewes which have been maintained on a lower average standard of feeding.

SYMPTOMS

Early symptoms may be missed and merely include standing off from the flock and not feeding. Affected ewes appear dazed and move about in an aimless manner, seemingly quite oblivious of their surroundings. They pay little attention to anyone approaching near them, appearing to be blind and semi-conscious. Their appetite is completely lost; there is grinding of the teeth and sometimes a thick mucous discharge from the nostrils.

When driven, affected ewes commonly show a stiff unsteady gait; they may collapse after going a short distance and be unable to rise again without assistance. Finally, the ewe goes down and lies in a comatose condition, usually with her head turned to one side, until death takes place.
Fig. 4.—A liver from a sheep suffering from advanced pregnancy toxaemia. Note light colour due to heavy infiltration with fat.

TREATMENT

In past years, varied treatments were used in an attempt to save ewes affected with this disease; however, the results obtained were invariably disappointing, and it was common to find 90 per cent. of ewes eventually dying once clinical symptoms become evident.

Recently, a satisfactory measure of success has attended the use of glycerine. This treatment aims to raise the blood sugar level to normal or above normal, and to maintain it at a high level for some time. Provided this treatment is carried out in the early stages of the disease when brain damage has not become too severe, then a reasonably high recovery rate may be expected.

The most effective means of keeping up the blood sugar level has been found to be by drenching with glycerine—4 oz. where Merinos are concerned, and 6 oz. in the case of British breed ewes—mixed with an equal volume of warm water, the glycerine being slowly absorbed and converted into glucose. This drench should be repeated each day until the symptoms disappear.

If treatment is commenced while the sheep is still able to stand, a high recovery rate may be expected; but if the ewe is down and unable to rise, it has usually been affected for several days and may have suffered irreparable damage to the brain. A better chance of recovery may be anticipated where the ewe is down in her normal breast position than lying on her side with legs outstretched. Gentle handling is essential during treatment, especially when drenching sheep that are down, since it is quite easy under these circumstances, for the drench to reach the lungs and cause pneumonia.

Ewes under treatment should be placed in a small sheltered yard or paddock with readily accessible feed and water. Once their appetite has returned, an adequate supply of easily digested carbohydrate such as the cereal grains, should be made available to help maintain the blood sugar at normal levels. By taking these precautions, recovered ewes will be less likely to suffer a relapse, such as might easily occur should they be immediately turned back into the same paddock as the rest of the ewe flock.

PREVENTION

It has been recognised for many years that the prevention of pregnancy toxaemia is a matter of good feeding and sound sheep husbandry practices.

Since under feeding in late pregnancy together with a resultant loss of condition is the principal predisposing factor, steps must be taken to prevent his happening. To ensure therefore, that ewes will at least maintain their condition during this period, hand feeding will be necessary on most properties. Obviously, the precise moment when supplementary feeding should commence will vary from property to property, depending on the quantity and quality of paddock feed available, but generally it should begin not later than eight weeks before the due lambing date.

During the last 50 days of pregnancy, the lamb in the uterus (womb) makes 75 per cent. of its total weight, while the ewe is also preparing for milk production for the occasion of the lamb's birth. The stress of these factors on the ewe is such that it can only be met by an adequate food intake.

The supplements available for hand feeding will generally be the grains and/or hay. It has been demonstrated that ewes will lamb satisfactorily when fed during the last eight weeks of pregnancy on a ration of ⅛ lb. of wheat grain per day, with some cereal hay in addition where paddock grazing has been poor. However, such a grain ration must be considered a minimum one, and a higher rate could be used with benefit, thus ensuring ample milk supplies and strong healthy lambs.
Up to 1 lb. of oats or 13 to 14 oz. of wheat or barley per head per day are suitable and recommended quantities. Where grain is unavailable, these rates may be replaced by 2 lb. daily of good quality meadow (clover) hay. Grain may be fed out in feeders or trickled out on a long thin line on the ground, and feeding twice or thrice weekly will give the best results by allowing the less vigorous ewes a better opportunity of obtaining their share of the feed.

It is well known that young greenfeed is especially valuable in the prevention of pregnancy toxaemia. The practice of providing early cereal crops of barley or oats, wherever practicable, is therefore recommended as being eminently suitable for ewes prior to lambing as well as for newly-lambed ewes.

The beneficial effect of exercise, where pregnancy toxaemia is concerned, is widely recognised, exercise of this nature appearing to have a stimulating effect on the blood sugar levels. Where the disease occurs on good feed and where there appears to be no obvious predisposing causes, driving for half an hour daily may be justified and is likely to give good results. Hand-fed sheep will be compelled to take exercise if the feed is distributed in a different part of the paddock on each occasion it is placed out.

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

**SUMMARY**

1. Pregnancy toxaemia occurs in in-lamb ewes in late pregnancy.
2. The main predisposing factor is under-nutrition which gives rise to very low blood sugar levels (hypoglycaemia) and resultant brain damage (encephalopathy).
3. Treatment of affected ewes by drenching daily with glycerine will give successful results, provided treatment is carried out in the early stages of the disease.
4. Prevention is a matter of maintaining adequate feeding levels in ewes, especially during the last two months of pregnancy.

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Habit.
Karri is one of the giant trees of Australia reaching a height of 270 feet with a clean bole of 100-140 feet. The diameter at the butt may exceed 9 feet. The tallest karri recorded has a height of 361 feet and is still standing. It is a magnificent tree with a smooth clean gum-type bark carried the full length of its straight, shapely trunk; the very thick bark is of a yellowish-white color blotched with pale to dark bluish patches. Karri regenerates readily after milling and the rate of growth is fast. At present 25,000 acres of cut-over forest have been given treatment for regeneration and placed under complete fire protection.

Timber.
The timber of karri is reddish-brown, closely resembling jarrah in appearance, although generally lighter in colour. Growth rings are not well defined and a wavy or striped figure due to interlocked grain is often shown. Karri can be distinguished from jarrah by the burnt splinter test, the former giving a white ash after burning whereas jarrah burns slowly to a black char.

Karri is moderately heavy in weight, having a green density of 73 lb. per cubic foot, and when dried to 12% moisture content has a range from 49-62 lb. per cubic foot, with a mean density of 57.4 lb. per cubic foot, before reconditioning. In drying from the green condition to 12% moisture content the average shrinkage, before reconditioning of a backsawn board, is 10% (tangential shrinkage) and average shrinkage before reconditioning of a quartersawn board is 4.9% (radial shrinkage). Reconditioning only reduces these averages to 9.5% and 4.6%, respectively, showing that very little collapse takes place.

Seasoning.
Karri requires more care in seasoning than does jarrah, since it dries more slowly and has a much greater tendency to check. Occasionally fine long checks occur as well as the usual ray checks. Thicknesses up to 2 inches can be kiln-dried from the green condition, but the considerable care required, the strict control of drying conditions and the fairly long period required for drying would, in most cases, make this practice uneconomical. Good results may be obtained by partially air-drying prior to kiln-drying, particularly if protection and shielding of drying stacks is given during periods of warm and dry weather. The seasoning schedule used for jarrah is applied to karri.

Relatively slight collapse occurs, and reconditioning is not generally practised, but it provides the advantages of making the timber milder for dressing and giving slightly larger sizes. Approximately four weeks are required to kiln-dry 1 inch green stock.

Mechanical Properties.
Karri is both stiffer and tougher than jarrah and has been included in Strength Group "B" together with spotted gum and Sydney blue gum. At 12% moisture content karri has an average modulus of rupture of 20,600 lb./sq. in. compared with 15,900 lb./sq. in. for mountain ash and 14,800 lb./sq. in. for jarrah. In compression parallel to the grain karri has an average value of 10,500 lb./sq. in. compared with 9,700 lb./sq. in. for mountain ash at 12% moisture content. Karri is tougher than jarrah, having a toughness value when dry of 245 in. lb. compared with 119 in. lb. for jarrah.

Uses.
This timber is well known overseas as well as in Australia for its valuable qualities. It is popular for superstructures because of its great strength, its availability in large sizes and long lengths, and its comparative freedom from defects. It is widely used in shipbuilding and as masts and spars. It is also used in the manufacture of agricultural implements, especially for plough shares. In railway workshops it is used for wagon, van and carriage construction. It is largely used in Western Australia for export apple cases and when treated, for wooden pipe lines. It can be rotary cut or sliced to provide a very good veneer and plywood, and these products are available commercially. Tests at the Division of Forest Products have shown that karri glues satisfactorily with casein, urea and tego resin film glues. Sleepers treated with preservative, have been found eminently suitable when used in dry climates.

General.
Karri, together with such timbers as blackbutt, southern blue gum, messmate, stringybark and red mahogany, is classified in durability class 3 and the sapwood is immune to Lyctus attack. It is fairly difficult to work and the grain has a tendency to rise; nevertheless with care it can be finished well and highly polished. It bends well at a radius of 6 inches after a minimum steaming period of one hour per inch thickness. Backsawn and quartersawn material have been found to bend equally well if free from checks, but selection requirements are more stringent with backsawn than with quartersawn stock.

The bark of karri has a tannin content which varies from 11 to 22% and gives a leather of a good light colour. There are certain difficulties associated with the extraction process and these have been studied by the Division of Forest Products. The bark, if not dried soon after falling, undergoes a change which is not fully understood, whereby some of the tannins become insoluble. It was, however, found possible to obtain yields of 90-95% of the total tannin present by the use of sodium blauslacht in extraction. There seems to be a definite possibility in this material as a basis for tannin extraction since karri bark could be made available at large mills in sufficient quantities to justify the erection of extraction plants.

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