Footrot in sheep

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ALTHOUGH less dramatic and spectacular in its effects than diseases such as enterotoxaemia, which may lead to heavy losses of sheep over short periods, footrot is undoubtedly one of the most serious diseases with which the sheep industry has to contend. It causes tremendous financial losses every year through reduced production of wool and meat; and the lowered physical condition resulting from footrot infection in a flock may contribute to sheep losses from other causes.

Footrot is a specific contagious infection which attacks the feet of sheep. It is primarily caused by a micro organism *Fusiformus nodosus* although it is very probable that a microscopic animal parasite *Spirochaeta penortha* plays a part in the infection. Feet affected by these germs are usually invaded by other secondary organisms.

**PREDISPOSING CAUSES**

Contagious footrot is largely a seasonal disease associated with high rainfall and good growth of pastures. In Western Australia footrot is most commonly met with in the 20 to 40-inch rain belt. Germs cannot readily infect a sound foot, but wet conditions which soften the hooves and skin of the feet, make entrance easier.

Long, rank grass dragging between the claws; mud, grit and general maceration caused by continual wetness tend to produce abrasions and injuries which form ideal sites for the footrot germs to enter and produce the disease.

It has been suggested that penetration of the skin by the larvae of a worm parasite *Strongyloides papillosus* may be a predisposing factor, but this is probably of little practical importance.

**SHEEP AFFECTED**

All breeds of sheep are susceptible to footrot and the disease affects sheep of all ages, including lambs. The footrot organism is highly specific for sheep and, while it is possible that infection may occur in goats, it is unlikely that other animals act as carriers, except mechanically, and this danger is so remote as to constitute a negligible risk. The disease in cattle referred to as footrot, is due to other causes.
SEASONAL INCIDENCE

Footrot in sheep is most likely to occur in the spring following good winter rains, but it may also occur in the late autumn and winter, especially when early autumn rains have been experienced. The reason for this, of course, is that the periods during which feed is plentiful are those in which the organism finds conditions most suitable for its spread from sheep to sheep. During the summer, the pastures dry off and there is little or no spread, although sheep already infected may continue to carry the infection.

SYMPTOMS

Usually the first indication of footrot is the appearance of lame sheep, which often have more than one foot affected. The disease spreads rapidly and up to 75% of the flock may soon become affected. There is an inflammation of the skin between the toes, this area being reddened and moist in appearance. This is commonly termed "scald" by the farmer. Later there is a break in the skin-horn junction and then a separation of the soft horn from the adjacent skin. This process of separation continues to the edge of the sole and around the back of the heel.

During the next week or so there is progressive under-running of the sole and walls of the foot, and finally the horny wall gradually becomes separated from the soft tissues and may only be attached to the foot near the coronet.

The affected feet smell badly, but there is little production of pus.

Paring of the horn will however reveal a small amount of greyish, necrotic (dead) material with a distinctive offensive odour, between the separating tissues. Both claws on an affected foot are generally involved at the same time.

Fig. 2.—An overgrown, mis-shapen foot with footrot lesions showing as a moist red area between the claws and separation of the horn from the skin.
Considerable loss of condition usually occurs during this period, due largely to the pain suffered and the inability to move around and feed normally. If both fore-feet are affected, the animal will be seen grazing on its knees, but with one or both hind feet affected the sheep may be more inclined to lie down most of the time.

With lack of wear the feet become overgrown, mis-shapen and commonly fly-blown, while in chronic cases the hoof may be shed. Without treatment, the disease may persist for months and then heal spontaneously, if the animal does not die from starvation.
DIAGNOSIS

Footrot may be diagnosed fairly readily when a number of lame sheep are examined and found to have symptoms of foot disease typical of that described above. Confirmation of this may be obtained by microscopical examination of pus smears, taken after adequate paring, from necrotic material within the affected foot.

TREATMENT

Foot-baths.—A concrete foot-bath is an essential where curative treatment for footrot has to be undertaken. This should preferably be in race form, 20 inches wide and 10 inches deep, and one accommodating 30-50 sheep should be suitable for most farmers in this State.

Alternatively, portable foot-baths could be used providing water is available or can be carted; these are especially helpful for treating individual mobs in the paddocks and thus obviate the necessity of driving them long distances which is not always possible when sheep are very lame. Suitable temporary foot-baths can be constructed of heavy-gauge black iron, 6ft. long, 3ft. wide and 5in. high; a removable grid-iron mesh fitting the bottom of this bath helps the sheep to retain their balance.

Foot Trimming.—In order to achieve the best results, treatment should begin while the disease is still in an early stage. The whole flock should be mustered, and lame sheep drafted for special treatment and retention in hospital paddocks.

Having separated the obviously affected from the apparently healthy sheep, attention should be directed to trimming the feet of all the sheep, using separate secateurs and knives for the healthy sheep. During the winter months, the hooves of sheep become markedly overgrown resulting in an accumulation of mud and dirt in the foot and it is advisable that the feet of all the sheep be trimmed and all overgrown portions of horn carefully cut away. The healthy mob should then be passed through a foot-bath, preferably in the paddock if possible, so as to avoid picking up infection.

The affected sheep in the hospital mob require special attention and affected feet must be trimmed very thoroughly so as to expose all the infected tissue; all loose separated horn must be removed. It is quite unreasonable to expect the best results unless the antiseptic used is allowed to come into intimate contact with the diseased tissue. The bleeding caused by thorough paring is not harmful but should be avoided, if possible, until the last stages of paring, merely because the haemorrhage masks the lesions and may cause them to be missed. Knives and secateurs should be disinfected after use on an infected foot, 5% dettol or similar antiseptic solution being quite adequate. All foot parings should be burnt.

The object of subsequent treatment is to disinfect the affected parts and thus destroy the germs responsible for the tissue damage within the foot. Various dressings have been used with success in the treatment of footrot, but when constant retreatments are necessary, a cheap but effective dressing or solution is required. Formalin, copper sulphate (bluestone) and arsenic have been commonly used in this State.

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the affected feet; the concentration used in foot-baths should be 5% of commercial formalin for 10 minutes or longer.

Copper sulphate solutions are quite effective, but have disadvantages in that they stain the wool and may cause copper poisoning from absorption, especially if high concentrations are used. A satisfactory strength of bluestone in foot-baths would be 10% for 10-15 minutes, i.e., 1 lb. to the gallon of water. In the presence of organic matter such as sheep droppings, bluestone quickly loses its potency, and it is necessary to skim off the droppings each time after use. When copper sulphate is used, a quantity of straw or waste wool should be placed in the bottom of the foot-bath to prevent splashing and subsequent wool staining.

In small flocks however when relatively few sheep are affected and no foot-bath is available, stronger solutions of formalin (up to 50%) or bluestone (30%) have been used. These solutions should be applied to the infected feet by brush and the sheep left standing on the boards for at least 30 minutes afterwards. There is a real disadvantage with these very strong solutions however, since the horn is rendered so hard that subsequent paring becomes difficult.
Sodium arsenite should not be used in a strength exceeding 14%; even so, severe pain may be seen following its use; it has a fairly good curative effect, but there is the obvious risk of arsenical poisoning.

Whatever medicament is used, it is absolutely necessary to re-bath the affected sheep in the hospital mob at intervals of three to four days; some of the less severely affected cases will clear up after two or three treatments, but more advanced cases may require much longer treatment.

If apparently cured after re-paring, they should be transferred in a month to a second isolation paddock, and be pared and re-examined after a further month before returning to the main flock through a foot-bath.

Chloromycetin. Recent veterinary research has been directed towards finding a medicament which would give a high recovery rate following a single application. Of a number of antibiotics tried, chloromycetin appeared to be the most promising, being stable in its action; its only disadvantage at present would appear to be its very high cost.

Five grams of chloromycetin are dissolved in 50 cubic centimetres methlyated spirits (about 70% alcohol) and this provides sufficient 10% solution of chloromycetin to treat between 17-25 affected feet. For application of the chloromycetin solution, a small paint brush serves best. The actual brush should be \( \frac{1}{4} \) in. wide and 1-1\( \frac{1}{4} \) in. long. Only 2-3 c.c.s. are used per foot and only a few c.c.s. at a time should be poured from the stock bottle into a convenient receptacle for dipping the brush. This has two advantages—it obviates excessive evaporation of the solvent and prevents wastage of heavily-soiled solution left over at the completion of the treatments.
Each affected foot must be thoroughly pared, ensuring that no loose flaps or under-run edges of horn remain. The feet should be pared if possible in the wool shed or in some other place which has a clean, battened floor. The chloromycetin should be applied with the brush so as to ensure that all parts of the affected foot are thoroughly covered; particular attention should be paid to the spaces between the claws and between the heels. After treatment, the sheep should remain on the boards for at least one hour.

Laboratory tests have shown an 80% cure from a single treatment with 10% chloromycetin, and some field trials recently conducted in this State have confirmed the early promise of this antibiotic. Where chloromycetin is used it would be wise to treat apparently healthy feet with 10% formalin (applied by a separate brush in the shed). Treated sheep should be examined 14 days after the initial application of 10% chloromycetin, re-treated if necessary and otherwise transferred to an observation mob.

**PREVENTION**

The organism primary responsible for causing footrot, *Fusiformus nodosus*, does not live very long in the soil. It has been shown that the germ will survive only a few days in material from lesions (discharges, foot clippings), but may live up to five days under muddy conditions. Allowing for a "safe" margin then, it is considered that 14 days spelling of pastures is an effective period at any time of the year to rid them of the infective agent.

In marked contrast however, it has been shown that the infective agent can survive 3½ years in chronically infected sheep (so-called "carriers"), while sheep that have apparently recovered may harbour the germ for seven months in superficial skin lesions between the claws. These types can be detected on close examination of the affected feet.

On the other hand, sheep recovered for a month or more and showing absolutely no signs of the disease are apparently free of infection.

Fig. 11.—Side view of sheep in cradle
CONTROL AND ERADICATION

Since the infection is unable to survive in the soil for more than 7-14 days it is consequently possible by disposing of the whole of an infected flock for slaughter, and restocking after a fortnight with “clean” sheep from a dry inland area, to completely eradicate footrot from a property. This method has been successfully employed by a considerable number of farmers in the higher rainfall areas. In a somewhat similar manner the disease may be eradicated by the removal of “carriers” while the disease is quiescent in summer.

The eradication campaign should commence in the winter when the feet should be kept pared and the flock regularly passed through a foot-bath and transferred to spelled paddocks. Any sheep showing evidence of the disease should be isolated in a convenient paddock where the feed is short and treated in a foot-bath containing formalin or bluestone until recovery is complete when they may be safely returned to the main flock.

Thus in order to control and eradicate footrot in sheep the following procedure properly carried out will result in satisfactory results.

(a) The feet of all sheep should be pared and examined during the dry months of summer or when the incidence of the disease is at a low ebb, to detect and eliminate infected sheep.

(b) Any active or latent cases (“carriers”) found should be isolated and either cured or sent for slaughter.

(c) Unaffected sheep should pass out of the examination point through a foot-bath into a paddock which has been spelled for 14 days.

(d) All sheep brought in to the property, including rams, must be held in isolation until their feet have been pared and passed as healthy.

(e) No sheep which have left the property for any reason—agistment, shows, etc.—should be allowed to return except through an isolation paddock where a systematic foot examination is made.

Note.—Latent cases (“carriers”) frequently have mis-shapen feet and require paring to discover any possible focus of infection. The term also may include all sheep showing chronic lesions, superficial skin lesions between the claws or any points of infection under the horn.

THE FOOTROT CRADLE

Where large numbers of sheep have to be treated, the footrot cradle, illustrated in this article, will be found particularly helpful.

Two 6ft. 6in. lengths of 3in. x 14in. timber form the sides of the cradle. These are about 13in. apart (inside measurement) at the top and splay out to about 16in. at the bottom. Three crosspieces are nailed on to give rigidity, one being placed 6in. from the top to serve as a check to hold the cradle-legs. The next is about 37in. from the top crosspiece and serves to prevent the sheep from slipping downward.

The cradle-legs are 4ft. in length and are attached to the sides by bolts on which they pivot. The legs should be approximately at a 90 degrees angle to the sides, when in the working position and are splayed out at the foot to give stability, and secured by a cross-piece.

Fig. 12.—A loop of rope provides a simple method of restraining a sheep when trimming the feet.
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Another method of restraint which may be used, is a length of rope with the ends joined together. The loop is slipped over the hind feet as shown and brought up between the legs and over the sheep's head. (See Fig. 12.)

IMMUNISATION AGAINST FOOTROT

An attack of footrot does not confer immunity to a subsequent attack and a sheep with one or two feet affected can be infected in another foot either naturally or experimentally by the local application of infective material containing *Fusiformus nodosus*.

Because of this factor, and considering the chronic nature of the lesions, footrot is not the type of disease in which the prospects of successful immunisation would be considered good.

SUMMARY

Footrot is a specific infectious disease affecting the feet of sheep. In the absence of *Fusiformus nodosus*, the disease does not occur. Factors such as particular types of soil, flush clover pastures and dampness under foot cannot lead to the development of footrot, although such conditions may favour its spread if there are active or chronic cases in the flock.

In the treatment and control of footrot, the following points are of importance:—

1. Detection of affected sheep.
2. Segregation of affected sheep for treatment or slaughter.*
3. Spelling of pastures for 7-14 days.
4. Adequate paring to achieve the best effects from treatment.*
5. Use of an efficient medicament every three to four days, holding the sheep in the bath 10-15 minutes.

* Most important.

OTHER FOOT AILMENTS

At least two other common foot troubles are frequently confused with footrot, namely foot abscess, and the condition commonly referred to as "clover burn" but which we prefer to call "separated wall." Both these conditions can cause lameness, but they are entirely different from true footrot. Descriptions of these diseases have been added so that they may be recognised.

FOOT ABSCESS

Foot abscess or digital suppuration is a purulent, non-contagious infection of the foot of sheep, generally associated with the micro-organism *Fusiformus necrophorus* and other pyogenic (pus-forming) bacteria. These germs are commonly present in the bowel of sheep and other animals, and may be passed in the droppings. They are widely distributed in nature and are responsible for other diseases of stock; it is not possible to eradicate them.

While foot abscess is not commonly met with, it has been encountered in this State, especially in seasons when rainfall has been excessive. This is perhaps due to the heavy contamination of the pastures by the organism, from the intestines of sheep which are passing more droppings than usual under the influence of green feed.

Predisposing Causes.—Any injury or abrasion to the foot may allow the bacteria to gain entrance, and sheep with badly-shaped feet and overgrown horn are more likely to sustain such injury. Grass seeds may assist the entry of the causal organisms with resultant foot abscess under dry conditions.

Symptoms.—Foot abscess may affect approximately 10% of the flock. Early cases show extreme lameness and "carry" the affected foot. Examination may reveal no visible abnormality, except heat in the foot which can be traced usually to one claw. If this is squeezed with the fingers or with a pair of secateurs, the foot will be quickly pulled away.

On close inspection, a crack may be visible where the infection has entered—frequently just inside the point of the toe. When the horn is carefully pared away at this point, rather thick creamy pus will be found inside the hoof.
If the foot is not opened at this stage, the pus takes the line of least resistance and breaks out at the coronet, most commonly at the front of the claw, or halfway along the cleft between the claws. Occasionally, owing to bad conformation of the foot and subsequent rubbing together of the heels, abrasions and subsequent infection lead to marked swelling in this area together with a break out of creamy pus.

Sometimes the pastern swells and the pus spreads up the leg involving tendons and ligaments, while at times the deeper structures within the foot may become affected and are extremely difficult to cure. Only a small percentage of the affected sheep die from the complaint and many apparently incurable cases recover when the ground dries up.

Treatment.—The routine method of dealing with flock sheep is to open up the affected foot as soon as lameness is noticed. If treatment is carried out at this stage, by carefully paring the horn away with a knife at the tender spot, the pus is released and the animal soon loses its lameness and recovers.

FOOTROT
1. All classes of sheep affected.
2. Both claws affected and sometimes all four feet.
3. Up to 75% of a flock affected.
4. Very little pus formation in lesions.
5. Occurs annually unless eradicated.

FOOT ABSCESS
1. Affects chiefly grown sheep.
2. One claw and one foot usually affected.
3. Usually only to 10% affected.
4. Pus formation characteristic of the disease.
5. Only appears at intervals, in years when seasons are very wet.

SEPARATED WALL ("CLOVER BURN")

The term "clover burn" is quite misleading and should be dropped from common use in this State. In other States the condition is apparently referred to as "shelly hoof" or "dry separation."

The term "Separated Wall" is more descriptive of this condition and would be less likely to lead to the confusion which "clover burn" conjures up in the mind of the farmer. Its only association with the term "clover" would be that due to its occurrence in improved (often clover-dominant) pastures which retain dampness for relatively long periods, while the "burn" is certainly a complete misnomer since no inflammatory changes suggestive of burning or "scald" are ever met with.

Observations suggest that this condition is associated with any soft wet country which does not wear down the horny walls of the foot. This leads to an overgrowth of soft horn which separates mainly for mechanical reasons. An obvious predisposing factor is the lack of routine foot trimming during the winter months.

The condition of separated wall does not appear to be due to any bacterial infection although it may occasionally be followed by secondary bacterial invasion resulting in foot abscess. The disease occurs during the winter with recovery during the dry months. It occurs commonly, where there is definitely no footrot in the flock, although footrot, foot abscess and separated wall may occur at the same time in some flocks. Usually older sheep are affected.

Once pus has broken out at the coronet or between the heels, the feet should be trimmed up with a pair of secateurs and, if the sheep can be kept away from muddy ground, recovery usually takes place without further treatment.

For valuable sheep, the daily injection of 33⅓% sodium sulphamezathine solution at the rate of 3 c.c.s. per 20 lb. body weight, is reported to give good results, although this has not been confirmed experimentally.

When the weather clears up and the ground dries, the incidence of the complaint is greatly reduced. Walking sheep through a foot-bath would appear to be of little value.

Prevention.—There is no method of preventing foot abscess. The feet should be kept in good order by regular trimming, the chief object of this being to establish a regular surface of healthy horn. Provided this is carried out conscientiously and low-lying wet paddocks avoided during periods of continued heavy rainfall, comparatively little trouble will be experienced.

The following are the main points of difference between footrot and foot abscess.

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2. One claw and one foot usually affected.
3. Usually only to 10% affected.
4. Pus formation characteristic of the disease.
5. Only appears at intervals, in years when seasons are very wet.
Symptoms.—On some properties, quite a large proportion of the sheep may be affected although not all of these may show signs of lameness. As a rule, only about 5% of the flock may be lame, but occasionally the total may be higher.

The condition may be seen in from one to all four feet, and usually both claws are affected. There is a marked over-growth of horn particularly at the toes, whilst the walls also become overgrown and may bend over the sole.

A section of the outside wall usually shaped like a half moon, becomes separated from the underlying tissues and the cleft thus formed becomes packed with mud and sheep droppings, and may thus give rise to lameness for mechanical reasons. When the detached and separated horn is removed and the soil scraped away, the underlying structures are dry and healthy, there being no pus or other evidence of infection present.

Occasionally however, the foot becomes fly-blowed, this being especially likely when the overgrown side walls of the foot bend over the sole, trapping therein a foetid, moist mixture of dung and soil which becomes attractive to flies. In the latter instance, the tissue changes may be fairly extensive and the foot becomes shrunken and necrotic (dead-looking).

Various stages may be seen in different feet on the same animal, but unless fly-blowed, the foot—apart from the separated horn described—shows no evidence of deformity.

Treatment.—The hoof should be pared to its normal shape, paying special attention to the removal of the outer layer of separated horn. A close examination should be made to make sure that there is only dry dirt and no infection present.

Any sheep with lesions other than those described above should be regarded with suspicion, and removed from the flock for further observation.

Those sheep passed as healthy should be put through a 5% formalin foot-bath and then returned to their paddock.

Prevention.—The disease may be prevented by constant and regular attention to the hooves during the winter months, but in wet soft country this may not always be practicable in the absence of suitable labour. Wherever possible, sheep should be frequently changed from flats to hilly country, or to harder ground.
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