

# CONTAGIOUS FOOT-ROT

IN

## SHEEP.

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WITH EIGHT ILLUSTRATIONS.

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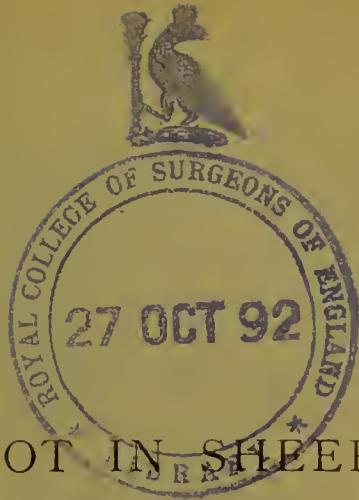
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THE STRUCTURE OF THE HORSE'S FOOT  
AND THE PRINCIPLES OF SHOEING.

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## CONTAGIOUS FOOT-ROT IN SHEEP.

IN the history of sheep-husbandry foot-rot has always been referred to as a scourge of the race, causing serious losses wherever it appears, and in some parts of the world the malady assumes a degree of malignancy which entitles it to be classed among the most virulent of animal plagues.

The different views which have been entertained as to the causes of the disease, its nature and contagious character, are due to the fact that several diseases of the foot of the sheep have been described as foot-rot, most of them depending on primary injury to the hoof, leading to inflammation of the tissues within the horny covering, whereas contagious foot-rot, in the first instance, invariably exhibits itself in the skin between the claws, whence it extends to the interior of the foot, and causes the shedding of the hoof from the pressure of the fungoid growths which spring from the secreting membrane of the internal foot.

### DISEASE BEGINNING IN THE HOOF.

A remarkable instance of the first form of foot disease was met with some years ago in Somerset and Dorset, and the following illustrations will show the changes which had occurred.

Three distinct conditions of the horny covering of the foot were seen.

One condition was the decay of the horn at the toe, and the passage of particles of sand and dirt through the openings in the shrivelled hoof at the toe into the interior of the foot. See Fig. 1 (1) on page 2.

Then a second condition was the overlapping of the lower edge of the wall of the hoof, illustrated in Fig. 1 (2), leading to the retention of grit and sand, which, owing to the pressure on the base of the foot in the ordinary course of movement, was driven through the spaces between the horn fibres into the interior of the horny cavity.

A third condition was the existence of a minute fissure in

some part of the hoof, commonly at the outer surface of one of the digits, appearing as a dark line on the hoof, sometimes not more than the sixteenth, and rarely more than the eighth, of an inch in length, as shown in Fig. 1 (3). The consequence of these changes of structure was exactly the same in each case, *i.e.*, the passage of gritty material into the interior of the horny box, either through the decayed horn at the toe, or through the sole under the overlapping wall of the foot, or through the small fissure in the wall of the hoof, which was the entrance to a crack which passes into the foot, as shown in Fig. 2.

Inflammation and exudation naturally followed the introduction of gritty particles into the interior of the horny box, and in time the hoof was thrown off as in true foot-rot. This form



FIG. 1.—Foot of sheep showing disease of horn.

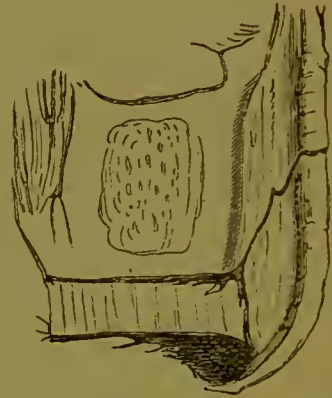


FIG. 2.—Section through the foot showing a crack extending through the wall.

may be classed with the several diseases of the foot due to injury from the constituents of the soil, thorns, broken glass, nails, and generally to any agencies which interfere with the integrity of the structure of the hoof, and thus expose the internal tissues to injury. Neither of these affections is in any sense contagious, and all of them may for the present purpose be excluded from consideration as not coming within the definition of contagious foot-rot, which is the subject of this paper.

### CONTAGIOUS FOOT-ROT.

**PATHOLOGY**—or, in simple English, **NATURE OF THE DISEASE.** Foot-rot may be described as an affection of the skin and its appendages very much like the common skin disease known as

“warts,” or, if another long word may be allowed—epithelioma. At first the affection seems to be confined to the skin above and between the horny claws or hoofs, and minute warts, sometimes in clusters, appear. As the disease goes on to a more advanced stage, the true skin, as it may be called, of the internal foot is affected, and warts are formed on its surface, pushing the hoof out of its place; the first separation always taking place on the inner side of the claw, as shown in several of the following drawings.

*Symptoms.* — It is most important for the cure and prevention of foot-rot to be able to detect it in the early stage without any risk of error, and at the outset, foot-rot can be distinguished from all forms of foot disease of the sheep with ease and certainty. If the skin between the hoofs is looked at, a little moisture or white discharge with very minute pimples covering the skin will be seen. In Fig. 3 this condition is shown as well as it is possible to indicate it by the aid of the pencil. Later on, as the disease of the skin advances, the whole surface may be covered with elongated warty growths, as seen in

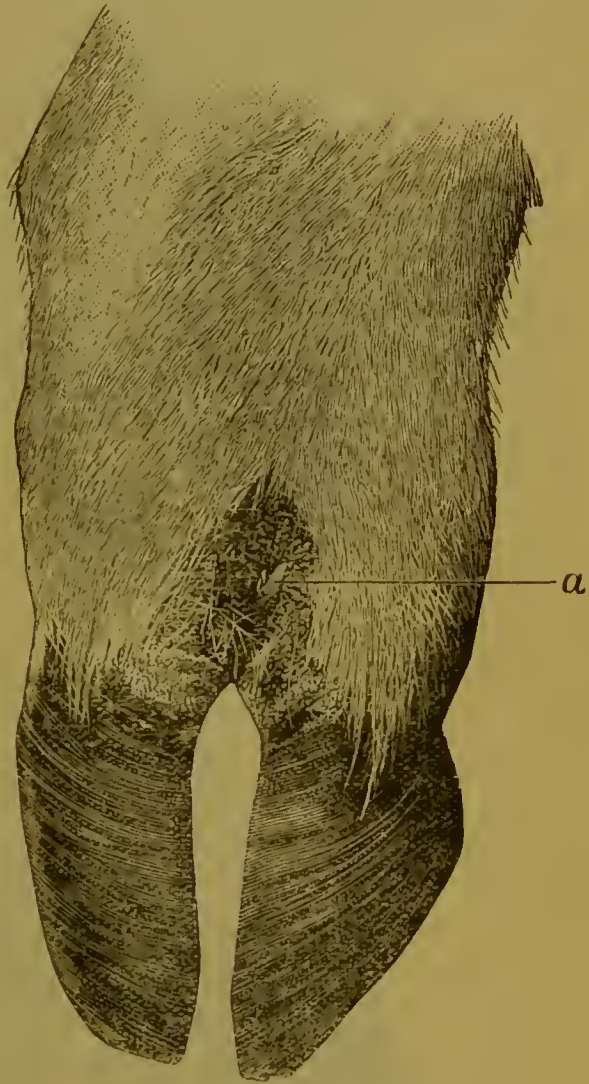


FIG. 3.—Foot of sheep showing early stage of disease affecting the skin between the claws.

Fig. 4. In most instances the inflammation extends to the inner side of the internal structures of one claw, and the hoof becomes disconnected from its membrane, which is covered with long fungoid growths, as they are called—in reality, horny matter, or epithelial growths of a warty kind. The whole product is, indeed, a mass of epithelial cells, as shown in Fig. 5. When the disease runs its course unchecked, the horn of the diseased claw is loosened from the inner surface and in a short time is entirely pushed off, and a new hoof begins to grow

from the coronet downwards. Fig. 6 shows this change. If the hoof is not thrown off quickly, it grows with rapidity



FIG. 4.—More advanced form of disease of skin between the claws.

and is more or less distorted in form, as seen in Fig. 7. The horny tufts sprouting from the diseased membrane are seen

distinctly in Figs. 6 and 7; and in the next illustration (Fig. 8) a small portion of the diseased membrane has been hardened and cut into fine sections, one of which is shown, exhibiting very distinct horn structure.

In reference to the changes which are illustrated in the last three drawings, it may be remarked that similar changes are now



FIG. 5.—Scraping from fungoid growths. *a, a*, Epithelial or horn cells, magnified 200 diam. *b, b*, Micro-organisms, magnified 1,000 diam.

and then seen in other inflammatory diseases of the foot of the sheep, also in foul in the foot of the ox, and in canker in the foot of the horse. It is therefore necessary to lay stress on the statement that the really definite signs of contagious foot-rot are most perfectly seen in the earlier stages of the disease.

#### EVIDENCE OF THE CONTAGIOUS CHARACTER OF FOOT-ROT.

Different opinions are held as to foot-rot in any form being contagious. Most flockmasters believe that it is,

and some think that it is the most contagious disease which is known.

Many experiments and observations have been made in



FIG. 6.—Foot-rot in an advanced form ; the secreting membrane is covered with fungoid growths.

different parts of the world to settle this question, and reference may be made to three or four sets of experiments which have extended over a long series of years.



In 1867, at the instigation of the members of the Maidstone Farmers' Club, who sent cases of foot-rot to the Royal Veterinary College for the purpose, an investigation was carried on for twelve months, and the results were sufficiently definite to justify the conclusion that the disease can be produced by contact with an infected animal, and also by the application of the discharge from a diseased foot to the skin between the



FIG. 7.—Distortion of hoof in an advanced form of foot-rot.

digits. Inoculation with the discharges by puncturing the skin, and in other cases by removing a small portion of the hoof of a healthy foot and applying the matter to the exposed secreting surface, was generally followed by healing of the injured part; but some days afterwards the skin between the digits became moist and swollen, and the early stage of foot-rot was developed, but did not advance beyond that stage, although no means were taken to check it.

Two years ago (1890) the question of the contagious nature of foot-rot was raised in a communication to the Society from

Mr. Nott, of Tenbury,<sup>1</sup> who contended that the disease is only produced by means of contact with a diseased sheep, and that the only certain method of prevention is to avoid the introduction of fresh sheep on to a farm.



FIG. 8.—Section of fungoid growths, horn fibres.

Mr. Nott sent two sheep to the Royal Veterinary College for the purpose of experiment in the beginning of April, 1890. The animals did not show any signs of foot-rot; indeed, their feet were perfectly healthy, but from the circumstances of their

<sup>1</sup> See Journal, Vol. I. (3rd series), 1890, p. 733.

history it was believed that the disease would appear if the sheep were placed under favourable conditions. Accordingly, they were penned on a pasture on a clay soil, and the want of rain was as far as possible compensated by constantly watering the ground. Two healthy sheep were put in the same pen with these sheep, and kept with them till the end of the third week in June without any result. All four sheep remained free from disease.

On November 11 of the same year a well-defined case of foot-rot was obtained and sent to the College, where it was put on grass with two perfectly healthy sheep. After about three weeks' exposure both the sheep became lame in one hind foot. The diseased sheep was much worse. Association of the animals was maintained until the middle of February, 1891, when the disease had practically ceased to exist. The diseased sheep and those in contact had recovered, and were perfectly sound. It is worthy of remark that during the whole time that this experiment was carried on the weather was generally dry.

In the early part of 1891 further experiments were conducted at Harrow and at Denham on a much larger scale than any which had been attempted previously. In the Harrow district the soil is stiff clay, and the difficulty was to find a pasture which had not become contaminated. At last an orchard was secured on which no sheep had been grazed certainly for many years past, and two diseased sheep from the neighbourhood of Maidstone, which were sent by Mr. C. Whitehead, were used for the experiment. Foot-rot in these animals was fully developed in a perfectly typical form.

In the pasture at Harrow three pens were constructed. In No. 1 pen in the first week in April were placed the two diseased Kentish ewes, one sound Welsh sheep, and three sound tegs; whilst in No. 2 pen were placed two half-bred tegs, and in No. 3 pen two Welsh ewes.

Owing to the absence of rain the experimental pasture was in a very dry condition until the last week of May. During this period the sheep's feet were frequently examined and nothing was found amiss with them, but rain having fallen for several days in succession towards the end of May the pasture became thoroughly soaked, and almost immediately afterwards signs of foot-rot were apparent.

On June 2 the Welsh ewe in No. 1 pen was noticed to be lame on its left front foot. On the following day it was caught and the foot examined, when it was observed that the skin of the interdigital space was much inflamed, and that suppuration existed at the upper border of both claws at the interdigital space, whilst the leg immediately above the hoof was swollen and

very hot. The left hind foot of this sheep was very hot, and on June 4 the disease had developed in this foot also.

On June 3 one of the tegs in pen No. 1 showed unmistakable symptoms of foot-rot in its right hind foot, but lameness was not marked until the next day; on this date also another of the tegs became lame. The remaining teg in this pen did not become affected until two months later, namely, on August 2, when the pasture was again very wet. Two of these experimentally affected sheep had the disease in three of their feet, whilst in one it appeared in one foot only. During all this period of time the four sheep which had meanwhile been kept in pens Nos. 2 and 3, under precisely similar conditions as the sheep in pen No. 1, except that they had not been in contact with affected animals, continued sound.

One of the Kent ewes and the Welsh ewe in pen No. 1 lambed in May, each having one lamb, sound and well nourished. On August 8 the Kentish lamb which remained from its birth in the pen had foot-rot in the off fore foot, and by August 16 all the feet were attacked.

On August 31 the sheep from pen No. 1 were placed on another pasture (seven acres); and on September 2 the two sound tegs from No. 2 pen, and a Welsh ewe from No. 3 pen (also sound), were put into *No. 1 pen*, from which the affected animals had been removed *two days previously*. On September 13 this Welsh ewe had foot-rot in both her front feet; on September 19 one of the tegs had also become affected. On September 19 a Cotswold wether and a cross-bred lamb (both sound) were sent from Denham, and were placed in the seven-acre pasture with the eight sheep out of pen No. 1. On September 23 all the sheep were placed in this pasture with the exception of one Welsh ewe, which had never been removed from pen No. 3, and was still sound. On October 2 the remaining teg<sup>1</sup> became affected in her right hind foot. On October 9 the cross-bred lamb from Denham had foot-rot in her off hind foot, and on October 11 the Cotswold wether had the disease, and was very lame in his right fore foot; while on October 18 both of the Denham sheep had the disease in two of their feet.

Up to October 25 the Welsh ewe, which remained still isolated in pen No. 3, was healthy, although the ground was extremely wet and the grass long; the Welsh lamb also continued healthy.

At the end of October the interest of the experiments was

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<sup>1</sup> *I.e.*, remaining teg from No. 2.

practically confined to the condition of the Welsh ewe, which had been isolated since the commencement of the work, and to the two sheep from Denham. The Welsh ewe had been removed on October 4 to pen No. 2. This was a healthy pen, lying very low. By October 25 it was a "quagmire." On November 8 this sheep had sores at the interdigital spaces of all four feet, due to irritation by foreign matter (mud, hay-bents, &c.), and was particularly lame on the right fore foot, but not from foot-rot. On November 14 it had still sores on all four feet, and there was loss of hair on the coronets, heels, and legs as high up as the mud extended; the interdigital spaces of all four feet still presented sores. This condition might be described as "foul in the foot" or "mud fever." The sheep was turned into the seven-acre field with the other sheep on November 14. It did not up to the date of its slaughter on February 9 develop foot-rot.

On November 8 the wether from Denham had foot-rot very badly in the left hind foot; the soles of both claws of this foot were "separated," and there was suppuration at the interdigital space. The right hind foot was nearly well. But the disease existed slightly in both front feet.

On November 8 the Denham lamb had foot-rot very badly in the left hind foot. The right hind foot was better. It had also foot-rot slightly in the right front foot.

The Kentish lamb, which had suffered terribly from the disease, having had it in all four feet, had new claws growing down from the coronet of the outside digit of three of its feet.

On November 14 both Denham sheep were greatly improved; all the sheep were then in the seven-acre pasture, and improved in condition for about a month, some of them getting quite fat; but on December 20 several of them again were extremely lame. This lameness appeared in a great measure to be due to the hardness of the ground, which was frozen, and to the overgrown and deformed condition of the feet. On January 11 (1892) the Denham lamb, which was very lame and lay about a good deal, was killed, and the feet retained as specimens. No sign of foot-rot was found on examination. On January 26 the feet of the speckled-faced teg and of the Kentish lamb were found to be deformed, but were free from foot-rot.

On February 9 the remaining sheep were killed. All were free from foot-rot.

A fourth series of experiments was carried on at the same time at Denham, where an outbreak of foot-rot afforded a most convenient opportunity for an investigation.

July 23, 1891.—Five Cotswold tegs and five half-bred lambs

were obtained from a hill farm at Cirencester (where, during the last seventeen years, there had never been a case of foot-rot, and prior to that, so far as could be ascertained, foot-rot had never been known on the farm). These sheep were arranged as follows:—

*Pen A, in a barn on concrete floor.*—One sound teg with one Southdown ewe with foot-rot.

*Pen B, same as above.*—One sound lamb with one diseased lamb (foot-rot). These concrete floors were swept out clean every morning during the experiment. The pens were eight feet by seven feet six inches.

*In orchard, running loose.* (The orchard is a dry and well-drained meadow.)—One sound teg and one sound lamb with one diseased ewe and one diseased lamb.

*On grazing meadow.*—At first penned by side of stream, and afterwards with range of whole meadow. (This is a very damp low-lying meadow almost surrounded by water, where sheep are never kept.) Three sound tegs and three sound lambs were placed to be left for a considerable time to test the action of damp soil and long coarse grass on the feet.

August 3.—All the above were examined. The sound sheep remained sound, and the diseased sheep were still diseased, although a little better.

September 12.—Second examination, with result as follows:—

*Pen A, in barn.*—Sound teg still sound; diseased ewe very bad in all four feet.

*Pen B, in ditto.*—Sound lamb still sound; diseased lamb nearly well.

*Orchard.*—Sound sheep and lamb still sound; diseased ditto much better.

*Note.*—On September 17 one teg and one lamb, both quite sound, from grazing meadow, were sent to Harrow and put on the pasture with diseased sheep, and both of them became affected; on October 9 the lamb, and on October 10 the teg, the lamb in the off hind foot, the teg in the off fore foot.

October 6.—Third examination:—

*Pen A.*—The sound teg had developed the disease in all four feet, as the result of being in contact with the Southdown ewe with foot-rot since June 25 on a hard floor which was kept as clean as possible.

A similar result occurred in *Pen B*, in which the sound lamb had developed the disease in the off fore foot, the diseased lamb still remaining diseased.

In the *Orchard* the sound teg had developed the early stage of foot-rot in the off fore foot and both hind feet, the sound lamb

showing disease very slightly in the off hind foot. Diseased ewe and lamb much better.

October 10, *Pens A and B.*—Disease becoming more developed in teg and lamb formerly sound; the ewe and lamb originally diseased are recovering.

*Sheep and lambs on grazing meadow.*—These were thoroughly examined on this day, and their feet were found in perfect order notwithstanding the long exposure to wet ground, long grass, and exceptionally wet weather.

October 12.—Two lambs from Pen B were sent to the Veterinary College, and the diseased ewe in Pen A was ordered to be killed and the feet sent to the College. The teg which had contracted the disease to be put in fresh pen (C), where no sheep had been before, with one sound teg and one sound lamb from grazing meadow. Floor to be kept thoroughly cleansed.

October 24, *Pen C.*—Teg and lamb free from any sign of disease, except that the lamb's feet were warm. Diseased teg remained in the same condition as when put into the pen.

November 5, *Orchard.*—Cotswold teg in orchard killed, feet sent to College; perfectly sound.

November 7, *Pen C.*—Diseased teg better, removed to another pen. Teg and lamb from grazing meadow still sound. Sound teg and lamb left in Pen C, to observe if disease would appear from contact with the diseased teg, from October 12 to November 7.

November 12, *Orchard.*—Cross-bred lamb killed. Feet sent to College, quite recovered.

November 19, *Orchard.*—Southdown lamb killed. Feet sent to College; found to be free from disease.

November 27, *Orchard.*—Southdown ewe killed. Feet sent to College; found to be free from disease.

November 28, *Pen C.*—Teg showed redness and swelling on inside digit of the off hind foot. Lamb had the off hind hoof ragged at the toe.

December 4, *Grazing meadow.*—The teg still remained sound; killed, and the feet sent to the College. No sign of disease after exposure to wet soil since June.

December 21.—Four sheep now remained at Denham, two tegs and two lambs from Cirencester (Cotswolds). One teg with foot-rot left in a pen by itself. A teg and lamb remained in Pen C.

January 2, 1892, *Pen C, teg and lamb.*—Teg remained free from disease. Lamb, off fore hoof ragged at bottom; off hind foot, horny growth above digits; slight evidence of foot-rot. Diseased teg in pen by itself had the off hind hoof still bad; off fore foot,

rotten sole; near fore foot better. Little paddock, the lamb (from grazing meadow) had the hoofs a little cracked at bottom, no sign of foot-rot.

April 2, *Pen A.*—Foot perfectly recovered. April 26, killed; sound.

*Pen C.*—Teg and lamb quite sound.

April 22.—Both killed, feet sound. Lamb from grazing meadow now on cricket ground, where foot-rot prevailed last summer, sound yet.

May 25.—This animal had been running with several sheep affected with chronic foot-rot since last summer, but did not yet show any signs of disease.

### CONCLUSIONS.

From the experiments the following conclusions may be drawn:—

(1) So far as the evidence goes it justifies the statement that foot-rot is a contagious disease; the infective matter being active when brought in contact with the skin between the claws, or when introduced into the system by inoculation, and probably when taken in by the mouth from contaminated pastures.

(2) Foot-rot cannot be produced by keeping sheep on un-drained moist soils with an abundant coarse and wet herbage, or on wet and rotten litter and manure.

(3) Animals exposed to these conditions for many months, and resisting entirely the influences named above, contract foot-rot in from fourteen to twenty-one days on being placed among sheep suffering from the disease.

(4) Sheep affected with foot-rot may improve, and from time to time become worse; and finally may recover and present a perfectly healthy condition of foot, notwithstanding that they have been kept the whole period under the conditions which induced the disease.

(5) The contagium of foot-rot remains for some time in the system (ten to twenty days and longer) without any indication of disease appearing in the skin between the claws. An infected sheep may therefore escape detection even by an expert, and may introduce foot-rot into a sound flock.

Lastly, the question arises as to the possibility of sheep contracting foot-rot by taking the infective matter into the system during feeding on an infected pasture. It must, of course, happen in a pasture on which sheep affected with foot-rot are grazing that a very large amount of infective material is dis-



tributed, and consequently taken up by all the animals feeding on the meadow; but it is not certain whether the disease can be so communicated.

#### CURE AND PREVENTION OF FOOT-ROT.

One important fact has stood prominently forward in the history of the experiments—*i.e.*, spontaneous recovery even in the most advanced stages of foot-rot without any trimming of the hoof, the use of any remedial measures, or the removal of the diseased animals from the places where they were kept during the progress of the disease. It is, on the other hand, to be remembered that the recovery is much assisted by proper remedies. So far as the evidence at present extends, it may be said that Contagious Foot-Rot has a period of incubation, followed by the development of a diseased condition of the skin, which extends to the secreting membrane of the internal foot, ending in loss of the hoof, and a new growth of horn when the virulence of the malady is exhausted.

*Treatment of Foot-Rot.*—In order that the course of the disease may be checked, timely detection is essential, and when foot-rot appears in a flock every sheep should be examined daily if possible, or at least three times a week, and a dressing applied the moment that any moisture is seen between the claws. A mixture of one part of pure carbolic acid with ten parts of glycerine is a very useful application, a little of which may be *poured* from a narrow-mouth bottle on to the skin and allowed to run between the claws.

Trimming the diseased feet is an operation which should be done with care; as a rule, the shepherd slashes the hoof horn away with his knife in a manner which may be described as brutal. In the advanced stages of the disease all the loose horn may be removed, and the club-like growths beneath it should be dressed with strong caustic—*i.e.*, pure carbolic acid, chloride of zinc, or perchloride of iron—and the parts protected by a coating of tar. But in a properly managed flock the disease should not be allowed to reach a stage at which such severe measures are necessary.

An easy method of dealing with foot-rot in a large flock without the work of daily examination of the feet is to drive the sheep twice a week over a dry floor which is covered with powdered lime, or through a trough containing a solution of one part of carbolic acid with fifty parts of water in which a little soft soap is dissolved. Sufficient fluid should be kept in the trough to insure that the feet are completely covered.

*Prevention of Foot-Rot.*—It has been suggested that the only certain way to escape the introduction of foot-rot is to avoid bringing fresh sheep on to the farm, and there cannot be a doubt that the proposed method is at once simple and effectual.

It is not, however, likely that the generality of farmers will follow such a plan; but without changing the present system a great deal might be done which is now neglected; for instance, sheep from any fair or market, or from any source not quite free from suspicion, might be kept by themselves until their feet had been carefully examined and found free from any signs of foot-rot. If the newly purchased sheep are kept separate from the rest of the flock for a month, there will be but little risk of an outbreak of the disease. Sheep which have been sent from the farm to a market and brought back again, should be dealt with in the same manner as if they had been bought at the market.

It is hardly necessary to insist upon the importance of detecting foot-rot at an early stage, in order that curative and preventive measures may be applied at once.

The question of including foot-rot among the diseases which come under the provisions of the Contagious Diseases (Animals) Acts may have to be considered in the future. But for the present the farmer will consult his own and his neighbours' interests by acting for himself without waiting for the compulsion of the law.

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