

THE CONTROL OF FOOTROT IN SHEEP IN SOUTH AUSTRALIA

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INTRODUCTION

Footrot was first recorded in South Australia in the annual report of the Chief Inspector of Sheep (C.J. Valentine) for the year ended 31st December 1875. He reported:

Footrot has shown itself in some parts of the country. Passing the sheep through a strong solution of arsenic in troughs where tried has been successful in reducing the disease. Carbolic acid is recommended, and has been tried in other colonies, many persons preferring it as being less dangerous than arsenic.

The next reference appears in 1891 when it is stated to have been serious in the western part of the Central District. In 1892 he stated, 'but I am afraid that the steps taken have not been thorough enough to eradicate the disease. It is a complaint which entails much labour and careful attention'.

In 1893, reference is made to careful paring and dressing of the feet and the use of strong bluestone mixture, 1 oz. to the gallon of water.

The disease was referred to at the Conference of Chief Inspectors of Stock in Sydney in November 1874, and again in November 1889.

Although footrot continued to be discussed there was little really worthwhile advice that could be offered to sheep owners before the publication of the work of Beveridge and Gregory between 1934 and 1941. These workers had shown that there was more than one foot condition of sheep and that in one type at least, there was a specific organism involved. The foot lesions were separated into these three main groups:

1. Contagious footrot due to the specific organism, *Fusiformis nodosus*, and with which other organisms appeared to be associated.
2. Foot abscess due to a variety of soil and bowel organisms including *Fusiformis necrophorus*.
3. A number of foot lesions of lesser importance.

These workers further showed that as the causal organism of footrot did not survive away from the feet of sheep for more than a few days under the most-favourable circumstances, it was possibly by careful treatment of affected sheep and spelling of infected pastures to eradicate the disease from a flock.

They also showed that the organism could remain hidden and protected in a pocket under the horn of the foot for years pending favourable conditions. Sheep affected in this way could be responsible for the re-appearance of footrot in an apparently clean flock.

Beveridge and Gregory's work demonstrated the need for meticulous care in paring the feet to detect all under-run horn and to expose even the smallest pockets of infection. Failure to observe this principle remains the major reason for the re-appearance of footrot in any flock where eradication by treatment is undertaken.

An earlier reference has since been found. In his book *South Australia and its Mines* published in 1846 F. Dutton on page 247 stated:

Of diseases amongst sheep, we have fewer than in New South Wales. Footrot when neglected is also fatal to the sheep and very infectious. The cases that have occurred in South Australia have been confined to marshy runs, and have readily given way to the simple expedient of driving the flocks on stony hills or drier pasturage.

Tasmania was the first to attempt eradication on a statewide scale commencing in 1939.

In 1950 Western Australia undertook a similar program.

In both States, the incidence of footrot as an acute disease of major economic importance has been reduced to negligible levels.

2. ECONOMIC LOSSES DUE TO FOOTROT

2.1 Annual loss of production

Figures showing the losses of production that were due to an outbreak of footrot in one of two paired flocks at Kybybolite Research Centre have been prepared for publication by Mr P.E. Geytenbeek, formerly Officer-in-charge of that centre. These observations indicate that the annual losses are in the vicinity of \$3 per ewe per annum.

2.2 Cost of annual control

The term 'annual control' is used to cover the procedure in those flocks where footrot is treated as necessary and kept as low as required, but where eradication is not attempted. Measures required for annual control will vary according to season, district, owners' standards and manpower and equipment available. To estimate the costs of annual control footrot in a 1,000 ewe flock (including rams and ration sheep) is assumed, in which a control programme of one foot paring and a weekly footbath for six months is adopted. In a wet district this would be the average requirements to maintain the sheep in reasonable condition for breeding and rearing lambs. Anything less would probably result in bigger losses of production. Accepting this assumption, the cost per sheep is approximately 52c (5/3) based on the following figures:

- i. Depreciation of 20% per annum on 4 footbaths at \$32 (£16) each is \$26 (£13)
- ii. Cost of formalin for monthly recharging at \$1.20 (12/-) per gallon at 3 gallons per bath per month is \$86 (£43)
- iii. Wages for one man for 2 days per week for six months for foot bathing, 1/3 week @ \$36 (£18) per week x 26 is \$312 (£156)
- iv. Wages for one paring of 1000 sheep @ 60 sheep per day @ \$36 (£18) per week = 17 days = 3 weeks @ \$36 – \$108 (£54) plus the Total costs for 1000 sheep – \$532 (£266).
- v. Cost per sheep – 52c (5/3)

To this annual cost of control must of course be added the losses of production of \$3 (30/-) per ewe as shown in 2.1 above.

2.3 Cost of eradication

2.31 By treatment

The cost of eradication by treatment if successful is in fact less than the costs of control.

Control involves foot paring and repeated foot bathing throughout the wetter months while eradication depends on two most thorough parings and a minimum of foot bathing.

- i. Erection of one large footbath – \$40 (£20)
- ii. Cost of formalin for charging 7 gallons @ \$1.20 (12/-) per gallon – \$8.40 (£4.40)

- iii. Wages for foot paring 1,000 sheep @ 60 sheep per day @ \$36 (£18) per week twice – \$216 (£108)
- iv. Wages for re-paring 200 sheep (assuming 20% infection at first paring) at above costs – \$22 (£11)

Total costs of eradication (if successful) – \$286 (£143)

Cost per sheep – 30 cents (3/-)

If eradication is not achieved, and there is a breakdown later in the year, then there must be added the costs of control by foot bathing, plus loss of production and costs of control again next summer. However, eradication may have been achieved from one or more mobs and losses of production may have been reduced.

2.32 By sale for slaughter

Costs cannot be assessed as so much depends on circumstances and problems of replacement. However, where an owner can afford to wait for the right time to sell and to buy, the losses are usually small and probably outweighed by costs of control or of eradication by treatment and losses of production.

3. CONTROL IN SOUTH AUSTRALIA

3.1 Introduction

For many years prior to 1955, there had been requests by individuals and by stockowner organisations for the Department of Agriculture to take regulatory measures to stop the sale of footrot infected sheep and to take action based on Western Australian experience to control and attempt eradication of the disease. These requests had been strongly resisted on the grounds that:

- a. Differential diagnosis was too difficult; and
- b. The disturbance to markets would be too great.

Following an inspection in 1955 of the Western Australian system and a review of the progress made in that State where geographic and climatic conditions are similar to those in South Australia, it was decided to proceed with a control programme.

The initial step was to appoint six additional inspectors of stock to be located in the areas where footrot was most prevalent. Following a period of training, these officers were stationed in their districts with instructions to:

- a. Proceed with an intensive educational programme using the film that had been prepared by C.S.I.R.O. and giving group demonstrations. These demonstrations were later restricted to individual owner instruction.
- b. Survey their districts to determine the incidence of footrot.

The appointment of these additional inspectors was materially assisted by an annual grant of £6000 from the Wool Research Trust Funds.

The basic qualifications of the inspectors were a diploma of agriculture or a certificate in meat inspection.

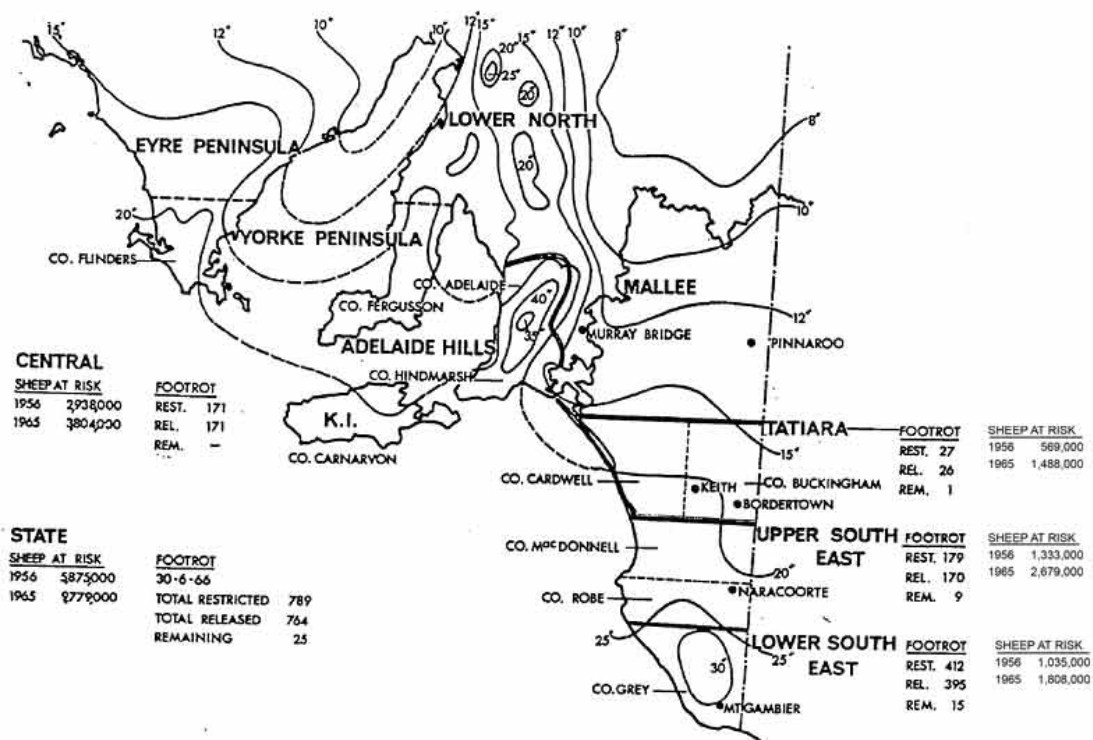
The intention of the government and the Department to proceed with the control of footrot was welcomed by most stockowners, and within a few months it became obvious that

legislative action would be necessary to protect the owners of those flocks which were free of the disease. It also became obvious that legislative action was necessary to stop dealing in affected sheep and their sale to areas where footrot was still uncommon. In 1956, a proposed set of minimum conditions for the control of footrot was prepared and placed before a committee of the Stockowners Association of South Australia and accepted by it. On 27 June 1957 footrot was proclaimed as a notifiable disease under the *Stock Diseases Act*.

3.2 Distribution of footrot in South Australia

The experience of Departmental officers over the years had indicated those districts where footrot was likely to be found. This was generally accepted to include all regions of South Australia, with a rainfall in excess of 20 inches per annum. The map below shows these areas, and the approximate numbers of sheep grazed thereon in 1956. This indicates that about 6 000 000 sheep, which was approximately 45% of the then State total of 13 584 000 were involved. It was recognised that the incidence would vary greatly and become higher in direct proportion to rainfall and pasture development. Soil type did not appear to have a great deal of influence on distribution. The disease does not appear to have been as severe on the rendzina soils in comparison to others but the difference is not significant.

Map 1. Districts in South Australia where footrot was likely to be found.



3.2.1 Estimated incidence in 1956

For convenience, the State was divided into four districts:

- Central
- Tatiara

- (c) Upper South East
- (d) Lower South East

(a) Central District

This district includes the Adelaide Hills and Plains from Cape Jervis north to Clare, Yorke Peninsula, Kangaroo Island and Eyre Peninsula.

- Eyre Peninsula – No footrot recorded
- Yorke Peninsula – Very low, only 5 cases recorded
- Kangaroo Island – Very low
- Adelaide Plains and Hills – 10% of 4000 properties

The rainfall ranges up to 45 inches at Stirling West.

Sheep population: in 1956 was 2 938 000 and in 1965 was 3 804 000.

(b) Tatiara District

This district includes Keith and Bordertown. The estimated incidence was 20% which would represent about 160 properties.

The rainfall is 19-20 inches per annum.

Sheep population: in 1956 was 569 000 and in 1965 was 1 488 000.

(c) Upper South East

This includes that area from Frances to Penola and from the Victorian Border to the seacoast.

It was estimated that 50% of all properties with a total of about 400 were infected.

The rainfall varies from 20 to 25 inches.

Sheep population: in 1956 was 1 333 000 and in 1965 was 2 679 000.

(d) Lower South East

This district extends south from Penola, and is the area of highest rainfall and greatest sheep concentration. Although the incidence was known to vary depending on soil type and the associated degree of pasture development, the figure was set at 50% with a range up to 70% in the Kalangadoo area.

This would represent approximately 700 flocks.

The rainfall is from 25 to 33 inches.

Sheep population: in 1956 was 1 035 000 and in 1965 was 1 808 000.

State Estimate

The estimate for the State was approximately 1660 flocks affected with footrot. As the average flock size is 850 sheep, this would represent approximately 1 400 000 sheep from a total of 6 000 000 at risk, i.e. about 23%.

For the seven high rainfall counties, viz. Adelaide, Hindmarsh, Cardwell, Buckingham, MacDonnell, Robe and Grey where footrot was known to be most prevalent, the figures were 1 300 000 sheep probably affected out of 3 856 000 at risk, i.e. about 33%.

3.2.2 Recorded incidence in 1966

The estimated incidence, total properties placed under quarantine, total released and number remaining in quarantine as at 30 June 1966 are set out in Table 1.

Table 1

District	Estimated Incidence 1956	Restricted	Released	Remaining
Central	400	171	171	0
Tatiara	160	27	26	1
Upper South East	400	179	170	9
Lower South East	700	412	397	15
Total	1660	789	764	25

It is difficult to explain the big discrepancy between the estimated and actual incidence of infection.

It is known that many owners eradicated footrot without coming under quarantine, but on the contrary side many of the properties which have been quarantined became infected after 1967.

3.2.3 Progressive annual figures

Table 2 shows the figures as at approximately 30 June each year.

Table 2: Commencement date – 27.6.1959.

Date	District	Total Restricted	Total Released	Restrictions Remaining
4/7/58	Central South East	53	16	37
		95	14	81
	TOTAL	148	30	118
3/7/59	Central South East	87 (+34)	46	41
		269 (+174)	69	200
	TOTAL	356(+208)	115 (+85)	241
8/7/60	Central South East	88 (+1)	67	21
		305 (+36)	180	125
	TOTAL	393 (+37)	247 (+132)	146
21/7/61	Central South East	113 (+25)	96	17
		364 (+58)	259	105
	TOTAL	477 (+84)	355 (+108)	122
13/7/62	Central South East	148 (+35)	122	26
		485 (+121)	333	152
	TOTAL	633 (+156)	455	178
13/7/63	Central South East	158 (+10)	152	6
		514 (+29)	439	75
	TOTAL	672 (+39)	591 (+136)	81
15/9/64	Central South East	167 (+9)	163	4
		535 (+21)	489	48
	TOTAL	702 (+30)	650 (+59)	52
30/7/65	Central South East	169 (+2)	168	1

		572 (+37)	544	28
	TOTAL	741 (+39)	712 (+62)	29
30/6/66	Central South East	171 (+2)	171	0
		618 (+46)	593	25
	TOTAL	789 (+48)	767 (+52)	25

3.3 Legislation

Initially, one amendment only to the existing regulations under the *Stock Diseases Act* was required. This provided that the inspectors of stock could take action on suspicion that disease was present in a flock whereas previously this power had been vested in the Chief Inspector of Stock only. In 1962 the *Stock Diseases Act* was amended to provide for making regulations to give the Minister of Agriculture power to require an owner to sell for slaughter any sheep quarantined by reason of footrot or which in the opinion of the Chief Inspector of Stock had been exposed to infection with footrot.

The Act was also amended to provide that the existence of disease in any stock is prima facie evidence that the owner knew or suspected that the stock were diseased.

The *Stock Diseases Act* under which footrot is proclaimed as a disease provides that:

1. 'Infected' stock in the case of footrot are sheep which have been in contact with sheep affected with footrot at any time during the preceding year or with sheep dressed or otherwise treated for the cure or the disease or which have formed part of a lot of footrot affected sheep.
2. The owner must report within 24 hours of discovering or suspecting that his sheep are diseased. The existence of disease in the flock is prima facie evidence that the owner knew or suspected they were affected.
3. Diseased and infected sheep must be kept isolated.
4. It is an offence to expose diseased or infected sheep for sale in or near any public or private saleyard.
5. It is an offence to travel such sheep without written permission of an inspector.
 1. to quarantine and direct any owner to do such things as are considered necessary to eradicate or check the spread of disease.
 2. right of entry.
 3. to order muster and to inspect.
 4. destruction of diseased travelling stock not in charge of any person. This includes stock on roads or in neighbouring properties.
 5. to order treatment.
 6. to order disinfection of premises, vehicles etc.
 7. to demand information.

Summary

The legislative powers available are adequate to handle any situation, which has arisen so far.

3.4 Administrative arrangements

Before footrot was gazetted as a disease under the *Stock Diseases Act*, a directive was prepared setting out the minimum legislative action considered necessary to control and possibly eradicate the disease, and the administrative steps necessary to implement this. This directive was placed before representatives of the Stockowners Association of South Australia and accepted by them. The conditions set out in this directive are as under:

3.4.1(a) Conditions of sale

- 1) Permission will be granted for the sale of sheep from diseased or infected flocks provided that:
 - a) the sheep are moved the whole distance from the owner's property to a market or abattoir by road transport (and railway),
 - b) if for sale, the sheep are consigned only to an approved market for sale for slaughter only,
 - c) if for slaughter, the sheep are consigned to an abattoir named in the permit.Until further notice, the only permitted market in South Australia will be the Adelaide Metropolitan and Export Abattoirs Board market.
- 2) When footrot affected sheep are found in markets their sale will be prohibited except for immediate slaughter at an abattoir approved by the inspector. If the owner so chooses, he may elect to return the sheep to his property. This return Journey will be by transport only.
- 3) Sales of sheep from infected flocks to other graziers will not be permitted.
- 4) If the inspector is satisfied that where an owner has two or more separately managed flocks and that one or more of these flocks is free from infection.

3.4.1(b) Sheep to interstate

There is no restriction on the sale of sheep from infected flocks to New South Wales or Victoria provided the movement across South Australia is by transport (and railway).

3.4.1(c) Sheep from interstate

No sheep may be introduced from interstate unless accompanied by a health certificate which includes freedom from footrot except that infected sheep consigned to an approved abattoir for slaughter, or entering South Australia for trucking to Victorian or New South Wales destinations may enter, provided they are accompanied by a health certificate but excluding footrot.

3.4.1(d) Conditions of movement

Owners of affected flocks, who are forced to travel them along or across roads from one part of their property to another, must not travel their sheep on the hoof where there is any danger of spreading footrot to their neighbours' flocks.

3.4.1(e) Straying sheep

Owners of affected flocks must not allow their sheep to stray onto roads or into neighbour's paddocks. Unclaimed, diseased, straying sheep may be destroyed.

3.4.1(f) Restrictions

The restrictions placed on flocks, although basically the same, will vary with circumstances. The district officers will use their discretion, but in all cases, the aim will be to give the maximum protection to the owners of clean flocks. Restrictions placed on an affected flock will be maintained until at least a winter and spring have passed after the last known case of footrot.

3.4.2 Railway facilities

In order to prevent spread of infection through railway facilities, instructions as set out below were issued in February 1958.

- a) Agents or owners desiring to off-load store or stud sheep at South Eastern stations without using railway sheep yards, may arrange with the station master for the vans to be left at a place where transports may be backed up to the van, to enable direct transfer from van to transport.
- b) All sheep under restrictions for footrot being sent by railway for slaughter or interstate, must be moved from the property or origin by transport and loaded direct into the vans. **THEY MUST NOT USE THE RAILWAY SHEEP YARDS.** Arrangements may be made with the stationmaster for the vans to be placed in a suitable position for this direct transfer.

3.4.3 Additional administrative arrangements

The administrative arrangements set out above generally proved to be satisfactory. Certain amendments have been introduced to meet changing conditions as the number of infected properties has been steadily reduced.

- a) Certain yards have been set-aside at the Metropolitan Abattoirs Sheep Market, and these only may be used for sheep from properties in quarantine.
- b) The restrictions on sheep from interstate proved to be inadequate and a proclamation was gazetted in 1966 providing more controls vide page 17.
- c) Owners of infected flocks have not been ordered to undertake treatment. Advice is given and a time limit is now set for eradication to be effected, either by treatment or by sale for slaughter.
- d) When placed in quarantine, each owner is issued with a book of travelling stock waybills overprinted in red letters 'Footrot – for slaughter only'.

These are completed in triplicate – the original accompanies the sheep, the duplicate is forwarded to the inspector, and the triplicate remains in the book for checking.

In reference to sheep to New South Wales and Victoria, it is noted that few if any sheep move from the infected areas to New South Wales. Movement to Victoria is almost entirely for slaughter.

3.4.4 Criteria for releasing restrictions

When eradication by treatment has been attempted, there is always a problem of determining whether all carrier animals have been eliminated.

It is not practicable for the inspector to examine every sheep before releasing quarantine.

The action taken depends somewhat on the owner. The practice is to visit the property periodically during that period of the year when footrot is known to be active, and to inspect all mobs and examine any lame sheep. These inspections, together with the owner's assurance are normally sufficient. Where there is doubt as to the owner's trustworthiness, a detailed examination is made.

Where an owner has persisted in regular foot bathing, it is very difficult to detect footrot in any mob. It becomes necessary to wait until the owner relaxes this precaution when footrot

quickly becomes apparent. More recently, instructions have been issued to owners of such flocks that no sheep are to be foot bathed after 1 May except with the permission of the Inspectors of Stock. Whenever a property is released following treatment, the owner is instructed to report any lameness immediately at the risk of legal action, if he fails to do so, and footrot is found in this sheep. A check of the records on properties has shown breakdowns in winter.

Where an owner eradicates by sale for slaughter, an inspection is made of the property to ensure a clean muster has been effected. This is considered essential, as odd sheep may be missed, and thus introduce the disease into the clean sheep purchased for restocking. See also 3.8.6.

3.4.5 Diagnosis

Diagnosis has been made mainly on clinical grounds with laboratory assistance for confirmation in the case of difficult owners or to obtain supporting evidence in case of legal action.

It has become obvious that the presence of *F. nodosus* in smears cannot be accepted as irrefutable evidence of footrot unless supported by the clinical picture.

The differential diagnosis of footrot and other conditions is described in appendices 1 and 4. Special reference is made to aberrant types of footrot, in 3.9.2, pg. 14 and for problems of diagnosis in 3.9.8 pg. 16.

3.5 Initial control steps

It was recognised that the seeking out of all properties on which the disease was present and the application of quarantine measures immediately after footrot was proclaimed under the Act could lead to many problems.

It was decided therefore that initially, action would be taken only where affected sheep were found in markets, on roads, or where owners reported that their flocks were infected. No action was taken to quarantine those owners who had sought help prior to footrot becoming a notifiable disease.

In this way, owners quickly recognised that they must keep their infected flocks isolated and could eradicate footrot by treatment or sale for slaughter without the fancied stigma of quarantine. It is accepted that many flocks were freed of footrot without coming under official notice.

Warning statements were issued through the rural press, notices were posted at saleyards and railway trucking yards and public warnings were given through all mediums that footrot affected sheep must not be exposed for sale or travelled on roads on the hoof or allowed to stray.

Particular attention was paid to markets and owners of infected sheep and therein were given the opportunity of selling for slaughter or returning them to the property of origin by road transport.

No prosecutions were sought for the first two years except for deliberate contravention of quarantine. Action was later taken against owners for travelling diseased sheep on roads or

exposing them in saleyards. More recently, prosecutions have been lodged for failing to report the presence of footrot in those cases where the owner had had previous experience and had no reasonable excuse for not knowing or reporting that footrot was present.

3.6 Methods of eradication

When a property is placed in quarantine, the inspector visits and reviews the situation taking into account flock size, fencing, facilities, manpower, type of sheep, incidence and severity of the infection and particularly the capabilities of the owner. He then assesses with the owner whether eradication should be by sale or attempted by treatment. If the latter, he advises and instructs the owner and his assistants and supervises the program, visiting as is necessary.

A number of articles for the guidance of sheep owners in SA was published In the *SA Journal of Agriculture* and are included as appendices 1–4.

In South Australia the earlier figures show that approximately 60% of owners eradicated footrot by sale of the affected mob(s) or the entire flock; 30% depended on treatment and 10% by treatment of the mildly affected sheep or mobs with sale of badly affected sheep or mobs.

The percentage of affected flocks sold for slaughter has gradually increased and is at present over 90%. Very few owners now attempt eradication by treatment only.

Owners of flocks in quarantine are now given a period of two years in which to eradicate the disease. This permits time for two attempts to eradicate by treatment or to sell for slaughter at the most opportune time. Where breakdowns occur after release following treatment, a time limit of 6–12 months is set for eradication. A warning is issued that failing eradication within this period, an order for compulsory sale will be sought from the Minister. Although 37 warnings have been handed to owners, it has been necessary to issue only two orders to date. In all other cases, it has been possible to cajole owners into selling for slaughter, or to complete eradication under Departmental supervision. The experience in South Australia has been that eradication by treatment can be costly due to the following:

- a) actual costs in manpower and formalin. These have been estimated at 30c (3/-) per head.
- b) loss of product/on especially if the disease recurs the following winter or spring. This has been shown in the controlled experiment at Kybybolite Research Centre in 1956 referred to earlier to be \$3 (30/-) per head.
- c) risk of breakdown within 1–2 years later.

Eradication by sale for slaughter is sure, provided great care is taken to ensure that there has been a complete muster. On at least two occasions checks by the inspector before the quarantine was lifted have shown affected sheep still to be present. In one case, it was two pet lambs both diseased and in the other case a diseased ration sheep.

3.7 Eradication by treatment

The plan of treatment advised is set out in appendix B and was prepared by Mr H.V. Chamberlain BVSc Senior Veterinary Officer (now Superintendent of Research Centres) and Mr T.D. St George Grambauer BVSc. Veterinary Officer (now with Division of Animal Health, CSIRO).

Experience over the past nine years has shown that several modifications are necessary to the advice given in the bulletin which was published in 1957.

The major amendments as would be expected apply to the recommendations are:

1. Detailed consideration must be given as to whether eradication is to be based on treatment or slaughter. The economies must be carefully weighed and the possibilities of successful treatment assessed in the light of the owner's capabilities. Unless treatment can be undertaken in a painstaking and thorough manner with strict adherence to the principles laid down breakdowns will occur. On the contrary 95%–98% efficiency can be obtained with one paring and foot bathing properly done.
2. The apparently clean mob (see pp. 7 and 13) should not be foot bathed again after the initial paring and foot bathing. It is accepted that foot bathing conceals any latent infection. Such infection should be allowed to reveal itself so that the affected sheep may be removed from the flock. Re-inspection of this mob should be done about six weeks later except that lame sheep should of course be removed and examined.
3. At the initial paring any affected or suspected footrot affected sheep should be put aside for treatment later. The emphasis should be on selecting the clean sheep. The affected mob may then be fully pared later and a decision made as to whether they will be, treated or sold for slaughter. The latter is the surest and cheapest.
4. If to be treated, the affected mob should be re-inspected 4-6 weeks later without any further foot bathing after the initial treatment. See Figures 7 and 13. Here again repeated foot bathing conceals infection and often results in carriers. Any sheep found infected at the second inspection should be sold for slaughter.
5. The affected mob should not be joined with the clean mob until they have passed through a season favourable to footrot. All sheep should be carefully rechecked the following year even if no footrot has shown up during the spring.
6. Formalin is the only chemical recommended. Copper sulphate and arsenic are dangerous and are not considered satisfactory. Antibiotics such as chloromycetin and terramycin are not recommended except for treatment of individual stud animals if the owner so desires.
7. The use of filled bags to hold sheep for paring, see pp. 8 and 9 is not entirely satisfactory as they do not hold the sheep immobile and further this method involves more bending than is desirable. It is preferable to have a cradle which holds the sheep firmly and enables all feet to be pared with a minimum of effort and a maximum of efficiency.

3.8 Factors influencing spread

The experience in SA indicates that the months of August, September and October are those most favourable for the appearance, spread and severity of footrot. In the Mount Gambier district November and December are also included.

In these months the temperature, moisture and pasture growth relationships are the most suitable. Ample moisture, with temperatures between 60°–70°F and adequate pasture growth are all present at the time.

Although moisture and temperatures are often optimum in March and April there is rarely sufficient pasture to provide suitable conditions for maximum spread.

During the winter months the lower temperatures and excessive moisture appear to limit the appearance of footrot.

The lower limit of rainfall for the disease to persist in SA is about 19 inches per annum. Severe sporadic outbreaks have been seen in lower rainfall areas when ideal conditions have existed in the Spring but the disease has not persisted.

Although footrot is seen on all soil and pasture types it has been most prevalent, severe and persistent on the solonchised solonch soil types and associated with subterranean clover dominant pasture. Footrot has occurred, quite frequently on the rendzina soils but it has rarely been as severe or widespread as elsewhere.

No explanation can be advanced for its absence from Eyre Peninsula nor its comparative rarity on Kangaroo Island and Yorke Peninsula.

3.9 Problems

As in most disease eradication programmes, the initial and middle stages of the foot, or control campaign proceeded smoothly with few technical problems. Breakdowns did occur. For most of these there were logical explanations and for a few there were not. The latter did not interfere with the general progress as they were of little significance against the large numbers of properties which were being freed and staying free of footrot. As the incidence dropped to below 50 properties in quarantine, those cases which did not conform to the accepted pattern have come to assume a greater significance.

3.9.1 Unexplainable breakdowns

Footrot on properties which have been free for a number of years and in which the source of the new outbreak could not be traced occurred in only 9 flocks but can be embarrassing. See 3.9.6.

3.9.2 Aberrant types

Foot lesions which do not resemble footrot clinically, but from which an organism morphologically identical with *F. nodosus* was found in smears have been seen. These have been of two types,

- a) A mild inflammation between the claws of one or more feet with moisture but no under-running of the horn, except a little at the skin-horn Junction and at the heels.
- b) A small heel abscess with a little pus and a little moisture between the claws.

Lesions as described in 3.9.2(a) have been seen in only nine flocks. They have been scattered over different years and in different districts and no common pattern is definable. In three cases they have occurred in rams only but in the others they have involved all types of sheep at the one time. Only in two instances have they occurred on any property more than once.

In all cases footrot has been present in the flock, but except in one case all had occurred many years previously. Except for a property which was completing its eradication programme and for a stud flock no quarantine has been imposed. Recovery in all cases has been complete and without recurrence of the infection.

Of the 3.9.2(b) type, three flocks only have been involved and only 2–3 sheep in each case. Recovery has been complete and rapid, and no further cases have been seen in these flocks. These lesions described in 3.9.2 (a) and (b) are embarrassing in that what appears to be *F. nodosus* is seen in smears from them. Economically they have been of little importance. They have not interfered with the control program. It is possible that a random survey of apparently healthy flocks would show a wider incidence than is known to occur.

The general policy is to quarantine on clinical evidence.

3.9.3 Other animals

The importance of animals other than sheep acting as carriers and spreaders of footrot has often been raised. The confusion in the minds of owners is largely due to the unfortunate nomenclature which has been adopted. Footrot in sheep is now recognised and accepted by all as a specific infection due to *F. nodosus*. Foot abscess is also clearly recognised and accepted as due to soil or bowel organisms, but unfortunately the analogous condition in cattle and pigs is referred to even by veterinarians as footrot.

Cattle

Lameness in cattle due to foot lesions, from which an organism closely resembling *F. nodosus* was seen in smears, has been investigated twice; on each occasion a single animal only was involved.

- a) This case occurred in the Kalangadoo area and was investigated by Shenman. Lesions resembling footrot of sheep were seen in all four feet of a heifer. No further cases have occurred on this property, nor has footrot been seen in the sheep.
- b) This was a two-year-old steer, one of a mob of 45 young cattle depastured in the Adelaide Hills. So far as can be traced, these cattle at no time had contact with sheep. The animal became extremely lame, lost condition and was slaughtered. All eight claws were badly rotted, and an organism resembling *F. nodosus* was seen in smears.

Goats

Footrot occurred on a property which had had footrot and then been completely de-stocked. Restocking was with sheep from the pastoral areas and footrot was found to be present some months later. The origin of the re-infection remained a mystery until an aged male goat, which had been on the property for many years, was noticed to be lame. On destruction, he was found to be affected with typical footrot. An organism resembling *F. nodosus* was seen in smears.

3.9.4 Indirect transmission

Although there is no proof to support the indirect transmission of *F. nodosus* from infected properties to clean flocks, this belief is firmly held by many owners and there is some circumstantial evidence to support it. The appearance of footrot in a clean self-contained flock shortly after handling by shearers who had come directly from an infected flock is certainly suspicious.

Whether mud carried by vehicles, cattle, horses, wild animals or birds can transfer footrot from infected to clean properties or not has not been proven, but is accepted and feared by many owners. To avoid any such accusation, the Electricity Trust of South Australia after moving across infected properties, sprays the wheels of its vehicles with 5% formalin as a precaution.

3.9.5 Owners

The most difficult problem has been some owners. Although the number of these has been small they have presented the most difficulties. Some of the older owners with large properties and a lifetime experience of living with footrot have been adamant that the disease could not be eradicated.

Even the success of adjoining owners could make no difference to their outlook. Proud owners of flocks bred and selected to suit their own standards have also been a problem, especially as is so often the case, the owner is too old to undertake successful eradication by treatment and is unwilling to sell.

Probably the most difficult owners have been the bad managers, especially when associated with alcoholism. These people make promises and give undertakings that they do not fulfil.

3.9.6 Breakdowns

The total of 789 properties which have been quarantined includes 86 which have been re quarantined after release. The reasons for the re-appearance of footrot are as follows:

Introduced with sheep from interstate	12
Introduced from neighbours	16
Introduced from elsewhere in SA (markets, transports, etc.)	11
Breakdowns due to incomplete eradication	38
No explanation available	9

3.9.7 Prosecutions

Only 17 prosecutions have been lodged. These have been for a variety of offences, including introduction of footrot infected sheep from interstate, no health certificates, exposing diseased sheep in markets, travelling diseased sheep on roads, failing to report presence of footrot (2 successful and 1 unsuccessful) and failure to obey a quarantine notice.

3.9.8 Diagnosis

The field staff have had little trouble in making their diagnosis.

Provided sufficient affected sheep were available and examined a diagnosis was usually possible. The most confusion has arisen in those cases where the laboratory has reported the presence of organisms resembling *F. nodosus* but which the field officers have been of the opinion were not footrot. Subsequent events have proved the field staff to be correct in that typical footrot has failed to develop.

3.10 Prevention of re-infection from interstate

It is known that about 60 properties have become infected by the introduction or contact with affected sheep from interstate. It is accepted that an owner who purchases from interstate without due precautions has only himself to blame if he introduces footrot. However, he may

put such infected sheep in a market or sell them privately or allow them to infect his neighbours sheep, and therefore it has been found necessary to introduce new legislation to control the movement of sheep from interstate.

Regulations gazetted on 18 August 1966 provide that sheep may be introduced from interstate if:

- 1) They are accompanied by a declaration by the owner and a certificate from an inspector of the State of origin certifying that to the best of his knowledge and belief after due enquiry they are free of footrot and from a property on which footrot has not been known to occur for one year. In this case, the sheep may enter and move freely in South Australia; or
- 2) They are accompanied by a declaration by the owner interstate and the owner introducing them into South Australia that they are free of footrot. In this case, they may go:
 - a) direct for slaughter; or
 - b) to those areas of South Australia outside the five South East counties and the Counties Adelaide and Hindmarsh in the Adelaide Hills, and remain there for at least a year; or
 - c) direct on to a property in the counties in the South East or the Adelaide Hills referred to in (b) and be held there until released by the district inspector or sold for slaughter.

Sheep coming in under (2) must not be placed in a market, nor sold without permission.

3.11 Costs of the control program

The footrot control program necessitated the appointment of six inspectors of stock. In the initial stages, members of the existing staff also devoted some of their time to this work. Conversely, after the early years, the new inspectors gave an increasing amount of their time to other duties. It is estimated that the program has cost approximately £100 000.

The staff commitment was approximately one inspector per 1 000 000 sheep at risk.

3.12 Benefits resulting from control

At the commencement of the program in 1956 there were 3 250 000 sheep in the five counties of the South East. As at 31 March 1965 the report of the Government Statist shows approximately 5 000 000 sheep and lambs in the same district. The incidence of footrot in 1956 was estimated to be approximately 50% of properties. If the control measures had not been enforced, it is reasonable to assume that 2 500 000 sheep would now be in affected flocks. If the estimate of 50c (5/-) per head per annum to control footrot and \$3 (30/-) per head per annum loss in production are accepted, the annual costs of footrot in those counties would have been approximately \$7 500 000 (£3 750 000). To this must be added a further \$600 000 (£300 000) for the Central District.

There are other less tangible but no less real gains, which followed footrot control. Flock improvement is no longer handicapped due to culling because of footrot; proper utilisation of pasture is not restricted; it is possible to move sheep freely on roads or to use neighbours' equipment; reluctance to buy or to return sheep from markets has been removed.

These all added to the economic burden imposed by footrot. In addition, there is no longer the community resentment as between buyer and seller and agents nor the friction due to movement of infected sheep over roads or straying into neighbours' property.

It has been stated that the southeastern markets are up 50c to \$1 (5/- to 10/-) per head because buyers, including many from interstate are able to purchase clean sheep for re-stocking without fear of introducing footrot.

4. ACKNOWLEDGEMENTS

It is desired to acknowledge the generous assistance of the Australian Wool Board which granted a sum of £6000 per annum with a total of £50 250 from the Wool Research Trust funds toward the control of footrot in South Australia as a research project. A further grant of \$2000 (£1000) has been made to enable this publication of the results of the project.

The co-operation which has been given to the Department by all the stockowner organisations including the Stockowners Association of South Australia, Australian Primary Producers Union, the South Australian Wheat and Wool Growers Association and the Agricultural Bureau of South Australia, Stock Agents, South Australian Railways, rural press and by individual stockowners is gratefully acknowledged. Without their help and support the rapid progress which has been a feature of the campaign could not have been achieved. The major criticism which the Department has had to combat is that we are not severe enough in our action against those owners who do not eradicate within a reasonable period. In defence, it is contended that the progress which has been made in the nine years since footrot was proclaimed as a disease under the *Stock Diseases Act* is sufficient answer.

Grateful thanks are also due to the staff of the Institute of Medical and Veterinary Science for their work in examining countless smears to confirm or cast doubt on field diagnoses.

The assistance of the officers of the Division of Animal Health, CSIRO is also recognised.

Note that no references or appendices appear to have been scanned – they are mentioned in the text and Contents. Also note that the page numbers mentioned in the text refer to the original pagination of the document.