



**Sheep Health
Matters**

Introduction

Hybu Cig Cymru/Meat Promotion Wales (HCC) was established in April 2003 and is the strategic body for the promotion and development of the Welsh red meat industry. Its mission is to develop profitable and sustainable markets for the benefit of all stakeholders in the supply chain.

It brought together the red meat activities of three organisations, namely the Meat and Livestock Commission in Wales (MLC Cymru), Welsh Development Agency and Welsh Lamb and Beef Promotions Ltd. Each organisation was responsible for different aspects of red meat activity, which have now been integrated into HCC's work.

HCC is now the sole body for the promotion and development of red meat in Wales.

This booklet forms part of a series of publications produced by HCC's Industry Development Team.

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Sheep Health Matters

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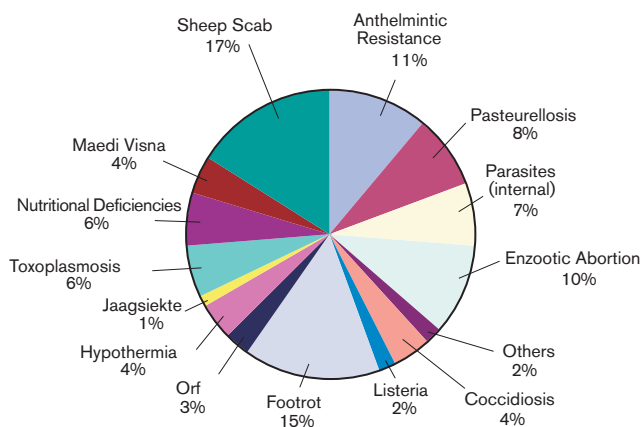
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Foreward

Optimising health and welfare is crucial to achieving top performance levels from your sheep flock. This booklet aims to provide producers with information and advice about the major threats to sheep health and welfare. The articles have been written and updated by leading scientists with a practical bias looking at how to prevent disease entering the flock, recognition of disease, and treatment on an individual animal or flock basis.

Figure 1: Major threats to sheep health and welfare



A practical guide to the control of sheep scab

Peter Bates

Veterinary Laboratories Agency

From 1 July 1997 it was made a criminal offence under the Sheep Scab Order 1997 if owners or keepers of sheep:

- **Fail to treat sheep visibly affected with sheep scab and all other sheep in the flock**
- **Move sheep visibly affected with sheep scab**

Prosecutions under these offences could lead to a fine of up to £5000.

The Mite

Sheep scab is caused by the non-burrowing mite *Psoroptes ovis*, which is just visible to the naked eye. The adult female is pearly white and approximately 1.0 mm in length. The life cycle of *P. ovis*, takes 14 days in ideal conditions from egg to adult, and consists of four motile stages, but the adult female can live for up to 40 to 50 days, depositing 1 or 2 eggs per day. The mite will remain infestive off the host for 15 to 16 days. Transmission can be either direct or indirect.

Direct Transmission: through direct sheep-to-sheep contact at market, in livestock lorries, at feeding troughs or any time that sheep are gathered and kept tightly packed together.

Indirect Transmission: through contact with residual mites in tags of wool or scab attached to brambles, fencing, farm machinery, animal housing etc. Shearing combs and cutters and contaminated clothing can also spread scab.

The scab mite will not naturally infest any animal other than sheep.

Sheep Scab – the disease and symptoms

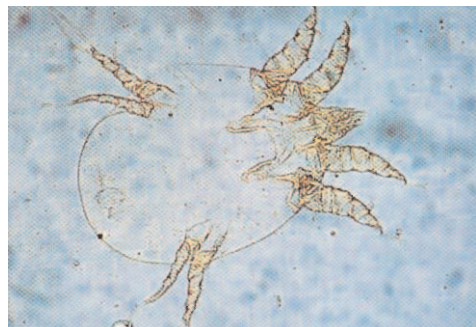
The Disease

Mites graze the skin around the moist periphery of the scab lesion, taking in nutrients with the serous exudate, skin secretions and lipid. The scab itself is not a direct result of the mite feeding but is in fact a form of allergic dermatitis to the mite.

Early lesions are almost undetectable, with the mite adjusting to the new host and



Sheep scab infested animals



The sheep scab mite Psoroptes ovis

the host responding to the mite. This sub-clinical phase can extend for weeks, months, even years.

In the early stages of disease excess serous fluid will dry to form a yellow scab with a moist, faintly green periphery. The lesion gradually spreads outwards as the mite population increases. Eventually the whole sheep can be covered in scab, at which time the infestation usually enters a decline or regressive phase and the mite population declines rapidly.

After this stage sheep appear to recover completely but in fact may still harbour a small population of mites, waiting to re-infest the sheep once normal skin conditions are restored.

The severity of scab depends on the individual animal. Animals with a strong response to the mite demonstrate more extensive lesions, compared to those that respond weakly.

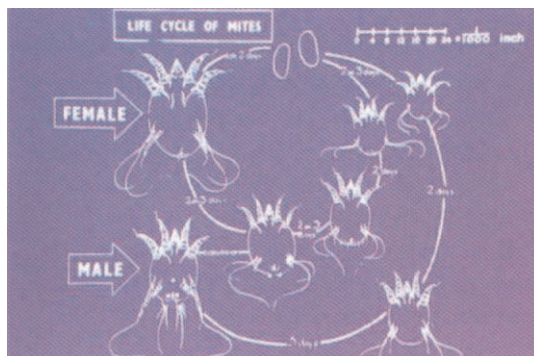
The Symptoms

Examining Sheep

Part the fleece in several areas, suspect scab if you find scales or scabs. Consult your veterinary surgeon if you are not sure. It is important that the cause of the irritation is accurately identified. The use of a wrong treatment could select for resistance, putting the welfare of your flock at risk. It would also be expensive, as the correct treatment would also have to be administered.

Early Disease

Generally speaking there are few definite symptoms of early, sub-clinical scab. Sheep with sub-clinical scab can look perfectly normal and can easily be introduced to a flock via market purchases. Eventually a pattern of symptoms can be seen as the disease progresses. Initially these include restlessness, rubbing against fence posts etc, soiled and stained areas of wool (particularly on the shoulders), head tossing and deranged or tagged fleece. These could also be the symptoms of other ectoparasite infestations (e.g., chewing lice (*Bovicola ovis*), blowfly strike (*Lucilia*, spp), fly bites, even scrapie).



Life cycle of Psoroptes ovis

Sheep Scab – symptoms and seasonality

Established Disease

In the later stages of infestations, the rubbing and head tossing become more excessive, areas of wool loss appear, together with open, bleeding wounds. Sheep rapidly lose condition and epileptiform seizures may be evident.

Infestations within Flocks

Numbers of infested sheep within the flock can vary from 1 or 2 in the early days of infestation, to the whole flock as the disease takes hold (depending on the immune status of each individual sheep). Throughout the flock there will be animals with non-established lesions (that will eventually die out), young sub-clinical lesions, together with animals with obvious extensive disease.



Sheep with extensive scab

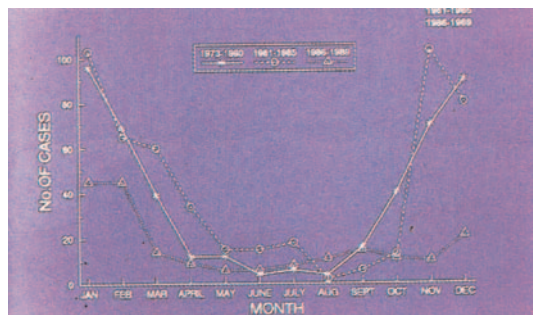
All sheep should be considered to be infested and the whole flock should be treated for scab. One missed sheep could re-infest the whole flock.

Effects of Sheep Scab

Apart from the obvious welfare issue, sheep scab can have significant economic effects within a flock including considerably reduced fleece and leather quality, reduced conception rates, poor lamb growth and in extreme cases, fatalities.

Seasonality

Sheep scab is mainly a winter disease, with the majority of cases occurring between September and April, although a significant number of cases do occur in the summer months particularly on animals still full fleeced (lambs, hogs etc) and on "ridges" of longer fleece on poorly shorn sheep. Shearing can halt the progress of disease by removing the micro-climate, leaving the mites exposed to dehydration etc.



Seasonal outbreaks of scab

Control of Sheep Scab

Outbreaks of scab require chemical treatment. Currently the only effective methods of control are plunge dipping in wash containing the organophosphorous (OP), diazinon or the synthetic pyrethroid (SP), high cis cypermethrin, or by double sub-cutaneous injections of formulations containing Ivermectin or Moxidectin or single intra-muscular injections of Doramectin. **Pyrethroid pour-ons are not effective against sheep scab and the use of shower dips or jettors is not currently advised.**

Although treatment is effective in controlling disease within a flock, it may be unnecessary if greater care was taken to prevent scab.

Sheep Scab – control and prevention

Preventing Sheep Scab

Oncoming Sheep

- Isolate all new stock, agisted sheep and shared tups for at least three weeks prior to mixing with the main flock.
- Observe isolated stock regularly for signs of scab.
- Seek veterinary advice if an ectoparasite is suspected. The parasite(s) should be identified professionally.
- All isolated sheep should be treated with the correct insecticide/acaricide for the diagnosed ectoparasite.
- Isolated sheep should not be released into the main flock until treatment is completed and the infestation has been shown to be cured.
- Infested sheep must be moved to clean housing directly after treatment to prevent reinfestation.
- Buildings in which infested sheep have been isolated must be thoroughly cleaned and disinfected with a strong disinfectant. All litter must be burnt or deposited out of sheep contact and all tags of wool must be collected and burnt.
- Sheep should not be introduced into quarantine housing and paddocks for at least two weeks after disinfestation.

At Grazing

- Fencing must be effective in preventing straying on or off the property and preventing direct contact with neighbouring sheep.
- If possible neighbouring flocks should be discretely observed for signs of scab.
- On common or unfenced grazing co-operation must be sought with neighbouring properties to attain equal standards of health. **All flocks should be treated simultaneously. The Sheep Scab Order 1997 empowers Local Authorities to enforce this if necessary.**
- Examine sheep for signs of scab at gathering for foot trimming, drenching etc, and particularly before winter housing.

Human Contact

- Scab can be introduced via contaminated shearing equipment and clothing. Stockowners should enquire if contract shearers have encountered infested sheep within the previous two weeks of shearing their flock.
- Protective clothing, shearing combs and cutters should be disinfested using strong disinfectant, sheep dip or where suitable, boiling water
- Scab mites can survive on clothing and the human body (particularly under finger nails) for a period of time. Anybody having contact with an infested flock must disinfest their protective clothing and wash exposed areas of skin with water (as hot as bearable) before leaving the premises. It is unwise to visit another sheep flock after contact with infested sheep, without a hot shower and a change of clothing between visits.

Sheep Scab – treatment

Chemical Treatment

General Considerations:

- **Follow the instructions carefully:** read the product label.
- **Sheep movements:** Avoid moving sheep on or off the property until treatment is completed.
- **Neighbours:** If possible neighbours should be informed of scab; they may unknowingly be the source of infestation.

Choosing the Correct Treatment depends on:

- **Accurate diagnosis** of the ectoparasite (avoid developing resistance in non-target species).
- **The size of the flock** to be treated. Apart from the cost, the inconvenience and detail of some treatment methods may lead to inadequate application at the expense of speed. All contact sheep must be treated, not just those clinically affected.
- **Physiological condition of the sheep.** Avoid causing dipping stress to in-lamb ewes (particularly within the first and last months of pregnancy). There may also be problems while ewes are lactating. Some treatments are not advisable for young lambs and tups and fat sheep are susceptible to immersion shock while plunge dipping. Read the manufacturers instructions thoroughly before use.
- **The end product** (e.g. meat, milk, breeding stock etc). The withdrawal period of some products may not be acceptable at certain times of the year.
- **Availability of labour and facilities.** Some treatment procedures are time consuming and need extra labour and fixed equipment.
- **Simultaneous control of other parasites.** Some treatments also offer anthelmintic activity. Planned treatment timing could lead to a more cost effective flock treatment.
- **Operator safety:** People can be adversely affected by certain active ingredients and should not contemplate their use if under medical advice. Certificates of competence are required in order to purchase OP or SP based dip formulations.
- **The environment.** Used dipwash is very toxic to the environment and should be disposed of according to current EU regulations
- **Use of concurrent medicines.** Some treatment methods are not compatible with other farm medicines.
- **The weather.** Plunge dipping should be avoided in extremes of heat and cold. As far as possible do not carry out dipping in the rain or when the fleece is wet. Hypothermia can occur if sheep are plunge dipped late in the day if the weather is cold. Allow enough time for dipped sheep to dry out before nightfall.
- **Shearing, bloom dipping or washing** should not be carried out for at least four weeks following dipping.
- **Handling.** Procedures requiring handling of sheep should be carried out before or as long as practically possible after the application of plunge dips. Protective clothing should be worn while handling dipped sheep.

Correct Plunge Dipping

In all baths sheep must be kept moving: swimming action displaces the air in the fleece and aids dip wash penetration.

Types of Dip Formulation

Sheep dip formulations can be divided into stripping dips (e.g. the OP formulations containing diazinon and non-stripping dips (e.g. the SP formulations containing high cis cypermethrin).

Stripping Dips

Stripping is the removal of the active ingredient from the dipwash, resulting in greater amounts of active ingredient remaining in the wool. Water is also retained by the fleece, the volume being dependent on the size of the sheep and the length of fleece. Stripping relies on the removal of fat-soluble suspended or emulsified active ingredient particles by active absorption into wool grease.

Non-Stripping Dips

Non-stripping dip formulations contain the SP high cis Cypermethrin. In these types of dip the active ingredient does not strip, so that the concentration of the dipwash in the bath remains the same throughout dipping.

Depletion and Replenishment

All sheep remove active ingredient and water from the dipwash. If active ingredient is not replaced the concentration will eventually become too low to be effective, a process known as **depletion**. Adequate concentrations of active ingredient and volume of dipwash must be maintained at all times. **Depleted dipwash must be replenished**. Replenishment is traditionally a method whereby concentrate and water are added either after a certain number of sheep (head count method) or after a specified drop in volume. For stripping dips replenishment is the regular addition of dip concentrate (at a level greater than the initial charge) and water to compensate for depletion. For non-stripping dips the wash is topped up with wash (concentrate and water) at the same concentration; therefore there is no need to wait for a specific drop in dipwash volume or a specified number of sheep and topping up can be carried out when convenient (as long as there is enough dipwash to immerse the sheep adequately).

Double Dipping

OP dips and some SP dips are effective after a single dipping. Some SP dips require a second dip after 14 days.

Immersion Times

Dipping for 30 seconds is adequate for the control of lice, blowfly or ticks but sheep need to be immersed for 60 seconds (with the head under twice) in order to eradicate sheep scab. Double the amount of acaricide is absorbed by dipping for 60 seconds compared to 30 seconds.

Protection Against Reinfestation

Flockowners are warned to read the instructions on the product label. The label will state whether a product is effective against sheep scab and whether it **protects against reinfestation as well as cures active scab**. The sheep scab mite can live off the host and remain infestive for 15 to 17 days. Approved dip formulations (licensed prior to 1992) containing the OP diazinon, are guaranteed to protect against reinfestation for at least three weeks on sheep with 1.0 cm of fleece. In reality this would be considerably longer on full-fleeced sheep. Consequently sheep dipped in one of the approved dips can be returned to an infested pasture, yard or barn directly after dipping, without risk of reinfestation. After 1992 it was no longer a requirement for a dip formulation to **provide protection**. It is important that you read the label instructions. Some high cis cypermethrin formulations provide protection – others do not.

Dipping Wet or Shorn Sheep

Wet sheep can add water to the dipwash. Acaricides have a strong affinity to fleece lipid and wet sheep will therefore remove little water from the dipwash but will remove relatively the same amount of active ingredient as full fleeced sheep. Thus dipwash volume will be slow to fall, despite depletion of the active ingredient. Replenishment by a drop in volume does not take into account wet or shorn-fleeced sheep. **Replenishment by head count** is advisable.

The Effects of Rain

Heavy rain during or directly after dipping can wash active ingredient out of the fleece, as can subsequent washing or bloom dipping. Continuous heavy rain falling on the draining pens and water contained in the fleece can also dilute the dipwash.

Dip Fouling

It is not unusual for dipwash to contain 3.0 to 5.0% organic matter (faeces, soil etc) at the end of dipping. Active ingredient has an affinity for organic matter leading to 60% less active ingredient being taken up by the fleece.

Acaricide Resistance

If dipping is not carried out correctly, the sheep scab mite can be exposed to **sub-lethal concentrations** of acaricide and could **develop resistance**. Resistance has already been reported to some products in the UK.

Systemic Endectocides

Systemic endectocides have both acaricidal and anthelmintic properties. That is they kill both scab mites and gut worms. At present all systemic endectocides are administered as injections e.g., Doramectin, Ivermectin, Moxidectin). Correct doses (according to body weight) control ectoparasites anywhere on the body through the ingestion of the active ingredient.

As endectocides are carried throughout the body it is important to observe the required withdrawal period for meat and milk.

Are Two Injections Necessary?

Ivermectin and moxidectin based formulations require two injections, seven and ten days apart, respectively. This is essential in order to kill parasites emerging from eggs deposited before treatment. Single injections can be only 90% effective in the control of scab after 10 days and live mites can be present on sheep as long as 84 days following a single injection.

Residual Mites in the Environment

Endectocides have varying periods of protection. Read the label for details. Only formulations containing moxidectin are effective in protecting against infestation (for at least 28 days). Rubbing and scratching of heavily infested sheep will deposit live mites into the environment (e.g. fencing, bushes, lorries, shearing combs etc). Mites can survive off the host for at least 16 days. **Consequently if sheep are reintroduced to the original contaminated accommodation, they are likely to be reinfested.** The prolonged period for complete resolution of clinical disease increases the chances of sheep rubbing and thus contracting residual mites from the environment.

Lame sheep matter!

Agnes Winter

University of Liverpool

Why is lameness important?

- Lameness means the sheep is in pain
- Lameness leads to losses in production

Rams

- lower fertility

Ewes

- lower lambing percentage
- increased risk of pregnancy toxæmia
- lower lamb birth weights
- less milk production
- less wool produced

Lambs

- increased mortality
- reduced growth rates

Trimming sheeps' feet

Foot trimming is only necessary to help make a diagnosis; to improve the shape of grossly overgrown feet; to remove obviously loose horn before footbathing or other treatment. A good handling system makes foot examination less of a backbreaking job. Use a good pair of foot shears or a sharp knife. Trim carefully and conservatively.



Lame ram



Unnecessary bleeding due to over trimming

- **Do not trim so hard that the foot bleeds - this is not necessary and may lead to permanent damage to the foot.**
- **Take particular care at the toe - it is very easy to cut too deep.**
- **If the foot is infected, trim only enough to make a diagnosis and to remove obviously loose horn.**

Lame sheep – distinguishing different causes

What are the common causes of lameness?

Scald and footrot are the most important causes and can affect many animals within a flock. In young lambs, joint infections are the main problems, often caused by bacteria in the environment, for example in dirty housing.

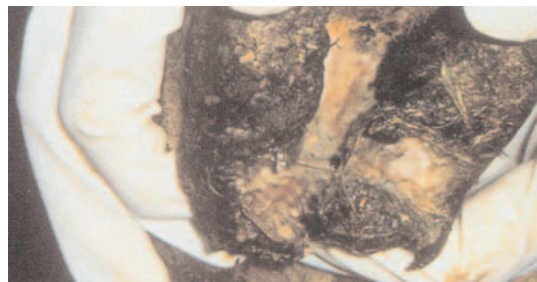
But there are other important causes of lameness in all age groups, so making a correct diagnosis is very important - only then can the correct treatment be chosen and measures to try to prevent future problems be decided upon.

Distinguishing features of different types of foot lameness

- **Scald** - the skin of the cleft between the claws is inflamed, moist and swollen, but there is no separation or underrunning of horn. All age groups are vulnerable, often many animals being affected within a short time period. It is caused by a particular bacterium (*Fusobacterium necrophorum*) found commonly in the environment (so it can be eradicated), which spreads particularly in warm, damp weather.
- **Footrot** - this starts as scald between the claws, but the action of a second bacterium (*Dichelobacter nodosus*) leads to separation of the horn near the heel, extending along the sole and even up the wall in serious cases. There is the typical footrot smell, with accumulation of



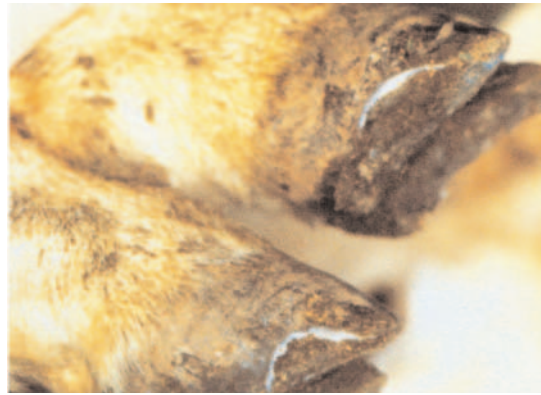
Early footrot showing underrun heel



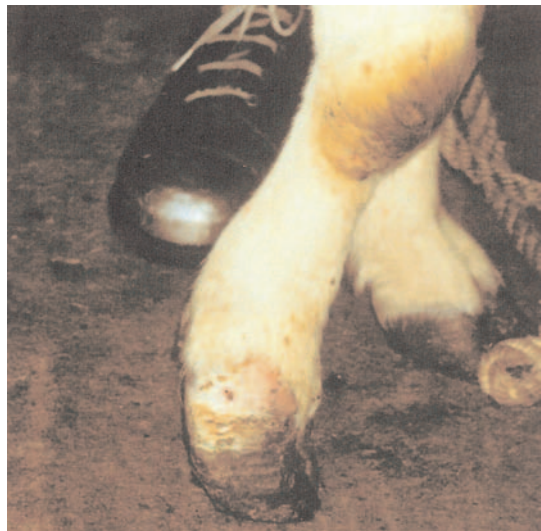
Severe footrot

blackish cheesy debris under the loosened horn. Footrot is an infectious disease that survives in the feet of infected sheep but can only live on pasture for about 2 weeks. For every obvious case there will be several other less obvious cases, and it will never be effectively controlled unless it is treated as a flock problem.

- **Contagious ovine digital dermatitis (CODD)** - this is a fairly new and serious disease. The cause is not fully understood but is possibly associated with the bacteria that cause digital dermatitis in cattle. In contrast to footrot, which starts in the sole and spreads outwards and upwards, this starts with a sore area at the coronary band and spreads down the claw rapidly undermining the horn. In severe cases the whole horn capsule is detached leaving raw exposed claws. Permanent damage to the foot may result. Consult your vet if you are concerned that your flock is affected.
- **Shelly hoof** - this is a common condition in which the outer wall of the claw becomes loosened forming a pocket which becomes impacted with soil. The sheep only becomes lame when the soil is forced far under the hoof wall and an abscess forms which eventually bursts at the top of the hoof. The sheep then gradually recovers but lameness may recur if the loose horn is not trimmed away.
- **White line (toe) abscesses** - this develops along a track under the horn of the wall causing acute lameness. Eventually pus bursts out at the top of the hoof after which the sheep gradually recovers, although the horn may become loosened and cracked.
- **Pedal joint abscess** - this serious type of infection is particularly common in heavy rams.



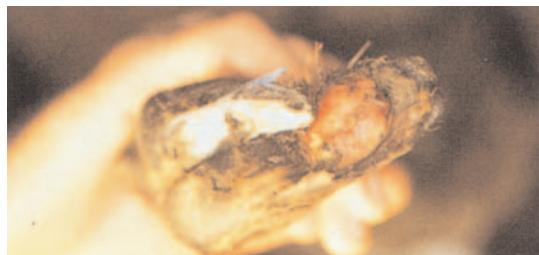
Shelly hoof



Pedal joint abscess

The animal is extremely lame with a swollen painful claw. Pus bursts out at several places around the tip of the hoof, including between the claws, often with loss of hair above the hoof. The joint within the hoof becomes permanently damaged and the animal remains chronically lame. Veterinary treatment is necessary; often the only answer is to amputate the claw.

- **Granuloma (Proud flesh)** - this is often the result of too severe paring but can also follow severe footrot or puncture wounds. A strawberry-like growth develops which may become covered with loose horn but never heals properly and bleeds when touched. Veterinary attention is needed.



Granuloma result of overparing

Other types of foot lameness include soil balling, puncture wounds and growths of skin between the claws which become infected and painful.

Lame sheep - treatment

Treatment of foot lameness

Scald, footrot and CODD need to be treated as flock problems, since only picking out individual lame animals for treatment is highly unlikely to result in satisfactory control. Various treatments are available and should be selected based upon the particular flock circumstances. When an individual sheep or flock is lame and fails to respond to the usual treatments, veterinary advice should be sought.

- **Paring** - this should be carried out with care, sufficient only to remove **obviously** loose horn before footbathing. It should **not** be done so severely that the foot bleeds.
- **Footbathing** - this is the most effective way of treating scald and footrot on a flock basis. Stand-in pens, which can hold a number of sheep, are better than walk-through baths; this makes sure that all feet are treated and allows sheep to be held in the treatment for the required length of time. Standing sheep on a hard dry surface for up to one hour after footbathing will increase the efficacy of treatment.



Stand-in foot bath

Several different chemicals are available. The best known are:

- **Zinc sulphate** (10%). Needs a stand-in time of about 5 minutes, sometimes longer (read the instructions!).
- **Formalin** (2-3% is usually adequate, never stronger than 5%). Walk-through, but has the disadvantage of being unpleasant and irritant to use; it can also cause too much hardening of horn if used frequently. However weak formalin (2%) may be the most practical way of treating scald. Formalin footbaths should be made up fresh as they degrade when muddy.
- **Antibiotic and other sprays** Effective against scald and mild footrot, particularly for individual or small numbers of sheep. Not to be used with footbathing as it gets washed off and is just a waste of money!
- **Antibiotic injections.** Can be very effective for severe footrot cases and for ewes in late pregnancy to avoid too much handling. Also may be necessary for foot abscesses where pus cannot be easily released. Consult the vet for advice on antibiotic use.
- **Antibiotic footbaths** – these may be necessary to treat CODD, but you should take veterinary advice on their use.

Lame sheep - prevention

Remember, if the cause of lameness is not clear, normal treatments are not working or a sheep is severely lame veterinary help should be sought on welfare grounds.

Prevention of lameness

It will never be possible to prevent all lameness, but the aim should be to minimise the incidence of scald and footrot, and CODD, if you are unlucky enough to already have that in the flock. By keeping these under control and not allowing advanced or chronic cases to develop (footrot and CODD), much less time is necessary to be spent on treatment of individuals. 'Routine' foot paring mostly becomes unnecessary - this has, in any case, been shown to often cause more harm than good if feet are damaged and infection is spread in dirty handling pens.

The keys to prevention are:

- **Trimming** - only grossly overgrown horn. Routine trimming of all feet is not necessary.
- **Routine footbathing** - particularly helpful in warm weather, as well as before and during housing, to protect against scald and to prevent footrot spreading.
- **Vaccination** - specifically against footrot, this can help in control, but needs to be part of an overall foot care plan. Protection is not very long lasting, so care is needed with timing. Vaccination may also help prevent at least one type of joint infection in lambs. Take veterinary advice.
- **Maintaining a clean environment** - dry, well bedded pens in sheep houses and well drained areas where sheep congregate around feed or water troughs will help to prevent the spread of footrot as well as joint infections in young lambs.
- **Culling chronically infected sheep** - these act as a constant source of infection for others.



Routine trimming – good handling system

Footrot can be controlled in all flocks and eradicated from closed flocks, but it is very easy to re-introduce the disease by carelessness or lack of thought.

All new sheep coming onto a farm should be kept separate from the resident flock until they have been examined, treated as necessary and rechecked before mixing. In this way the risk of introducing new footrot infections, as well as other infectious diseases, can be minimised.

If you haven't got CODD you don't want it. Don't buy it in. Don't buy lame sheep.

Towards Sustainable Roundworm Control in sheep

F Jackson and R L Coop

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Introduction

Gastrointestinal roundworms are still a major cause of loss of efficiency of production in small ruminants, particularly through the presence of insidious subclinical infections which are difficult to detect. Currently control in most intensive animal husbandry systems is achieved through regular dosing with anthelmintics (wormers/drenches) combined, where practicable, with grazing management strategies. However, the frequent use of anthelmintics needs to be reviewed in the light of increasing prevalence of worms resistant to one or more of the three broad-spectrum families of anthelmintics currently in regular use (see Table 1).

Group	Chemicals	Examples
1	Benzimidazoles	Fenbendazole
	Albendazole	
	Pro-benzimidazoles	Netobimin
		Febantel
2	Imidazothiazoles	Levamisole
	Tetrahydropyrimidines	Morantel
3	Avermectins	Ivermectin Doramectin
	Milbemycins	Moxidectin

Table 1: Anthelmintic Families

Resistance to an anthelmintic arises when there is a change in the susceptibility of the worm population to the drug. Normally wormers have a very high efficacy (near to 100%) but when resistance occurs a greater proportion of the worm population is able to survive treatment. Anthelmintic resistance is also heritable, i.e. passed from adult worm to the larval stages, so the offspring of resistant worms also carry the gene(s) for resistance.



Nematodirus worm on the surface of the small intestine of a lamb

Anthelmintic Resistance

The prevalence of anthelmintic resistant isolates of worms is increasing.

The situation in the United Kingdom and Europe is less severe than in the southern hemisphere but one must not be complacent as surveys have shown an increase in the prevalence of drug resistant nematode populations in sheep, goats and horses. Surveys conducted in 1990 showed that benzimidazole resistant worms were present on over 40 per cent of sheep farms in England and on 24 per cent of lowland sheep farms in Scotland. A more recent survey conducted in 2000 in Scotland showed that this figure had increased more than threefold to over 80% on lowland farms. There is also some recent evidence in the UK of worms that are resistant to all three broad-spectrum drug families, the benzimidazoles, imidazothiazoles/tetrahydropyrimidines and the macrocyclic lactones. At present multiple resistance seems to be confined to the brown stomach worm (*Ostertagia*) although single drug family resistance has been reported in other economically important species such as *Haemonchus*, *Trichostrongylus* and *Cooperia* in the UK. To date there have been no reports of anthelmintic resistance in *Nematodirus* in the UK.

Ideally, anthelmintic resistance needs to be detected at an early stage because once the population of worms becomes highly selected there does not appear to be any significant reversion to susceptibility.

Once resistant worms are present on the farm they can be considered permanent for all practical purposes.

Unfortunately, the tests currently available for the detection of resistant worms are relatively insensitive and will only detect resistant worms when they comprise more than one quarter of the total population. Current research is being directed at developing more sensitive diagnostic assays.

Other strategies for the control of gastrointestinal roundworm infections are being researched, such as biological control, anti-parasite vaccines and genetic selection, but in the foreseeable future the use of wormers/drenches will remain the main means of achieving control in intensive flocks to maintain efficient production and comply with animal welfare concerns. It is therefore important that farmers adopt sensible strategies for worm control that will conserve the efficacy of the anthelmintics that are currently available. The number of new drugs with a novel mode of action which can be expected to emerge in the next decade for use in sheep will be very limited due to the high cost of development and registration.

In planning a strategic dosing programme, full account must be taken of the types of grazing available on the farm. By integrating grazing management it should be possible to reduce the number of anthelmintic treatments and thus reduce the selection pressure for development of resistant worms. The practical aspects of devising a control strategy for each individual farm needs to be discussed with the local veterinary practice but Table 2 outlines management practices that will provide 'clean' and 'low-risk' pastures.

For grazing in the spring and early summer

'Clean' pasture

- New grass leys sown after an arable crop in the previous year
- Pasture which has not been grazed by sheep in the previous 12 months (eg grazed only by cattle)
- Pasture used only for conservation in the previous year

'Low risk' pasture

- Pasture grazed only by dosed ewes in the previous autumn
- Pasture grazed by cattle since the previous July
- Pasture grazed by yearling sheep up to mid summer

For grazing in Mid-summer and autumn

'Clean' pasture

- Aftermaths which have not been grazed by sheep in the spring
- Grass which has not been grazed by sheep since the previous autumn and which only carried cattle earlier in the spring

'Low risk' pasture

- Grass grazed by non-lactating ewes in the spring/early summer

Table 2: Practices to provide pasture with minimal or reduced larval infectivity

Selection for Resistance

An understanding of the factors that influence the development and transmission of resistance is important and helps in the development of a rational approach to worm control.

In any population of worms there may be a very small proportion of worms that already carry the gene(s) for resistance, even before the drug is first used. Every application of a drug will increase the selection pressure and may eventually result in a marked shift in the proportion of the population that is able to survive anthelmintic treatments. The selection of anthelmintic resistance occurs more rapidly in goats for a number of reasons including a poor immune response (which leads to the need for frequent treatments) and their ability to rapidly metabolise drugs (which leads to underdosing if goats are treated at the sheep dose rates with the benzimidazoles and levamisoles). Where goats and sheep are grazed on the same unit, extra care must be taken to avoid the selection of worm resistance by the goats and its transfer to sheep.

Major Factors Influencing the Development of Resistance

The major factor influencing the rate of development of resistance in the worm population is now thought to be the proportion of the total population that is not exposed to treatment (referred to as the population in refugia). In drought situations where most of the free-living stages are killed, then nearly all of the worm population is in the sheep and is thus exposed to treatment. If sheep are treated under these circumstances and when conditions allow the development of the free-living stages (eggs and larvae) the pasture becomes re-populated with resistant worms that have survived treatment. Other important factors include the frequency of treatment, particularly the adoption of suppressive dosing regimes that only allow resistant worms to pass eggs on to the pasture. Underdosing also increases the selection of resistant parasites since it allows worms that carry some part of the genetic material associated with resistance to survive.

Strategies to delay the transmission and development of anthelmintic resistance

It is now generally accepted that the emergence of anthelmintic resistant worm populations is an inevitable consequence of precautionary chemical treatment against parasites, however the rate at which populations change from being essentially susceptible to anthelmintics to becoming resistant to them can be slowed down by adopting a series of measures that are designed to either prevent the movement of resistant worms onto the farm (transmission) or the selection of resistant populations. The principles underpinning this approach can be summarised within the acronym ACME.

Adopt an effective quarantine strategy

A well planned quarantine programme for replacement stock (sheep/goats) should reduce the likelihood of introducing anthelmintic resistant worms onto your farm.

Since most of the resistance in the UK is to drugs within the benzimidazole group (Group 1), it is a wise policy to treat all livestock arriving on the farm with drugs, from the other two families (the levamisole and macrocyclic lactone families). Although multiple resistant worms are relatively rare at present the use of two drugs applied sequentially (not simultaneously) at the full-recommended dose rate can increase markedly the efficacy of these drugs against these multiple resistant worms (see figure 2). To reduce contamination of grass with worm eggs, withhold animals from pasture for at least 24 hours (ideally 48 hours) after drenching with these anthelmintics.

Check that your current wormer is working

If you suspect that your wormer is not working effectively then consult your veterinary practitioner who can arrange for tests to be made to check the efficacy of your anthelmintics. It is important to remember that persistent scouring may be attributable to a variety of causes other than worms.


Monitor to treat the right parasites at the right time

Use mob faecal egg counts to decide when to treat and to identify the predominant parasites. Your practitioner or local veterinary investigation service can examine a pooled sample to decide if animals require treatment and importantly the species of parasites that need treating.

Ensure that you follow best practice advice

Risks Associated with Drenching Animals onto Clean Grazing

The practice of drenching animals and moving them onto clean grazing offers short term gains in terms of productivity since it limits the size of the challenge from pasture, however this practice also promotes the selection of anthelmintic resistant worm populations. The risk is associated with the resistant worms that have survived treatment and which will make a major contribution to the repopulation of the pasture



with parasites. Consult your practitioner or advisor to develop means of reducing the risk posed by this practice on your farm. e.g. give careful consideration to how such pastures are used subsequently and try not to rear replacement stock on them since they will be moved around the farm disseminating resistant parasites selected in this way.

Reduce the Frequency of Drenching

There is a need to minimise the number of parasite generations that are exposed to an anthelmintic. By integrating grazing strategies such as provision of 'clean' or 'low-risk' pastures, and mixed grazing of sheep and cattle, it should be possible to devise a policy which will avoid unnecessary drenching. The more frequently you treat your animals the more likely the risk of selecting for resistance. Consult your veterinary practitioner for advice to optimise the number of drenches per season.

Apply the correct dose of wormer

Anthelmintics should be used following the manufacturer's instructions as under dosing can select for resistance.

- Regularly check that the dosing gun is delivering the correct volume of drug by using a plastic measuring cylinder to calibrate the drenching gun. Adjust before commencing dosing.
- It is important to obtain an accurate weight of the groups of animals being treated as the dose is calculated as a volume per kg liveweight. Do not guess the weight of animals. Divide the livestock into groups of similar size and classes and weigh a few of the heaviest in each group and treat them all at this dose level. It is better to slightly overdose some individuals rather than underdosing any of the sheep within a group.

Make full use of the wormer families available

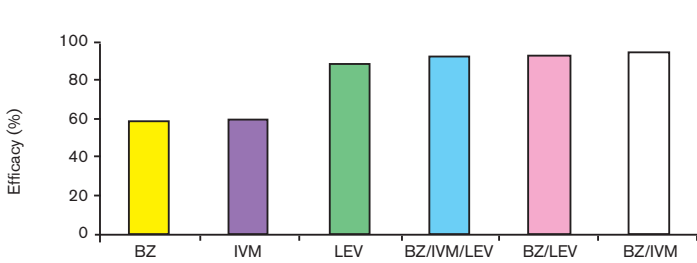
Resistance is more likely to develop if you use the same family of wormer year after year. It has been suggested that it is good policy to change families each year (not more frequently) in order to limit the extent to which resistance develops in a single season and to maximise the potential for reversion. If you have resistance against a single drench family then an annual three-drench rotation becomes impractical.



Multiple anthelmintic resistant worms may require sequentially administered treatments using two or more of the drug families. In any anthelmintic treatment strategy it is very important to make each treatment as effective as possible. Consult your veterinary practitioner or sheep adviser if in doubt about which anthelmintics to use and the most appropriate time to use them.

Correct drenching technique

To maximise drug efficacy orally delivered anthelmintic drenches should pass into the rumen (first stomach). However poor administration of drenches (into the mouth rather than over the back of the tongue) may result in the drug passing down the oesophageal groove, by-passing the rumen and entering the other stomachs directly. Since this will affect drug uptake and presentation it is important to ensure that the nozzle of the drench gun delivers the drug over the back of the tongue.



KEY
 BZ = benzimidazole IVM = Ivermectin LEV = levamisole
 BZ/IVM/LEV = sequentially administered benzimidazole ivermectin and levamisole
 BZ/LEV= sequentially administered benzimidazole and levamisole
 BZ/IVM = sequentially administered benzimidazole and ivermectin

Figure 2 The efficacy of single and sequentially administered multiple treatments given against a Scottish multiple resistant isolate of Ostertagia.

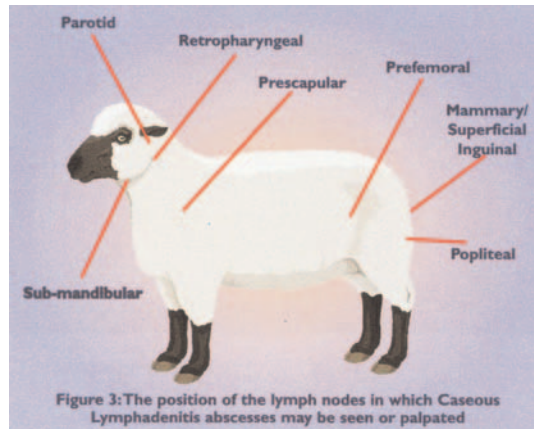
Caseous lymphadenitis

Graham Baird

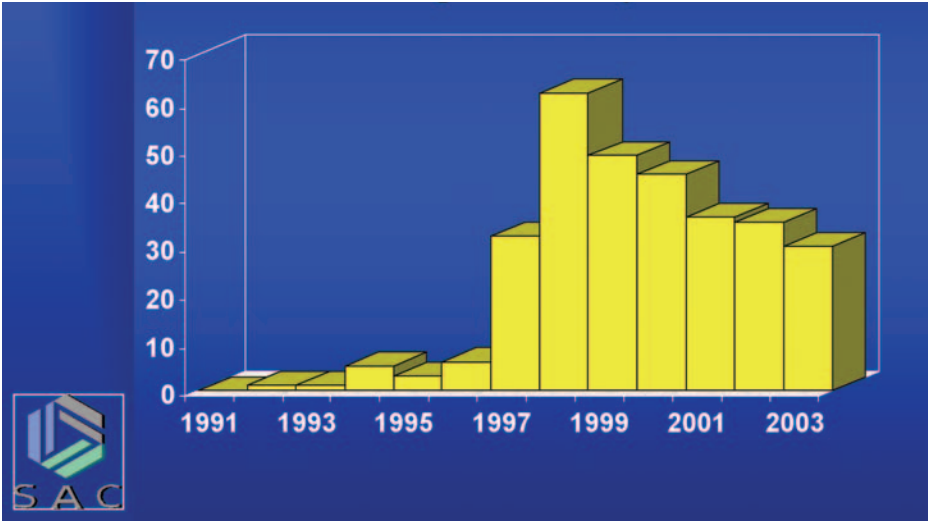
SAC Veterinary Division, St Boswells

Caseous lymphadenitis (CLA) is a chronic, suppurative disease caused by the bacterium *Corynebacterium pseudotuberculosis*. Although it can affect the number of domestic species and man, it is as a disease of sheep and goats that CLA is most important. The infection causes abscesses in the animal's lymph glands, these being outwardly visible as swellings at specific sites (see Figure 3 below) which may rupture and discharge pus. The disease occurs in most parts of the world where there is intensive sheep production. In countries such as Australia and New Zealand, CLA causes considerable financial losses through the condemnation and down grading of affected carcasses at meat inspection. In Australia, CLA is the most common bacterial disease of sheep and from abattoir figures, the leading cause of economic loss to the sheep industry. In the USA it is the third most important cause of condemnation at slaughter, although for every carcass condemned, ten are passed after removal of abscessed nodes. Infection in humans is occasionally reported tending to affect those like sheep shearers who may come into contact with pus from CLA abscesses.

The condition was first recorded amongst UK livestock in 1990 following the importation of infected Boer goats from Germany. Since then cases have been recognised in sheep flocks in England, Scotland, and most recently Northern Ireland. The number of diagnoses recorded at veterinary investigation (VI) Centres in Britain reached a peak in the late 1990's and has since declined slightly (see Figure 4 below). However, many in the Sheep Industry believe that CLA has continued to spread, partly because some vets are making the diagnosis of CLA without recourse to their local VI Centres. It also seems likely that some sheep breeders are either not recognising the problem or choosing to ignore it within their own flocks.



The position of the lymph nodes in which Caseous Lymphadenitis abscesses may be seen or palpated



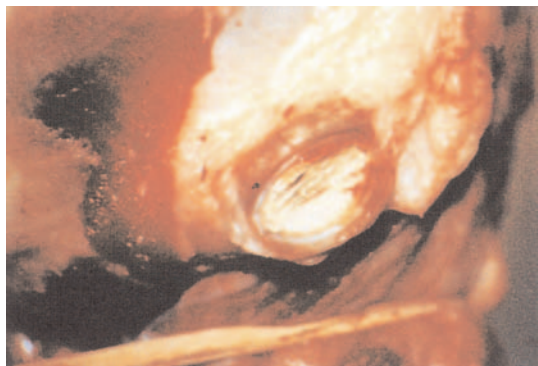
Outbreaks of Caseous Lymphadenitis in UK sheep flocks 1991-98 (source veterinary investigation Diagnosis Analysis VIDA)

Efforts have now been made to inform both sheep farmers and veterinary practitioners of the disease, and bacteriological examination of suspect cases is currently offered free of charge. It is likely then that at least part of this increase in confirmed outbreaks is due to an improved awareness of the condition on the part of the farmers and vets. It is certain however, that spread of infection is also occurring through the movement of infected animals between flocks.

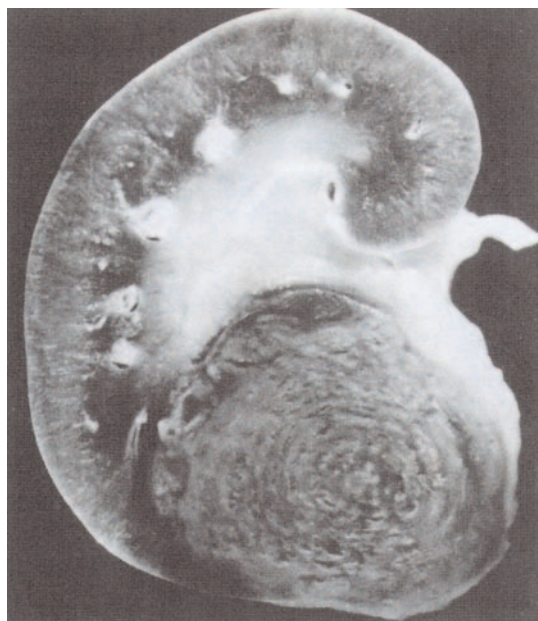
There is currently concern that CLA is most prevalent within terminal sire breeds, and that the spread of infection might be accelerated by widespread distribution of these sires through the rest of the UK industry. A recent survey carried out by SAC and funded by MLC indicated that as many as 18% of terminal sire flocks in Great Britain are infected. Experience of the condition in Scotland suggests that a disproportionate number of rams are affected by the disease. Indeed, in most flock outbreaks dealt with by SAC, the first animals to be identified with CLA have been rams. In one closely studied Scottish case, CLA has been shown to be transferred between two flocks, through the temporary loan of one ram for the duration of the breeding season.

CLA is effectively untreatable and the only vaccines presently licensed in the UK are of the autogenous type, which must be prepared for individual infected flocks.

Proprietary vaccines are available and widely used in other parts of the world, but as yet are untested and unlicensed in this country. In flocks where CLA is an established problem, control schemes aim at removing affected animals before they can act as a source of infection to others. At present this must be done by physically examining sheep for evidence of CLA, but in time it is hoped that a blood test may be available to identify those, which have the infection. In the absence of such a diagnostic test a policy of isolating young stock from all older sheep from weaning onwards, has been shown to greatly reduce spread of the infection amongst the younger groups. If no evidence of infection is apparent within these juveniles, they may be prepared for sale with a degree of confidence that the disease will not be passed on to potential purchasers.



Lymph nodes infected with CLA



A kidney with an abscess caused by CLA

Scrapie

Brian Hosie

SAC Veterinary Services

Information on Scrapie

Scrapie is a fatal brain disease of sheep and goats. It has been present in parts of the British sheep flock for over 200 years. By law, any animals that are suspected of having scrapie must be reported to the local Animal Health Office of the State Veterinary Service.

Although scrapie does not spread rapidly through a flock like a contagious disease it can build up over time to a flock problem that can reduce profits by increasing ewe losses. The disease is also important in international trade. Although scrapie has never been shown to be a risk to man, its presence in the national flock could mask cases of BSE. Although no case of scrapie which has been tested has turned out to be BSE, the Government does need to know about every case of scrapie. This is in order to assess each case, and to be able to reassure consumers that everything is being done to protect them against any risk of BSE from whatever source.

How do I know if my animals have scrapie?

There is often a general change in temperament or behaviour weeks before the more specific symptoms develop. In most cases animals will show a combination of symptoms, but none of the symptoms alone can be regarded as a diagnosis of scrapie. As a general rule scrapie should be considered in any sheep or goat over 12 months of age showing nervous or behavioural change. If there is no obvious alternative diagnosis, the case must be reported to your divisional Veterinary Manager for further investigation.

Irritation

- Repeated rubbing of flanks and hindquarters against objects.
- Repeated scratching of flanks.

- Nibbling or grinding teeth when rubbing themselves or when rubbed firmly on the back.
- Continued scratching of a shoulder or ear with a hind foot.
- Unusual or agitated nibbling of the feet, legs or other parts of the body
- Excessive wool loss or skin damage.

Changes in behaviour

- Excitability
- Drooping ears
- Increased nervousness or fear
- Lagging behind
- Aggression
- Depression or vacant stare

Changes in posture and movement

- Unusual high stepping trot
- Severe incoordination
- Stumbling
- Standing awkwardly
- Weak hind legs
- Unable to stand

Later symptoms

- Dramatic weight loss
- Death

When does scrapie occur?

Age: Most cases of scrapie occur in sheep between two and five years of age. Scrapie is very rarely seen in sheep less than one year of age or over five years old.

Numbers affected: There is a long incubation period so cases generally appear singly in flock. This is different from scab or mange, which spread quickly through flock.

Season: Cases can occur at any time of the year, but stress can cause the clinical signs to appear. Scrapie may therefore be more obvious at certain times i.e. lambing.

Development of symptoms: Most sheep show a gradual development of symptoms over a period of several weeks or even months, although in some cases condition may worsen rapidly.

What else could these symptoms be?

If single symptoms occur it is possible that other causes may be to blame:


- Irritation - can also be caused by ectoparasites i.e. scabs or lice.
- Changes in posture or movement- can also be caused by infection i.e. listeriosis or by metabolic disorders i.e. staggers or pregnancy toxæmia.
- As scrapie has a long incubation period the only certain way to find out if an animal is infected is to examine the brain tissue under a microscope after slaughter or death. There is no test yet, which can reliably identify the infection in live animals before they develop the symptoms.

What should I do if I suspect an animal has scrapie?

The penalties for not reporting suspected cases of scrapie are severe. Failure to comply can result in heavy fines or imprisonment. In addition scrapie compensation payments cannot be made.

Notify the Divisional Veterinary Manager (DVM) at the local Animal Health Office. A Veterinary officer will examine the animal to diagnose or rule out scrapie. There is no charge for this visit. If scrapie is suspected, the animal will be taken to a Veterinary Investigation Centre for post-mortem examination and the flock and or others associated epidemiologically with it may be placed under movement restrictions. Samples will be taken for diagnosis and research, and the carcase will be incinerated.

If the Veterinary Officer considers that the symptoms are not caused by scrapie, you should contact your Veterinary surgeon to discuss an alternative diagnosis or treatment. If the symptoms of scrapie recur you should report your suspicions again to the DVM.



If scrapie is confirmed, the Veterinary Officer will visit the farm to conduct an assessment and discuss the options with the flock owner. As a consequence of EU-wide legislation that came into force on 1 October 2003, due to be enforced in the UK in summer 2004, the flock may (i) be slaughtered and destroyed with compensation and the land remain fallow of sheep for 3 years or (ii) follow a programme of scrapie susceptibility testing, selection and culling under lengthy movement, sales and breeding restrictions. Support for the flock owner includes free genotype testing, compensation for slaughter animals and assistance towards the costs of buying replacement breeding rams that are highly resistant to scrapie.

Compensation

Compensation is paid for suspect cases of scrapie, which are slaughtered for diagnosis or consequently under the control measures. The rate of compensation has previously been paid at an average 'cull ewe' rate calculated and published monthly by DEFRA. Higher value animals may be compensated for at a higher rate, subject to official valuation. When the tests on the brain tissues are complete you will be informed as to whether or not scrapie has been confirmed by laboratory examination. This may take some weeks. A higher level of compensation may be paid where suspect animals are slaughtered, but the laboratory diagnosis is unable to confirm scrapie.

How do I stop my animals contracting scrapie?

It is not fully understood how scrapie is transmitted, but infected animals can transfer the disease from one flock to another. Infected birth fluids, membranes and placentas (cleansings) probably spread the infectious agent around the pastures or the building during lambing. Regular cleaning of buildings used for lambing may reduce exposure of the sheep to the agent. Timely and complete disposal of cleanings is considered to be particularly important. It is also advisable to avoid grazing sheep on pastures recently used for lambing ewes.

Susceptibility to scrapie is genetically controlled and a programme of blood testing and selection of breeding animals for resistance is the basis of the control of scrapie

in the European Union. In Great Britain the National Scrapie Plan is a voluntary scheme to increase the number of sheep genetically resistant to scrapie and related diseases. Breeding from animals that are resistant to scrapie will reduce the incidence of the disease and may lead to its eradication. Under EU legislation, the breeding for resistance programme will become compulsory in all Member States from 1 April 2005.

Scrapie Genotyping

The genetic basis for susceptibility to scrapie is now well recognised and it is fundamental to the control of scrapie and related diseases in sheep within the European Union. Genotyping is the testing of a blood sample to look for certain information on the sheep's prion protein (PrP) gene. The PrP gene is so called because it encodes for prion protein, protein which in a deranged or distorted form appears to be associated with the development of scrapie disease. An individual sheep has two copies of this gene, one inherited from each parent. Five different patterns of the PrP gene are recognised in sheep and each pattern is associated with a different degree of scrapie susceptibility or resistance. Breeds vary in the frequencies with which each pattern occurs.

The Government launched the National Scrapie Plan (NSP) for Great Britain in the summer of 2001 with the objective of reducing and eventually eradicating diseases like scrapie from the National Sheep Flock. The NSP is a long-term, voluntary plan which initially consists of a breeding programme to increase the number of sheep that are genetically resistant to scrapie. All owners of purebred breeding flocks are urged to enrol their flock in the NSP. All adult (stock) rams in the flock plus any male progeny that are to be used for breeding within the flock will be tested as a priority. A proportion of ram lambs born that year for sales will then be tested. If this does not meet the minimum number of animals for a cost effective visit, then additional ram lambs or females can be selected to bring the figure up to the minimum number. During the visit, the sampler will administer an electronic identification device (EID) to each sheep entering the scheme. The EID uniquely identifies each sheep and the EID number appears on the genotype certificate with the results of the test. The results are grouped into five risk categories. At present rams in the top three categories may be used for breeding. Those in the bottom two categories must be slaughtered or castrated. These criteria will be tightened progressively over the next few years such that only rams in groups 1 and 2 may be used for breeding. There is no restriction on the ewes but clearly flock owners are advised to select ewes from the three better categories. The speed at which this will be implemented depends on the frequency of the different genotypes within the breed.

Private genotyping services are available for the owners of flocks that do not qualify for the NSP or do not wish to apply at this time. Also some flock owners may wish to test sheep over and above those tested under the NSP. These flock owners can arrange for their sheep to be sampled by their own private veterinary surgeon and tested at private laboratories. These results remain confidential to the owner.

Further information

Please contact HCC's Industry Development Team

Tel: 01970 625050 or email: enquiries@hccmpw.org.uk

For further information on this brochure or the work of HCC please visit

www.hccmpw.org.uk