

Control, Treatment, and Elimination of Foot Rot from Sheep

W. Dee Whittier, Professor, College of Veterinary Medicine; Extension Animal Scientist, Virginia Tech
Steven H. Umberger, Professor, College of Veterinary Medicine; Extension Animal Scientist, Virginia Tech

Ovine foot rot was first reported in 1869. It is an infectious, contagious disease of sheep that causes severe lameness and economic loss from decreased flock production. In a Virginia survey, approximately 21 percent of the producers considered foot rot to be a serious health problem in their flocks. With current understanding of the disease, and aided by drugs and vaccines, control and elimination of the disease should be the goal of all sheep producers.

Ovine foot rot is caused by an interaction of two anaerobic (without oxygen), Gram (-) bacteria, *Bacteroides nodosus* (formerly *Fusiformis nodosus*) and *Fusobacterium necrophorum* (formerly *Sphaerophorus necrophorus*). *Fusobacterium necrophorum* is a normal inhabitant of the ruminant digestive tract and in wet weather may interact with another bacteria, *Corynebacterium pyogenes*, to produce foot scald, an infection of the skin between the toes. This infection sets up the foot for invasion by *Bacteroides nodosus*, which, working in conjunction with the *Fusobacterium*, produces the condition referred to as foot rot. Since *Bacteroides* can only live in the hoof of an infected animal or in the soil for no more than 10-14 days, it is possible, through careful management procedures, to keep from introducing foot rot into a flock and to successfully control and/or eliminate the disease if the flock is infected. See Figure 1 for a diagram of the predisposing factors for infection.

Diagnosis

Lameness is usually the major sign of an infected animal, although sheep with an early infection may not exhibit lameness. The area between the toes first becomes moist and reddened. Then the infection invades the sole of the hoof, undermining and causing separation of the horny tissues. The infection causes a characteristic foul odor and may infect one or more feet at the same time. Not all lame sheep have foot rot. Before undertaking an eradication, treatment, or control program, it is best to consult a veterinarian for a positive diagnosis and advice. Other diseases that may be confused with foot rot are foot abscesses, foot scald, laminitis or founder, corns, traumatic

injuries, and foreign bodies lodged between the toes.

Transmission

The bacteria that causes foot rot, *Bacteroides nodosus*, is spread from infected sheep to the ground, manure, bedding, etc., where it is then picked up by noninfected sheep. Foot rot is introduced by purchase of an infected animal or by simply using facilities or trucks that have been contaminated by infected sheep. Spread occurs best when temperatures are from 40-70°F and the environment is wet. Since the organism doesn't survive long in the environment (< 2 wks), carriers in the flock will continue to reinfect the flock unless the animal is either culled or the organism is eliminated by proper treatment.

Prevention

It is always easier and less expensive to prevent foot rot than to treat it after it has become established. To remain disease free, there are five management principles that will help keep foot rot from being introduced into a clean flock.

1. Never buy sheep with foot rot or from a flock infected with foot rot, even if the animal(s) appear unaffected.
2. Avoid buying sheep at sale yards or livestock markets where clean and infected sheep may have been commingled or run through the same area.
3. Avoid using facilities (trails, corrals, dipping areas) where infected sheep may have been in the last two weeks.
4. Never transport sheep in a vehicle that has not been properly cleaned and disinfected.
5. Trim and treat the feet of all new arrivals, then re-examine them periodically during the 30-day isolation period.

Treatment

The control of ovine foot rot is based on several management practices that decrease predisposing factors, and on the treatment and immunization of infected and susceptible sheep. The best results are obtained when several of the following methods are combined.

www.ext.vt.edu

1. Foot trimming: This reduces the number of cracks and crevices where bacteria can hide, removes infected hoof, and exposes the organism to air and various medications. All affected tissue should be trimmed away. Many times, this involves removing a large portion of the hoof wall as well as the overgrown portion. This is necessary if the medication and oxygen are to reach the bacteria and kill them. Foot trimming should be done at least one to two times per year as a part of normal management practices, and more often in conjunction with footbaths in the control of foot rot. When trimming feet, it is important to disinfect the trimming instruments (foot shear, hoof parer, or knife) between animals to prevent spreading of the infection. During a severe outbreak, trimming without any other treatment may actually increase the severity of the disease. If there are problems or questions on how much to trim, request the help of a veterinarian.

2. Footbaths/Footsoaks: There are two different types of solutions commonly used in foot baths: zinc sulfate and copper sulfate. For treatment, they should be used 1-2 times per week for several weeks. They may also be used routinely after foot trimming and as a preventative.

A) Zinc sulfate (10% solution = 16 pounds in 20 gallons of water) is perhaps the most effective and least toxic of the two baths. Tag wool should be added to all the solutions to reduce splashing and wastage and to discourage consumption by the animal as it stands in the solution. A surfactant or wetting agent (detergent) can also be added to the baths to increase their penetration into the cracks and crevices of the hoof. Use of zinc sulfate or copper sulfate solutions as a foot soak (30-60 minutes of contact) increases their efficacy in a treatment program. When designing the foot bath area, it is important that length of contact with the solution be kept in mind. Sufficient sized baths/soaks are necessary to handle the flock and allow sufficient contact time with the solution. Besides the footbath design included as Figure 2, some producers may find it easier and more cost-effective to design a concrete-floored pen that will hold a large number of sheep at one time.

B) Copper sulfate (bluestone) solutions (10% solution = 16 pounds in 20 gallons of water) are also useful but are toxic if consumed by the sheep. Hot water helps dissolve it, as does the addition of some vinegar. It is very corrosive so it should not be used in metal foot baths. It also stains the wool.

3. Dry chemicals: Zinc sulfate (dry) can be placed in a box in an area sheep must walk through. This will not treat infected animals, but will help decrease the spread of the disease. Lime, disinfectants, or drying agents may be used around feed or water troughs to reduce moisture and decrease the spread of the disease.

4. Oral therapy: Zinc sulfate at the rate of 1/2 (0.5) gram per day for 21 days may be helpful both in treatment and prevention, especially if the diet is zinc-deficient. High levels of certain antibiotics may also be helpful in some situations but should only be used after consultation with a veterinarian.

5. Injection of antibiotics: Penicillin and streptomycin combinations used either as a one-shot treatment (1 ml/8 pounds) or every day up to ten days has been proven to be effective in treating foot rot. Procaine Penicillin G or long-acting penicillin products at the same dosage may also be effective. Single injections of long-acting tetracycline have also been successful in some cases. Use of any of these should be after consultation with or by a veterinarian and should never be used on animals that are intended for slaughter before an adequate withdrawal time.

6. Topical medications: There are several different medications that can be applied to the hoof immediately after paring that are helpful in controlling foot rot.

- Zinc sulfate (10%) - 1/4 (0.25) pound in one quart of water.
- Copper sulfate (10%) in vinegar - 1/4 (0.25) pound in one quart vinegar.
- Copper sulfate in pine tar - 2 parts $CuSO_4$ in one part pine tar.
- Oxytetracycline solution in alcohol - one 25.69-gram pkg to 1/2 cup water, then add alcohol to bring solution to 2 quarts.

Figure 1

PREDISPOSING FACTORS

WARM, WET WEATHER
INJURY TO INTERDIGITAL SKIN
OVERGROWN HOOVES

INTERDIGITAL SKIN IRRITATION

<p><u>CONTAMINATED</u> PREMISES</p>	<p><u>FUSOBACTERIUM NECROPHORUM</u> (from intestinal tract or lesions)</p> <p>+</p> <p><u>BACTEROIDES NODOSUS</u> (from infected sheep (clinical/asymptomatic))</p>
---	---

SKIN AND HOOF INFECTION (FOOT ROT)

e. Penicillin in alcohol - 5 million units of potassium penicillin G with 10 cc (ml) water, then add to 1 quart alcohol.

7. Vaccination: Vaccines for *Bacteroides nodosus* are approved for use in the U.S. They may range in effectiveness from 0-100 percent; most users report from 60-80 percent success. The vaccine works not only as a preventative but has been shown to be fairly effective as a treatment. A regimen of two vaccinations given subcutaneously on the neck just behind the ear 4-6 weeks apart is used. Vaccination before the start of the wet season is recommended, followed by a booster each year prior to the wet season if eradication efforts have not been successful. Abscesses are common at the injection site but should not be treated. These will usually break and drain on their own with no ill effects to the sheep. For this reason, vaccination of show animals or animals that may be going to slaughter soon may not be practical. As always, follow label directions carefully. In the eradication protocol, vaccination can be done six weeks prior to the start of the program and the booster can be given when processing is started. This can increase the immunity, and some healing may be taking place by the start of trimming. Some labor savings can be made by doing the first vaccination at the start of the eradication program. Also, there will be savings on vaccine because the clean group will not have to be vaccinated a second time. Discuss this process thoroughly with a veterinarian or an Extension Agent to determine the best approach.

Eradication

Using combinations of these procedures, foot rot can be eradicated. Eradication is difficult and requires commitment but is well worth the effort. In a comparison of treatments from recent studies (Table 1), it is apparent that eradication is possible using combinations of these treatment programs. It is also apparent from the following studies that no single treatment is effective. It must be a combination of the ones that best fit the facilities, management, and financial limitations of the flock owner/manager.

Table 1. Effectiveness of different treatments for foot rot.

Study One		
	Treatment	% Cure
Group 1	Soak	38.9%
Group 2	Soak and feed antibiotic	36.3%
Group 3	Vaccinate	36.5%
Group 4	Vaccinate and soak	62.5%
Study Two		
	Treatment	% Cure
Group 1	Soak and pare	85.5%
Group 2	Footbath and pare	66.5%
Group 3	Vaccinate and pare	94.0%
Group 4	Vaccinate, pare, and bathe	100.0%

(from National Wool Grower and Utah State University)

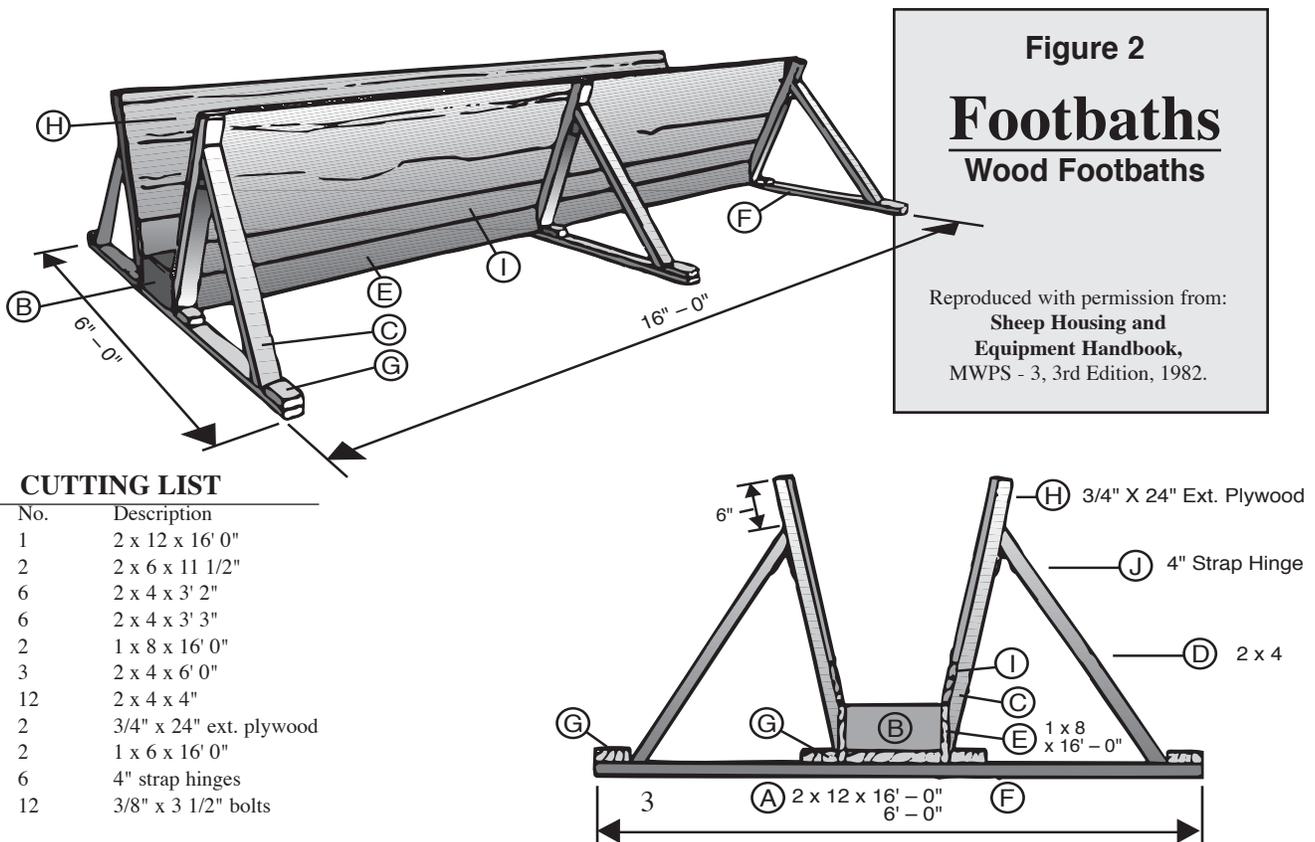


Figure 3 shows the basics that are necessary. The essentials of the program are the willpower to cull chronically affected sheep and those that do not respond to vaccination, antibiotics, foot trimming, and footsoaks/baths. Also important are a clean pasture or lot (no sheep with foot rot on it for more than 2 weeks minimum) to place clean animals on, and adequate fencing to assure that separation of clean and infected flocks is maintained. Any lame sheep in the clean group should be immediately examined or put in the “dirty” flock to prevent contamination of the clean flock.

Recent research points out that some sheep seem to be more resistant to foot rot than others. Ewe lambs should not be saved from ewes that have a history of repeat occurrences of the disease.

Summary

Foot rot is a costly disease to the sheep industry. Treatment costs of labor, drugs and equipment, decreased flock productivity, losses from sales of breeding stock, etc., make this disease an economic hardship for producers. But, with current technology, it is possible and practical to eradicate the disease.

Disclaimer

Commercial products are named in this publication for informational purposes only. Virginia Cooperative Extension does not endorse these products and does not intend discrimination against other products which also may be suitable.

Figure 3

ERADICATION PROTOCOL

Trim feet, vaccinate* and segregate the flock into two groups.

