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FOOT ROT IN SHEEP
Cause, Treatment and Eradication

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Foot rot is a common, contagious disease of sheep which causes severe lameness and production losses. The greatest economic loses are due to reduction in weight gains, decreased lambing percentages, lowered quality of wool, treatment and prevention costs, premature culling and reduced sale value of infected animals.

Foot rot is found worldwide, though it is most prevalent in warm, moist areas. It is seen in both acute and chronic forms, and affects sheep of all ages, especially those over a few weeks old.

Causes

Ovine foot rot is caused by two bacteria, Bacteroides nodosus and Fusobacterium necrophorum. F. necrophorum normally lives in the digestive tract of ruminants, the soil and manure. A milder foot infection, called foot scald, is seen during wet weather when the bacteria F. necrophorum and Actinomyces pyogenes react to produce a raw infected area between the toes. This raw area allows the skin to be invaded by Bacteroides nodosus, the true cause of foot rot. Bacteroides nodosus and F. necrophorum combine, to cause the condition known as foot rot.

The life span of Bacteroides nodosus is normally only 4 to 14 days when the bacteria is in the environment, but the bacteria can live for 2 to 3 years in the foot of an infected animal. Like many other microorganisms, B. nodosus varies in its ability to cause disease problems with

some farms having much more severe problems than others.

Risk Factors for Foot Rot in Sheep

Several factors make it more likely that foot rot will be more likely to be a problem on a farm:

- Foot Rot is almost always brought onto the farm with a purchased, infected animal.
- Farms that infrequently trim feet are more likely to have a problem with foot rot.
- Warm, wet weather, such as is seen in the spring and fall, makes foot rot more likely.
- Overcrowded housing and wet, muddy areas where animals congregate increases the rate at which the disease spreads.
- Long grass in pastures may irritate the skin between the hooves making it easier for the disease to become established.
- Some individuals seem to be more susceptible to foot rot than others.
- Sheep moved to new ground which has recently held infected sheep are more likely to become infected.
- Five to ten percent of infected sheep will become chronic carriers of the bacteria. Having these animals on the premise provides a continuous source of B. nodosus.

Diagnosis

In the early stages of foot rot, sheep may or may not be lame. In this stage of the disease, a reddened, inflamed area between the toes is often observed. Lameness and foul odor are characteristic signs in the later stages, and examination of the foot reveals separation of the horny tissue of the hoof.

Less common diseases that result in similar symptoms are corns, founder, foot scald, foot

abscesses, injuries and objects wedged between the toes.

Transmission

Foot rot bacteria are spread when susceptible sheep are exposed to infected bedding, ground or manure. The bacteria spreads best in a wet environment with temperatures ranging from 40-70 F. The bacteria do not survive in cold soil, so most flare-ups occur in the spring due to recontamination of the environment by carrier animals.

Unfortunately, most foot rot is purchased. Introduction of an infected animal can infect a previously clean environment for the rest of the flock. Carriers within the flock will continually reinfect the environment, so treatment or culling is necessary.

Spread of the organism is predominantly by other sheep, but it may be carried on boots, tires, feeders or hands as well. Sheep producers who are serious about keeping foot rot out of their flock will often insist that visitors wear disposable plastic boots. These boots may be obtained from many veterinarians or from animal health product suppliers.

Prevention

A large measure of dedication and some expense are needed for successful treatment of foot rot, so prevention is the best policy.

Rules to follow that help prevent foot rot in a clean flock:

1. Do not purchase sheep with foot rot or from an infected flock.
2. Do not purchase sheep that have been through an environment (public auctions, markets, etc.) through which infected sheep may have recently passed.
3. Do not use areas or vehicles where infected sheep may have been in the last two weeks.

4. Isolate all new sheep on the premises for 30 days. Examine and trim feet on arrival. Repeat in 3 weeks.

5. Consider vaccination for foot rot. Discuss this practice with your veterinarian. Effectiveness as a preventative has been reported to range from 60 to 80 percent with immunity lasting only 4 to 12 weeks. Vaccinate at 4 weeks or more before foot rot is likely to occur on the farm. Follow label directions for best results. A vaccination knot normally develops at the vaccination site.

6. Foot trimming the entire flock at least twice a year results in healthier, less susceptible feet and earlier diagnosis of a foot rot problem.

Treatment

When prevention fails, foot rot must be treated. Success in eradicating foot rot requires aggressive treatment of the disease and management of predisposing factors. The best results are obtained when a combination of control approaches are implemented (Table 1).

Following are a number of measures which have proven successful in a foot rot treatment program.

1. Foot trimming: This is an absolutely necessary part of a successful foot rot control program. Use at least two pairs of shears. Soak shears between each animal in commercial disinfectant or bleach. Trim closely, leaving no hidden pockets in which bacteria thrive. This will invariably cause some amount of bleeding. Put all foot trimmings in a plastic bag and dispose of them or burn them, as they are another source for recontamination of the environment. Keep dogs away from the foot trimming area as they will pick up the trimmings and

spread them around. Examine and retrim at 4 week intervals until 2 checks have been done with no foot rot found.

2. Foot soaks: Sheep should be allowed to soak in one of the following solutions for about an hour. Construct a foot soaking bath that allows several sheep to be treated at once. Construct this bath with smooth sides and no "lip" or other protrusion that will allow sheep to climb out of the solution.

The recommended solutions are:

a. Zinc sulfate (10 percent solution = 16 lbs. in 20 gals. of water). For best results, add a surfactant or wetting agent (Example: 0.2 percent volume per volume of liquid laundry detergent, i.e. 2/3 cup detergent/20 gal. water).

b. Copper sulfate (bluestone, Blue Vitriol) solutions (10 percent = 16 lbs. in 20 gals. water). Note: copper sulfate is corrosive and toxic if consumed.

c. Formaldehyde solutions have been used in the past but this harsh chemical is difficult to buy, is classified as a cancer causing material and difficult to dispose of safely.

d. Putting discarded wool in the bottom seems to help the foot soak up the solution.

3. Area decontamination: Another method for "arresting" foot rot is to use dry chemicals (Zinc sulfate and hydrated or "slake" lime) and/or disinfectants (½ strength bleach or chlorohexadine at label dilution) as a decontaminant for infected areas. These prevent spread and are not, strictly speaking, a treatment,

but should be used in conjunction with other treatment steps to improve success rates.

4. Oral therapy: Zinc sulfate ½ (0.5) gram/day for 21 days administered in bolus or drench.

5. Injectable antibiotics such as, Procaine penicillin G or tetracycline are available. Discuss this with your veterinarian and administer according to label directions.

6. Topical medications are available for applying to the infected area(s). It is often best to use after trimming the feet. Adding a squirt or two of liquid detergent to the solution seems to help the solution stick to the foot better.

7. Recommended topicals include the following:

    a. Zinc sulfate (10 percent) in Vinegar - 0.25 lbs. in one quart of water.

    b. Copper sulfate (10 percent) in vinegar - 0.25 lbs. in one quart of water.

    c. Copper sulfate in pine tar - 2 parts copper sulfate in one part pine tar.

    d. Oxytetracycline solution in alcohol - one 25.69 gram pkg to ½ cup add alcohol to make a 2 quart solution.

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

    f. Tylocine and Erthromycin mixed 1:1 with DMSO has been used successfully but this is an off label use and these drugs may not be available.

8. Vaccination for foot rot is used as a treatment as well as a preventive. Consult your veterinarian when using the vaccine as a part of a total treatment program.

Vaccination usually leaves a knot or lump at the injection site. Effectiveness for the vaccine when used as treatment is reported to range from 60 to 80 percent.

Additional Pointers for Controlling Footrot

Following are some additional facts and hints that may assist sheep producers in controlling foot rot:

1. Isolation is vital for controlling foot rot. All sheep should be inspected on a regular basis. Isolate and treat all suspects.
2. Foot rot cannot be prevented or treated by nutritional means alone, but good nutrition is a great asset when combatting any disease. Adequate salt/mineral mixes containing iodine should be available. A good mixture will also contain vitamin A & E and the minerals selenium and zinc.
3. Solutions (bleach, hydrogen peroxide) other than zinc or copper sulfate and formalin will kill the bacteria that cause foot rot but they have a poor residual effect.
4. Foot baths may also be used for people who are entering a sheep facility. A solution often used in personnel foot baths is diluted bleach (1 part bleach to two parts water). These baths should be used by all personnel traveling through foot rot infected areas.
5. Discarded zinc solutions used in foot baths will kill vegetation and build up in the soil.
6. There are 20 known strains of B. nodosus, the bacteria that causes foot rot. Available vaccines don’t contain all strains.

7. Foot rot also occurs in a mild or benign form called foot scald. This is also caused by B. nodosus, but with a less virulent form of protease (protein-digesting enzyme) produced by the bacteria. When milder symptoms are seen, they often heal spontaneously. Foot scald is often seen when sheep are kept in mud or wet manure for several days.
8. Signs of lameness usually appear within 20 days after introducing susceptible sheep to a contaminated area.
9. Formalin tends to harden the hooves, especially with repeated uses.
10. To accomplish eradication, foot soaks should be repeated on a weekly basis for four to six weeks for one hour each.
11. Design foot baths without protrusions that sheep may attempt to climb during their soaking period.
12. Vaccinate (see prevention steps).
13. Cull extreme cases. Some sheep are more prone to foot rot than others. Removing sheep that have extremely serious foot rot is important. It is possibly even more important to cull sheep that come down with foot rot more than once or which do not respond well to treatment.
14. Foot rot can be eradicated from a flock. For a large flock a turntable and alley way are very helpful. Consider using the following program:
    a. Trim the feet on all sheep and check for foot rot
    b. Sort the sheep into an non-infected sheep into a pasture that has not held any sheep for at least 2 weeks.

c. Treat the infected sheep as indicated above with foot soaks and topical treatment.

d. Put the infected sheep in a pasture where they cannot share ground with the noninfected ones.

e. Resoak and retreat the infected sheep's feet twice a week.

f. Once the infected sheep have gone for 2 weeks without signs of foot rot, add them to the infected flock.

g. Any sheep still having foot rot after 8 weeks should be culled.

h. Sheep should not be allowed access to the pasture where the infected sheep have been for at least 2 weeks after the pasture has been emptied.

Table 1
Cure Rates with Various Foot Rot Treatment and Treatment Combinations

Treatment	% Cure
Soak & feed antibiotic	36.3
Vaccinate	36.5
Soak	38.9
Vaccinate & soak	62.5
Footbath & trim	66.5
Soak & trim	85.5
Vaccinate & trim	94.0
Vac., trim, & bathe	100.0

(SID Sheep Production Handbook; see resource list at end)

Summary

The economic impact on the sheep industry caused by foot rot is due to:

1. Reduced productivity
2. Losses from the sale of replacement animals
3. Increase cost in labor, drugs and equipment

Eradication of foot rot is possible if there is dedication to implementing an effective treatment/prevention program.

For Additional information:

1. Sheep Producer Fact Sheet No. 3, 4, 5, 6, 7, 8, 9 by Bill Kruesi. RD1, Box 549, Wallingford, VT 05773.

2. Jensen & Swift's Diseases of Sheep, Cleon V. Kimberling. 3rd edition. Lea & Febiger. 1988. Pp. 317-320.

3. A Practical Guide to Sheep Disease Management by Norman Gates. 2nd edition. News-Review Publishing Co., Moscow, ID. 1985. Pp. 48-60.

4. Current Veterinary Therapy, Food Animal Practice, 2nd Ed. By Jimmy Howard. W. B. Saunders Co., 1981. Pp. 1107-1108.

5. Veterinary Medicine, 6th Ed. by D. C. Blood, O. M. Radostitis, J. A. Henderson, Basilliere Tindall-London. 1983. Pp. 665-669.

6. S.I.D. Sheep Production Hand Book by Sheep Industry Development Inc., 1988. Pp. 40-43.

7. Kimberling, C., Ellis,R. Advances in the Control of Foot Rot in Sheep: In Advances in Sheep and Goat Medicine. Veterinary Clinics of North America-Food Animal Practice, November 1990,Vol. 6, No. 3, Pp 671-679.

8. Sheep and Goat Medicine. David Pugh-Editor, WB Saunders. Philadelphia, 2002. Pp. 225-227.

9. Control, Treatment, and Elimination of Foot Rot from Sheep. Whittier, D, Umberger, S. Virginia Cooperative Extension Service. Publication No. 410-028, August, 1996.

10. Winter, A., Lameness in Sheep 1. Diagnosis. In Practice, 2004; 26:58-63.

11. Winter, A., Lameness in Sheep 2. Treatment and Control, In Practice, 2004; 26:130-132.

12. Ghimire,SC, Egerton,J, Dhungyel,O. Transmission of Virulent Footrot Between Sheep and Goats. Aus Vet J. 1999, 77:7, 450-453.

13. Wassink,G., Grogono, T., Moore,L., Green,L. Risk Factors Associated with the Prevalence of Footrot in Sheep from 1999 to 2000. Vet Rec. 2003, 15212, 351-358.