



# FOOT SCALD, FOOT ROT AND WHITE LINE DISEASE IN DAIRY GOATS

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**F**oot rot and foot scald are closely related conditions in goats and sheep. Foot scald, also known as “benign foot rot”, is a common inflammatory disorder affecting the interdigital skin and can progress to “virulent (or contagious) foot rot” in situations where the causative bacteria is more aggressive. The distinguishing feature of “virulent foot rot” is evidence that the inflammatory process has resulted in undermining of the axial (medial) wall and sole. A related disorder that is less commonly described, but equally if not more important, is white line separation, otherwise known as white line disease.

The purpose of the article is to explore these conditions in order to provide greater clarity on their recognition and insight on effective treatment and control measures.

## Benign Foot Scald and Virulent Foot Rot

**Benign Foot Rot (Foot Scald)** is an infectious disorder of the foot skin most frequently observed in sheep, and occasionally goats. Development of the disease is favored by warm wet weather conditions that predispose to foot scald by keeping the interdigital skin softer and thus more susceptible to superficial injury. The primary causes of foot scald are benign (less pathogenic) strains of *Dichelobacter nodosus*, often with secondary infec-

tions of other bacterial organisms including *Fusobacterium necrophorum*.

The earliest symptoms of foot scald are mild to moderate limping on one or more limbs. Closer examination of the foot, and in particular, the interdigital skin will reveal a raw to reddish interdigital dermatitis (inflammation of the interdigital skin) accompanied by a characteristic foul odor. Sensitivity of the interdigital lesion may be exhibited by applying direct digital pressure, such as with the tip of one’s finger, to the surface of the inflamed skin. Most animals will quickly react by withdrawing the foot.

**Virulent (Contagious) Foot Rot** is a relatively uncommon disorder in goats. Evidence suggests that

foot rot is more common in sheep. The primary clinical feature of foot rot, which differentiates it from foot scald, is undermining of portions of the hoof horn shell, primarily the sole. The ability of an organism to migrate or undermine the sole requires that it possess a powerful group of protease enzymes that are capable of dissolving hoof horn. Microbial organisms equipped with these potent and very destructive enzymes are found in the virulent strains of *Dichelobacter nodosus*, thus the term “virulent foot rot”.

## Distinguishing Virulent Foot Rot from White Line Disease

It is important to distinguish foot rot from other conditions of the foot or hoof that may appear similar. One of the most common of these in goats is white line disease. The white line is a structure best viewed by observation of the weight bearing surface (the sole) of the hoof. It is most visible in a black hoof appearing as a white line at the junction (i.e. in between) of the hoof wall and the sole. It is the softest horn within the claw or hoof horn shell (or capsule) and therefore vulnerable to the development

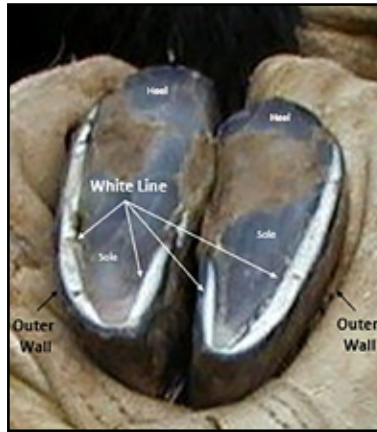


Figure 1. Weight bearing surface of the normal hoof showing the heel, sole and white line as they appear in a freshly trimmed hoof.

of small defects, microcracks and separation. Once these breaks and defects form within the white line horn, further enzymatic breakdown of white line horn occurs thanks to the presence of a multitude of putrefactive bacteria such as those found in benign and virulent strains of *Dichelobacter nodosus*.

It may be easiest to form a mental picture of how this disease develops by describing it in the context of what most goat owners have experienced when trimming feet. As most will know, hoof overgrowth in goats occurs as a flap of outer wall that grows over the sole. Moist organic matter, often mixed with soil and other particulate matter such as sand or grit, becomes sandwiched between this flap of wall horn and the underlying sole. This creates a near perfect environment for the propagation of a multitude of destructive bacteria that thrive in low oxygen environments. These organisms are specially equipped with highly potent enzymes (proteases and keratolytic enzymes) that eat away at the softer less resistant white line horn. Small cracks and defects that form within the white line as a consequence of poor horn formation or physical damage now become filled with organic matter giving these destructive bacteria an avenue to eat and dissolve away horn thus making it weaker and expanding the size of these cracks.

Soon the white line junction between the wall and sole begins to weaken and separate. Once weakened, continued separation is aided by weight bearing that mechanically forces additional environmental material into the separated area between the wall and the sole causing it to expand ever larger.

White line separations are readily visible during the trimming process once the flap of wall horn and entrapped organic matter (i.e. between the flap and sole) are removed. The separation appears as a dark area separating the wall from the sole and is fittingly called “white line separation”. When the separation has led to pain that may be causing abscess formation and lameness it is called “white line disease”.

## Treatment Recommendations

### Treatment of Foot Scald

Drier weather alone is sometimes sufficient to clear foot scald conditions. However, during periods when wet weather is unavoidable, early detection and prompt use of a disinfectant footbath is generally successful and prevents progression of the disease to foot rot. One

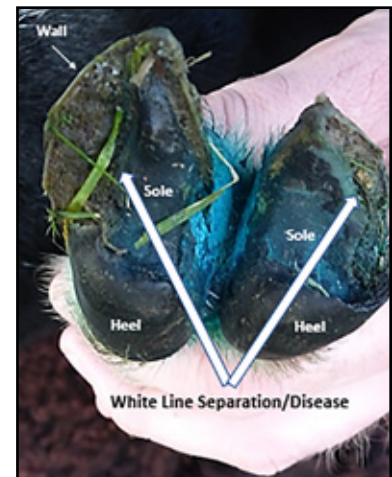


Figure 1. Weight bearing surface of the normal hoof showing the heel, sole and white line as they appear in a freshly trimmed hoof.

option for treatment of individual animals, is the use of a stand-in type footbath containing zinc sulfate at concentrations of 10%, 15% or 20%.

Frequency of treatment and length of time for exposure to the bath varies depending on whether the footbath solutions are intended for treatment, control or prevention. In most cases a period of 10-15 minutes is considered sufficient. Zinc sulfate can be purchased through most feed stores and comes as zinc sulfate monohydrate.

### Proper mixing tips of zinc sulfate

It is important to be sure that footbath solutions are properly formulated. Below are some tips on proper mixing of zinc sulfate to achieve the concentration desired for a footbath.

To determine the amount of zinc sulfate to be added to a rectangular footbath, first determine the footbath's volume (gallons). Multiply the Length (in feet), times the Width (in feet), times the Depth (in feet), times a constant of 7.48 - the result is the number of gallons in the bath.

Length (X) Width (X) Depth (X) 7.48 = gallons

Example for a footbath that is 3 feet long, 2 feet wide and 4 inches deep the calculation is as follows:  
3 feet (X) 2 feet (X) .33 feet (4 inches) (X) 7.48 = 14.8 gallons

Zinc sulfate is distributed as a water-soluble powder in 50 lb. or smaller bags. Therefore, in order to mix the zinc sulfate to a specific percent concentration (i.e. such as 10%), it's necessary to convert gallons to pounds. A gallon of water weighs 8.3 pounds; therefore, to make a 10% zinc sulfate solution for our example:

14.8 (total gallons of water in the footbath) (X) 8.3 lb. (weight of a gallon of water) = 123 lb. (total)

For a 10% zinc sulfate solution:  
123 (Total lb. of water in footbath) (X) .10 = 12.3 lb. of zinc sulfate

Footbaths can be constructed of wood with a water proof sealant such as silicon on the seams. Some may elect to use a plastic trays/tubs that can be fitted into a handling chute or alleyway as a walk-through footbath. Key is to find an area where the footbath can be positioned or located so that the entire herd or flock will have convenient

access to the bath.

### Treatment of Foot Rot and White Line Disease

Foot rot is a more severe condition. In addition to inflammation of the interdigital skin of affected feet, the infectious process extends beneath the medial wall and sole. Trimming with particular attention to the removal of all loose undermined horn is necessary to expose healthy tissues and alter the micro-environment to one that is less favorable to virulent strains of *Dichelobacter nodosus*. Once trimming is complete, the clippers should be disinfected before further use to avoid the risk of spreading virulent *Dichelobacter nodosus* to other uninfected animals. Animals with affected feet may be soaked or bathed in a disinfectant stand-in footbath (10% zinc sulfate) for a period of 5-10 minutes, and repeated at daily or weekly intervals until the disease is under control.

White line disease is treated most effectively by trimming away the separated wall horn and removing all organic matter and decayed/necrotic hoof horn. In most cases, one will encounter a new layer of wall horn will be present signaling that the healing process is already well underway. Nothing more is necessary unless there appears to be deeper infection or abscess formation. Antibiotics are rarely needed for foot rot or white line disease disorders, particularly if the above measures are instituted early-on in the course of the disease. Readers are advised to consult their veterinarian before instituting antibiotic therapy.

In summary, it is important that goat owners understand the difference between foot scald, foot rot and white line disease and the most effective therapies for each condition. Prompt recognition and appropriate treatment are the keys to managing these important causes of lameness in goats. ■