Texas Dairy Matters

Higher Education Supporting the Industry

Effectiveness of footbath design and solution on lameness rates in dairy cattle

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Introduction

Lameness is one of the top four reasons for early culling in dairy herds following reproductive issues, mastitis, and poor milk production. In a study of 120 herds with a total of over 29,000 cows in Canada, primiparous lame cows have reduced milk yields of 1,788 to 2,844 lbs. which led to profit losses on their first lactation ranging from $419 to $862 compared to non-lame cows¹. Another study estimated lameness costs are $178 per case with the average cost per case of sole ulcer, digital dermatitis, and foot rot being $216, $133, and $121, respectively². Thus, demonstrating the financial impact of lameness.

Disinfecting footbaths are commonly used to prevent infectious foot diseases such as digital dermatitis (hairy heel wart) and interdigital dermatitis which cause lameness³. However, a wide variation exists in footbath design and solution use. Copper sulfate, formaldehyde, glutaraldehyde, quaternary ammonium, inorganic, and organic acids are disinfecting agents used to combat infectious sources of lameness⁴. Products such as copper sulfate are the gold standard in the industry but have harmful effects on the environment. It is necessary to investigate and compare footbath designs and solution types to determine a method that works best for your farm.

Disinfectant Choice

A survey of 65 free-stall dairies with from five different countries found that 42% of herds use more than one disinfecting agent⁵. Copper sulfate was the most commonly used antibacterial agent, with 63% of the herds using concentrations from 1 to 10%. Formaldehyde was used by 34% of these herds with concentrations from 2 to 5%⁵. Another study with 141 Canadian free-stall dairies reported 62% of herds used more than one product with 41% of herds using copper sulfate and formaldehyde, 37% using only copper sulfate, 15% using only formaldehyde, and 7% using other products⁶. Several footbath agents are marketed to the dairy industry; however, alternative products are untested and unregulated given the perceived efficacy of copper sulfate and formaldehyde. If other products such as glutaraldehyde, quaternary
ammonium, and inorganic and organic acids are more tightly controlled and researched, there is a potential for these products to be efficacious.

Examples of Footbaths

**Water-Based Hoof Washer:** Because some disinfectants are unfavorable for the environment and carcinogenic towards humans, washing hooves with water is an alternative method as opposed to products such as copper sulfate and formaldehyde. When an animal passes through a hoof washer, the hooves are cleaned with water and a small amount of antimicrobial soap. The hoof washer is a box with four nozzles that spray the cattle’s feet. Once the system has been installed, it requires minimal maintenance. Experiments conducted in seven Danish dairy herds using automatic hoof washers examined the effects of cows whose hooves were washed with water and a 0.4% soap solution compared to cows whose feet were washed with water only. Cows washed with the soap and water solution had a 48% increase in the odds of contracting digital dermatitis, while cows washed with water had an odds ratio of 1.27. The study found that washing the hooves with soap and water was more effective than only using water, and it did not require the use of antibiotics or other chemicals.

![Example of a water-based hoof washer. Picture from Thomsen et al., 2012](image)
Automated Footbath: Implementing a proper footbath system is critical to improve foot health. Automated footbaths aim to improve efficacy by reducing human error, maintaining consistent chemical concentrations, and ensuring accurate frequency of use, steady refill and emptying of solutions. It is recommended that an automated footbath system be 3 meters long, 0.25 meters wide and 0.15 meters high. Your footbath setup should include a center grate, rubber flooring, side walls and a flush door. Maintenance of the footbath system should include a daily checkup to ensure it is functioning properly, flushing footbath contents, and refilling the solution as required. If using 5% copper sulfate, it is recommended to replace the solution at a maximum of 200 cow passes. While copper sulfate and formaldehyde are known to reduce the prevalence of digital dermatitis, interdigital dermatitis and heel horn erosion these products have been linked to hazardous runoff water and carcinogenic effects, respectively.

![Figure 2. Example of a recommended design for an automated footbath. Picture from Solano et al., 2017](image)

Conclusion
Preventive programs that include hoof trimming, footbaths and optimum cow comfort (lying surface, and heat abatement) are necessary to reduce lameness rates. Products such as copper sulfate are the gold standard in the industry but have harmful effects on the environment. Having systems in place such as water-based hoof washing or a flush system are helpful for the environment, but are not as effective at preventing sources of lameness when compared to the automated footbath. Carefully assessing your footbath program and using a product that is safe and effective is critical to reduce lameness on your farm.
References


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