Past, Present and Future of Footbaths in Alberta

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Take Home Messages

- Footbaths are an essential component of claw health management.
- Footbath location should allow undisrupted cow flow, and preferably allow passage of young stock, dry cows and new additions to the herd.
- Footbaths should have proper dimensions.
- Not all products available are equally effective.
- Not all products available on the market have proven efficacy.
- Not all products work effectively when contaminated with manure.
- Adequate frequency of use and product concentration are essential.

Introduction: The 5 W's of Footbaths in the Dairy Industry

Who

Worldwide, footbaths are considered to be an important component of a preventive claw health program. They play an important role in controlling potential contagious hoof disorders such as digital dermatitis (DD; aka hairy heel warts, strawberry heel warts, Mortellaro's disease). With the dairy industry moving away from tiestall housing, management in freestall housing with slatted or concrete flooring has lead to a more frequent occurrence of

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infectious claw lesions. Although footbath products are not registered for treatment of claw diseases, they are sometimes used as a curative measure.

What

What is a footbath? Although the term “bath” makes us think the feet are bathed in a solution, dry footbaths have also been introduced. Mostly, footbaths are referred to as solution filled baths aiming for cleaning and disinfecting the feet of cows.

Where

Where can footbaths be used? Footbaths are an important component of the management of both pastured cows and cows housed indoors. The first step in installing a footbath is to determine the location of the bath; it must allow for undisturbed cow flow. Most often a position is chosen where cows exit the milking parlor; in pasture settings, outdoor locations can be identified too. These locations are chosen where all cows need to pass on a daily basis, without the opportunity to avoid the footbath. To allow for easy use of footbaths, filling and draining ease must also be considered when identifying the location. Preferably, cows should enter the footbath with minimal manure on their feet, and exit onto a clean floor to allow the product to work on clean skin. The use of footbaths for non-lactating animals or animals newly added to the herd might be a driver to identify an alternative location that allows for heifers and dry cows to walk through the bath.

The size of the footbath is also very important. Ideally the solution in the bath should reach the skin of the foot over the coronary band. This meets the recommendation of a footbath solution depth of approximately 10 cm (4 inches) when the last cow walks through the footbath.

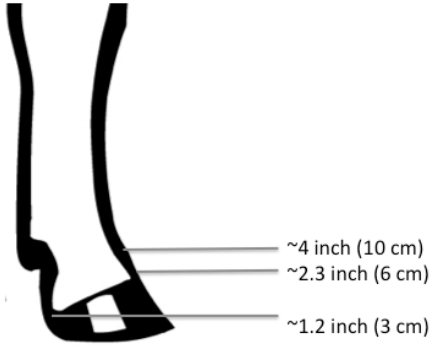

Figure 1: the preferred depth of the footbath solution

University of Wisconsin researchers recommend a footbath 3.0–3.7 m long and 0.5–0.6m wide, with a 28 cm step-in height (Length: 10–12 feet, width: 20–24 inches and ~11 inch deep; Cook et al., 2012). These dimensions optimize the number of foot immersions per cow pass, while limiting the footbath volume. The bath should not be perceived by the cow as an obstacle; it should allow cows to freely step in and out of the bath. The footbath should have a textured bottom or otherwise provide enough grip (i.e. footbaths with a sponge) for the cows to safely walk through without the risk of slips and falls.

When

Footbaths should be used for the control of infectious claw/skin diseases and potentially for hardening of the claw horn. When footbaths are used in temperatures below 10°C, the efficacy of the product (e.g. formalin) will drastically decrease. This can be mitigated using warm(er) water and storing solution at room temperature. If the solutions sticks to the cow's claw skin, the interdigital space is likely back to body temperature within 3 minutes.

If the solutions are left overnight or between milkings in colder temperatures, reduced efficacy should be anticipated. In high temperatures solutions might evaporate or precipitate, also negatively impacting the efficacy. A general recommendation is to refresh the solution after 200 cow passes. This number is somewhat variable and should be optimized for each farm, taking into account herd size, contamination with organic material, temperatures etc.

Why

Through the use of footbath solutions, cow's claws can be disinfected. This is needed in the control strategy for infectious claw diseases. Certain solutions like formaldehyde may help in hardening the horn of the claws, thus making the claws more resistant to non-infectious claw disorders (Arkins et al., 1986).

▪ Use of Footbaths in North America

Past

As was recently reviewed by Barkema et al. (2015), in North America, dairy cows are predominantly housed in tie- or freestall barns. Although there are considerable regional differences in housing type, a significant but decreasing proportion of dairy herds are housed in tiestalls. With increasing herd size and where freestall barns are the predominant housing system, an increase in infectious claw diseases is commonly observed, resulting in the need for preventive measures like footbaths.

Present

In 2011-2012, Dairy Farmers of Canada, along with Alberta Milk and ALMA, funded a research proposal investigating cow longevity and comfort. Part of this assessment focused on lameness and lameness management. In Quebec, Ontario and Alberta, a footbath was routinely used on 122 farms, which represented 87% of all farms visited. Smaller herds (below 100 cows) were less likely to use a footbath (Solano et al., 2015). One to 4 products were used per farm, the most common being copper sulfate and formaldehyde, with median concentrations of 4.5% (ranging from 0.3 to 12.5%) and 5% (ranging from 1 to 10%), respectively. On farms where footbaths are present, half of the farms visited used footbaths two days/week and the other half used them more than two days. Footbaths were more frequently used on farms with lower lameness prevalence (Table 1).

Table 1. Footbath management variables for dairy herds with low, medium and high lameness prevalence (Solano et al., 2015).

	Herd level lameness prevalence			
	Low (≤ 10%) n = 24	Medium (10 - 30%) n = 94	High (≥ 30%) n = 23	Overall n = 122
Footbath product (%)				
Copper sulfate	38	38	35	37
Formaldehyde	5	16	20	15
Copper & formaldehyde	52	40	35	41
Other	5	6	10	7
Number footbath products (%)				
1	29	41	35	38
2	57	44	50	47
≥3	14	15	15	15
Footbath frequency of use (%)				
≤ 2 d/wk	38	51	50	48
> 2 d/wk	62	49	50	52
Footbath dimension (median)				
Length (cm)	186	186	220	208
Width (cm)	76	72	73	74
Depth (cm)	15	16	15	15

Note: the overall category excludes 19 farms that had a footbath, but rarely used it

Cook et al. (2012) studied freestall-housed dairy herds with an average herd size of 1023 milking cows in 5 different countries (US, Spain, Japan, UK and New Zealand), and found that footbaths were used 1–4 times per day for 1–7 days per week, with between 80 and 3000 cows passing through the bath between changes of the chemical solution. Similar to that found in Canada, the most common agents used were copper sulfate (63%) and formalin (34%). Twenty-seven herds (42%) used more than one chemical. The median footbath was 2.03 m long by 0.81m wide (80 x 32 in), and was filled to a depth of 0.11 m (4.3 in).

▪ Efficacy of Footbaths

Footbaths Used in a Standardized Manner

We performed a follow-up study on 9 Alberta farms to evaluate what happens to the prevalence of DD if a standardized footbath is implemented. The prevalence of DD in the lactating herd was followed over a period of 4 months. DD scoring was done every 2 weeks in the milking parlor and confirmed with the observations in the trimming chute. For DD diagnostics we used the so-called M-score, that classifies the foot in 5 categories: M0 (no lesions), M1 (small early lesion), M2 (larger active lesion), M3 (healing lesion), M4 (chronic lesion) and M4.1 (chronic lesion, with an active M1 lesion) (Berry et al., 2012). Two months after the start of the study an automated footbath was implemented, with a computer-based weekly protocol of 2 consecutive days (4 milkings) using 5% copper sulfate. Controlled concentration and programmed refreshing of footbath solutions resulted in a decrease in DD on these dairy farms. All farms had a significant increase in M0 scores from 31 to 40%, whereas cows diagnosed with active M2 lesions transferred to more chronic stages of the infection (M3-M4). Cows affected with active M2 lesions decreased from 41 to 25%, whereas M3-M4 lesions increased from 28 to 35%. This shows that when footbaths are well designed and carefully used, the prevalence of active DD lesions will decrease dramatically (Student presentation Laura Solano; WCDS 2015).

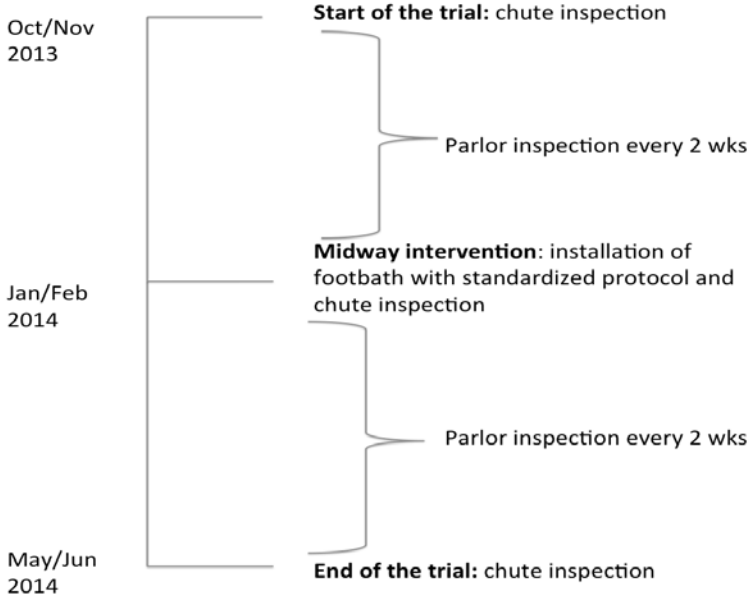

Figure 1. Timeline for DD prevalence study with implementation of standardized computerized footbath protocol.

Footbaths Used More Frequently

Our group performed another study on 10 Alberta dairy farms; 5 farms were assigned to an intensive copper sulfate protocol (5% solution, once a day, Monday–Friday), and 5 farms did not change their previous footbath protocol (non-interference). We scored the DD lesions of hind feet of all lactating dairy cows, every 3 weeks in the 5 times/week group and every 6 weeks in the non-interference group, respectively. Scoring was done in the milking parlor using the M-scoring system of Berry et al. (2012).

The farms that used the intensive copper sulfate footbath protocol experienced a decrease of all DD lesion stages and maintained a low prevalence of active lesions compared to farms with less specific and less frequent protocols irrespective of product used. Optimal frequency of footbath use to maintain low DD occurrence appeared to be >2/week, regardless of product used. This frequency results in active DD occurrence equal to the intensive copper sulfate protocol (Student presentation; Casey Jacobs WCDS 2014).

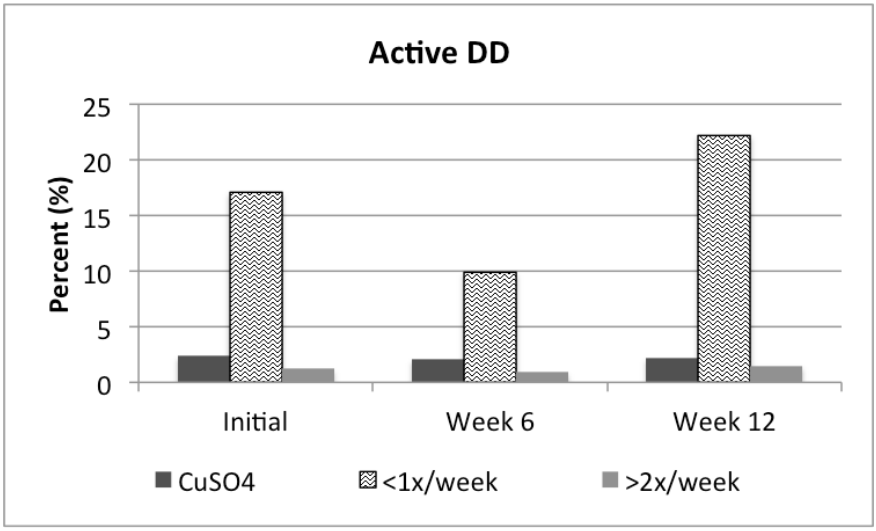

Figure 2. The impact of frequency of footbath use on prevalence of active DD lesions.

Our results are in line with a study conducted in the UK in 2012. Comparing the impact of weekly footbathing versus every other week with 5% copper sulfate, none of the cows had active DD lesions (M2) at the end of the study; however, in the group that was treated weekly, more cows had fully cured (M0) and had no lesions at all. When comparing a biweekly to a monthly application of copper sulfate, significantly more cows had active lesions in the

monthly treatment, indicating that more frequent use is necessary (Speijers et al., 2012). In an additional study from the same research team comparing both copper sulfate and hypochloride to no treatment, copper sulfate was the only footbath solution that was consistently effective for treatment of DD (Speijers et al, 2010).

▪ Future

Examples of Published Field Studies on Footbath Products

With concerns over use of antibiotics, environmental and carcinogenic impact, many new products are currently being tested in the field. Smith et al. (2014) determined the effect of a tea tree oil and organic acid footbath solution (Provita Hoofsure Endurance) on DD in dairy cows. The tea oil product resulted in similar outcomes compared to copper sulfate and the authors concluded that both products effectively reduced the active DD comparing the start to the end of the trial (Smith et al., 2014).

Teixeira et al. (2010) studied the effect of Dragonhyde, a commercially available disinfectant, and found that Dragonhyde performed better than formalin and that there was no difference between copper sulfate and Dragonhyde.

Besides environmental concerns, risks for farm workers have also been identified as a side-effect of footbath use. Doane at al. (2014) evaluated the exposure of farm workers to formaldehyde through the use of formalin footbaths. Although fumes were formed, the measured formaldehyde concentrations were falling within the safety guidelines established by the Occupation Safety and Health Administration (OSHA) of the United States and not perceived harmful for the farm workers.

Finally, with the increase in automated milking systems (robotic milking), alternatives to footbathing are explored, like foot sprays. The aim of foot sprays is comparable to footbath solutions; disinfection of the hoof and skin of the foot.

A Laboratory Approach Towards Testing Effectiveness of Footbath Products

Many new products are currently being tested in the field, exposing cows to new products without proven efficacy. The results, although published, are often hard to compare as experiments are evaluated differently and also products and concentrations used vary.

Therefore, funded by ALMA and Alberta Milk, our research team is currently working on a project together with the University of Wisconsin (Dr. D. Döpfer) examining techniques to test footbath products in the laboratory. In this study, concentrations of footbath products are determined that both inhibit as well as kill bacteria that cause DD. We are also testing the impact of manure in the footbath. This laboratory testing will help identify products with the highest potential. Ultimately, a field trial on dairy farms in Alberta should be the next step; i.e., testing these most promising chemicals under field conditions. With that knowledge, we can improve prevention and control strategies.

A study from the team in Wisconsin (Kulow et al., 2015) determined the ability, in the laboratory, of the product Thymox to kill or inhibit various species of microorganisms associated with infectious causes of bovine lameness. This product was identified as an environment and worker friendly product. The team found that this disinfectant has the potential as an alternative antibacterial agent for footbaths. However, field trials are needed to determine its effectiveness for the control and prevention of infectious claw diseases.

▪ Conclusion

On farm, the right location for a footbath needs to be determined allowing undisturbed cow flow. The footbath should have proper dimensions so all feet are immerged. If possible, the cow's feet should be clean before she steps into the footbath and out onto a clean and dry floor. Finally, the right concentration of the right product needs to be used in a high enough frequency to allow for proper disinfection to help prevent infectious claw diseases.

▪ Good Resources

Websites

http://dairy.ahdb.org.uk/resources-library/technical-information/health-welfare/footbathing-and-lameness-effective-management-for-dairy-cows/#.VoRZp5MrJZ0

http://dairyhoofhealth.info/

Books

Hoof signals: http://www.roodbont.nl/en/bookshop/15_Koesignalen/96-228_Hoof-Signals

Bovine Laminitis and Lameness: A hands-on approach
Edited by: Paul R Greenough, FRCVS
ISBN: 978-0-7020-2780-2

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