Modern Hoof Care Management

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Abstract:
Lameness remains one of the leading causes of lost efficiency in cattle production systems. Furthermore, losses attributed to decreased reproductive and udder health performance are likely associated with initial hoof health problems that are not usually considered. Hoof care programs, involving interventions such as lameness detection, preventive and therapeutic hoof trimming or nutritional strategies are commonplace in well-developed dairy industries, but certainly inconsistently applied around the globe.
The objective of this abstract is to review the current standard hoof health programs, evaluate the background history that justifies the basis for these programs and justify a more sophisticated approach to maximize hoof health in dairy herds.

Current Hoof Health Programs. Lameness detection remains one of the pending subjects in even well run dairies. Traditionally, the prevalence of lameness has been evaluated based on visual assessment of locomotion. Unfortunately, given its subjective nature (Silva del Rio et al., ADSA-ASAS, 2015), the precision of lameness detection remains conditioned to the experience of the observer (Fabian et al, 2012) and the compliance with a systematic approach.

Lesion records have been also used to evaluate the hoof health status in the herd, sometimes as a complementary piece of information to locomotion assessment. Traditionally, lesion records have been stored in paper, with obvious limitations for their use and analysis, or in farm softwares that, although made their management easier, lacked standardization within and between farms. The industry has shown however this to be an actively developing area with the surge of multiple digital platforms serving as data recording and management tools, mainly used by professional hoof trimmers and less frequently used to modify farm level hoof health programs.

In general, and strongly dependent on the different production systems (pasture, freestalls, open lots, farm size…), cows have been recommended to be functionally trimmed at dry-off and at mid lactation (around 150 d). Variations in trimming schedules between the rearing systems have been primarily based on differences in hoof horn development, overall hoof health and the extent of the trimming "culture" in a given country. As expected, a wide distribution of lameness prevalence has been reported across production systems and regions. In example, Cook et al. (2003) reported a lameness prevalence of around 11% in the best 25th percentile of 30 farms surveyed in Wisconsin, and Von Keyserlingk et al. (2012), reported large differences between various regions in Canada and the US with alarming lameness prevalence ranging from ~30% to >50% of the herd.

The reality is that about one half of the adult cows visiting the trimming chute show some type of foot lesions in well-developed dairy industries where the cows are mainly kept in confinement (The Alberta Dairy Hoof Health Project, 2012). Specifically for the type of lesions, digital dermatitis represents 50% of them. When dealing with replacement heifers, the total percentage of animals with lesions is certainly less (~15%), and digital dermatitis is by far the most common lesion found (NAHMS, 2007).

History of hoof health management programs. The understanding of lameness in cattle has fundamentally evolved over the years. The initial systematic approach to foot problems was laid out by Toussaint Raven (1985) from a biomechanics perspective. The cow's anatomy and the natural progression from heifer to milk production defined the conditions that predisposed the animal to suffer from imbalanced hoof growth and therefore for the occurrence of lameness.

Years later, hand in hand with the improvements in nutrition and subsequently in milk production, much of the attention was diverted to the metabolic etiopathology of lameness problems. Subacute ruminal acidosis and the consequent inflammation of the hoof laminae became took the responsibility of how we understood lameness. However, much of the ideas about "laminitis" were brought by robust research developed in the horse hoof. Many of the trials trying to replicate "laminitis" in cows through changes in rumen conditions failed to reproduce the typical lameness observed in the field, and much of the pattern in seasonal non-infectious lesions remained unexplained by simply using the "metabolic perspective".

During the last decade, much of the attention shifted then to the study of the relationship between the cow and the environment as a determinant of lameness problems. The distribution of the different activities the cows do during the day, or so called timebudgets, and the interaction with different walking and resting surfaces was the subject of extensive research that really shed a lot of light on the understanding of the problem. Specific lines of research looking at the anatomy of the protective hoof fat pad and the relationship with body condition score, the traumatic origin of lameness due to suboptimal walking surfaces, the influence of social competition or the physiology around parturition and aspects of bone and epithelial development lead to recently concluding that lameness is likely a response to an inflammatory state of multiple origin (Newsome et al., 2016).

Modern approach and solutions to modern hoof health problems. Successfully managing hoof health requires the consideration of the different perspectives indicated above. Prompt detection of lameness, establishment of a correct trimming technique, trimming schedules and the evaluation of trimming records, adequate hygiene and use of well-designed footbaths, consideration of the timebudgets, precise nutrition and properly built transit surfaces are the factors to be managed in any hoof health program.

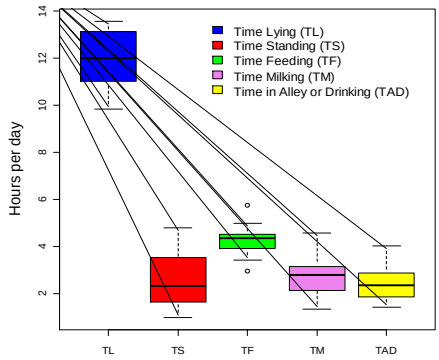

Figure 1. Timebudget of dairy cows (Gomez and Cook, 2010).

1. Lameness Detection: We acknowledge the benefits of systematically evaluating the locomotion status of the herd. The correct evaluation of the distribution of lameness severity across lactations and days in milk, can be used to have an approximate estimation of the losses in production performance, easily translated to marginal lost revenue. However, from a practical stand point, the goal in the farm should be, in my opinion, to have a simple and sensitive method of detecting lameness promptly. In example, if the 5-point locomotion scoring system is used, ONLY the locomotion 3 would be the real focus of an intervention or lameness detection, implying zero percent allowance for score 5 and 4. As importantly, the allocation of resources and compliance with the protocol aimed at finding locomotion 3 cows can make a difference on the final success.
2. Correct Trimming Technique: Very well-known is the fact that >90% of the lesions occur in the lateral toes of the rear legs. Only in a few specific cases lameness problems are more prevalent in the front legs. The gold standard trimming method ("Dutch method") was defined by Toussaint Raven three decades ago and still used by most of the professional trimmers. Other methods have been also described (Kansas method, white line method,…) but their use is less extended. Over time, trimmers and hoof specialists using the "Dutch method" have been putting a lot of attention on the rear lateral toe's care due to the higher proportion of lesions found in this toe but unfortunately, the recommendations on how to trim the medial toe have been "relaxed" a little bit. Although it has been originally described that the dimensions of the medial toe could serve as a reference to trim the lateral toe (its growth and wear are most of the times correct), it is not uncommon to see many professional trimmers removing more hoof horn than needed from this toe. The conscious review and eventually correction of the trimming technique is a fundamental part of a successful

hoof health program and as herds become larger the sensitivity to over- or under-trimming becomes more important.

Figure 2.Correctly trimmed foot according to the Dutch method.

3. Trimming schedules: The common approach in many farms with an organized trimming program is to trim cows at dry-off and mid lactation (~150 DIM). This schedule meets the needs of correcting any problem during the dry-off period as cows would be "resting" until calving, and there is a good opportunity to recover. The mid lactation trim at 150 DIM, however, might not be the most recommended practice. For each farm a careful study of the records/problems could help to establish the most appropriate moment to perform a trimming during the lactation. My recommendation would be to adapt the trimming, taking into consideration changes in management or environmental conditions overtime and, in general, perform a trimming during the lactation about two months before the median time of the main lesions occurrence.

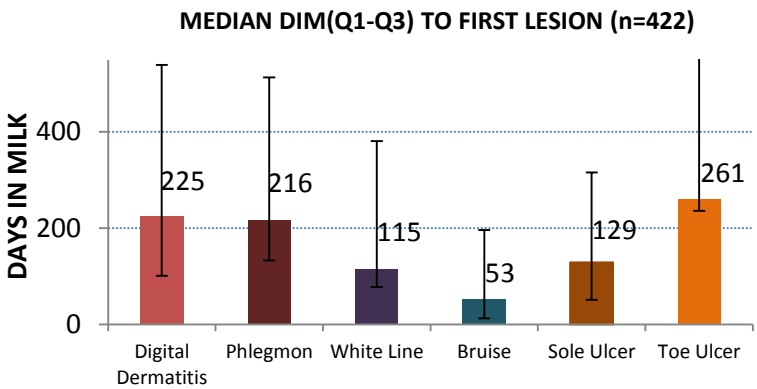

Figure 3.Distribution of time of lesion diagnosis by DIM in a 1000-cow dairy in Wisconsin.

4. Adequate hygiene and appropriate use and designed footbaths: Infectious problems are a function of infectious and environmental pressure and skin quality. Digital dermatitis is the most common hoof infectious lesion in cattle. During the meeting there would be extensive coverage of the topic and, from a practical stand point, I would like to refer to the abstract "Digital dermatitis: successful control".
5. Timebudgets and transit surfaces. Lying time can be used as a marker of cow comfort in confined dairy cattle. In relation to lameness, the influence of milking time, defined by the management practices and the design of the facilities, has been correlated with changes in behavior in lame animals, primarily modifying lying time. The relationship between lying behavior and the lying surfaces has been as well strongly associated with lameness events. Similarly, the transit surfaces have been shown to be one of the more significant risk factors for lameness.
The traditional approach to hoof health has been based on the adaptation of the management to the facilities. Given the importance of hoof health in the overall farm sustainability, new facilities are today designed and built taking into consideration the timebudgets to minimize, between others, hoof health problems.

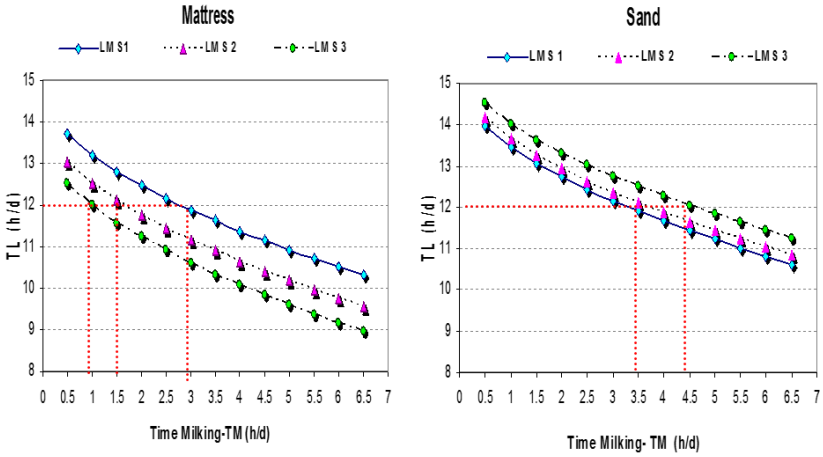

Figure 4. Differences in lying time (TL) between lame (LMS 3) and healthy (LMS 1, 2) cows by type of freestall base (Sand or Mattress) and milking time (TM).

6. Nutrition. Nutrition has evolved considerably in the last decades and so milk production. We have better mastered the science of feeding cows to improve efficiency, minimizing digestive upsets. However, the best producing cows remain still in higher risk of lameness. We have also learnt that by using new feeding technologies we can better meet the needs for milk production, reproduction but also for hoof health growth, skin

quality and decreased local or systemic inflammation. A relevant technology that has given good results when included in hoof health programs has been the correct supply of trace mineral nutrition. Organic compounds where the trace metals are linked to an aminoacid have given an advantage to hoof health and facilitated the implementation of successful hoof health programs.

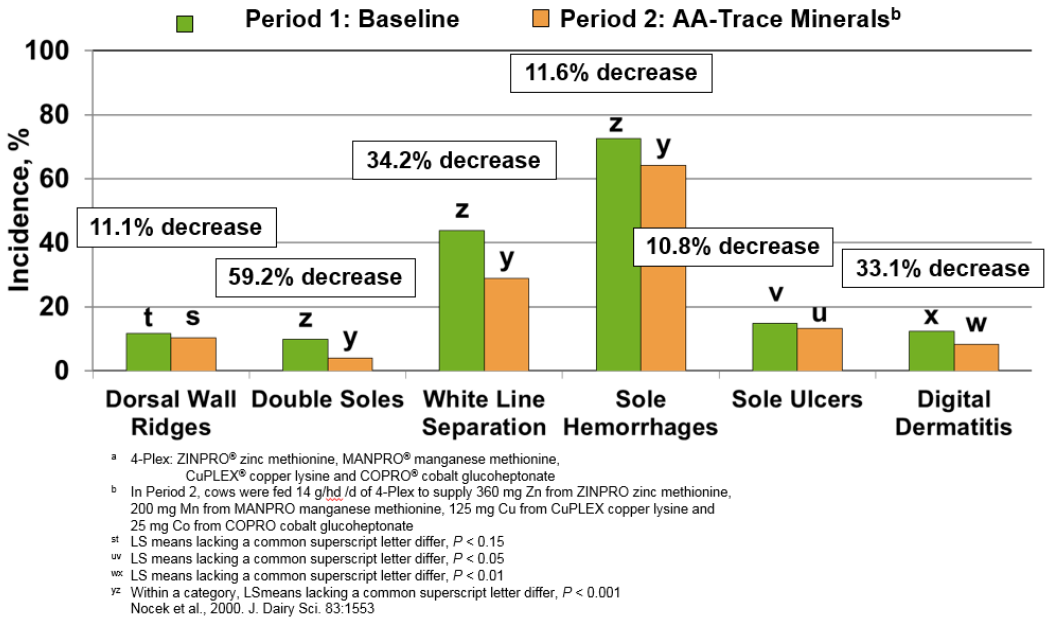

Figure 5. Effects of feeding aminoacid trace mineral complexes in comparison with the traditional inorganic forms on hoof lesion prevention (Nocek et al., 2000).

Farm profitability is certainly limited by suboptimal hoof health. Additionally, lameness is likely the best marker of animal welfare and one of the main arguments that the general public used to judge modern farming. Lameness prevention is a must today and requires of a sophisticated approach according to the extraordinary capacity of our animals.

Let's make happy cows!

References and questions: Available at agomez@zinpro.com