

## **A Guide to Investigating a Herd Lameness Problem**

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### **Introduction**

Current estimates of lameness in dairy herds in North America suggest that at any one time, 20-25% of cows are clinically lame. The peer-reviewed literature suggests that the lactational incidence of lameness varies widely between herds around the world from around 1.8% to 69%. However, these data are deeply flawed and fail to appreciate the limitations of incidence data captured on farm. We know that farmers do not recognize as many lame cows in their own herds as trained independent observers, while veterinarians see very few of the cows that are actually lame. In many herds, where the hoof-trimmer provides most of the lameness treatments, the incidence rate of lameness is perhaps more related to the frequency of trimming visits than the rate of new lesion development. It is also clear that it is commonplace to find several cows that get treated each visit for the same recalcitrant lesion, while other cows are never treated for lack of recognition, lack of time and resources, and lack of organization of the recording system.

Over the last few years we have developed a plan to organize lameness recording and the recruitment of lame cows on small and large dairy herds. The basis for the plan is to clearly define and separate routine TRIM events from clinically LAME events.

### **A System for Identifying Lame Cows**

An overview of the recording, recruitment and organization of TRIM and LAME events is shown in Figure 1.

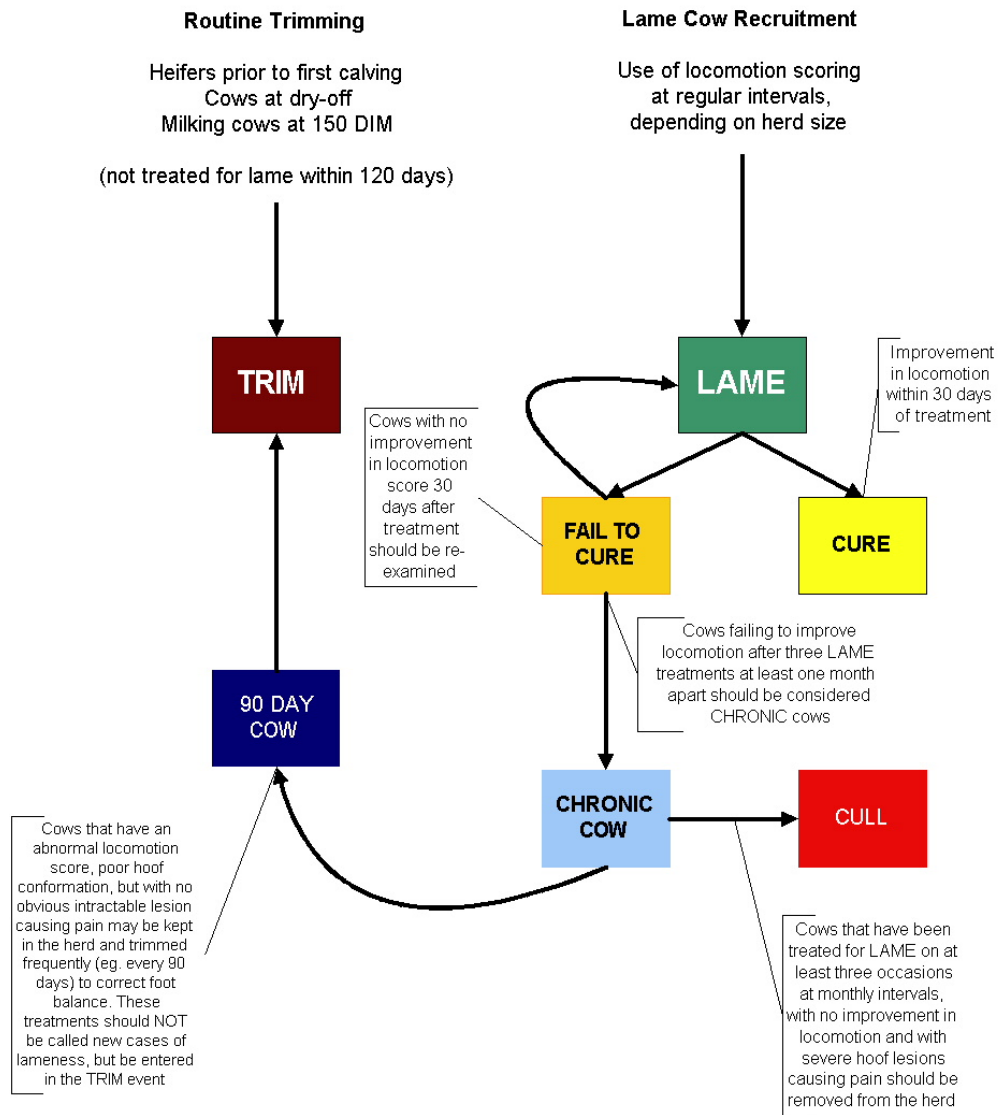
The plan has five main components:

1. LAME cows are recruited through routine locomotion scoring – at intervals specific to individual herd requirements. Because treatment is usually limited to periods when the trimmer visits, we must be very careful to avoid over recruiting lame cows, particularly when we start developing the system. If we identify 60% of the herd as ‘lame’ on the first day, the system for handling these cows will be overwhelmed. Therefore, it is best to use the higher locomotion scores to define lameness initially, and once the program is up and running to then use the observation of any abnormal gait to recruit lame cows for treatment.
2. TRIM cows are created by listing cows at a certain stage of their lactation cycle – at dry-off, pre-calving for heifers and in mid-lactation. These cows should not have been treated for lameness in the previous 4 months to avoid over-trimming.

3. Hoof lesion information from the hoof-trimmer is entered into the appropriate event – TRIM or LAME, where the most important lesions are recorded along with the affected limb(s) and treatment, and four actions are taken:
  - a. Cows requiring a wrap removed are listed for 3 days after treatment
  - b. Cows requiring a block removal are listed for a recheck at 30 days
  - c. Other cows that need to be rechecked after 30 days are identified
  - d. Cows that have been treated for several months (typically three) for similar hoof lesions, which are failing to heal or are slow to heal must be identified and a decision made whether to cull the cow, or whether it will be possible to trim the cow frequently and keep her in the herd. These are the ‘90 day cows’ – so called because we will present them for TRIM every 90 days. They will no longer be entered as a new case of lameness.
4. All cows treated for LAME are examined and/or locomotion scored 30 days after treatment to determine whether there has been improvement in the severity of the lesion or gait abnormality. This may be done at a hoof-trimmer visit, or the cows may be locomotion scored at a fertility visit or at some other convenient time.
5. LAME cows that have failed to improve locomotion score are re-examined as a new lame event at the next visit after 30 days.

Once the herd is frequently being surveyed for abnormal gait, the number of cows submitted for routine trimming may diminish. The TRIM event therefore becomes our default category, so that we make sure that all cows are routinely trimmed at least once a year at dry-off. This is a good time to review the cow history and to check that a cow wasn't neglected throughout her lactation.

**Figure 1.** Overview of lame cow recruitment plan



### Incidence or Prevalence Monitors

The LAME event, as described above, is used to manage the treatment and recruitment of cows for new examination and re-examination, and as such does not measure ‘incidence’ particularly well. In fact, in most herds using the system described above, the rate of LAME events usually increases. A much better monitor of the extent of lameness in a herd is the proportion of cows with abnormal locomotion scores over time – and such scoring is the starting point of any lameness investigation.

Four or five point systems of locomotion scoring are now commonplace, based on identifying easy to recognize changes in the gait of the cow. The new 5-point system from Zinpro

Corporation aims to combine features of lameness related to arching of the back, with differences in weight-bearing between the limbs measured by the degree of observed sinking of the dew claws to the ground, as an easy to identify reference point. Table 1 presents the proportion of cows scored at each locomotion score level for an average herd and for a target herd (upper quartile cut-point).

**Table 1.** Locomotion score targets for a 5-point scoring system.

Locomotion Score	% Cows scored at each level	
	Average Herd	Target Herd
1	55	65
2	10	10
3	12	15
4	20	10
5	3	0

Once the prevalence of lameness has been determined in a herd, we can use records to determine the predominant cause.

### Claw Horn Lesions or Infectious Lesions?

An examination of lesion records for TRIM and LAME events can determine the prevalence of lesions which are predominantly sub-clinical and those which are associated with lameness. Lesions may be simply sub-divided into those affecting the claw horn and those which can be viewed as infectious. Lesions such as corns (interdigital hyperplasia) should be considered as ‘other’, but they rarely cause lameness on their own without infection. Table 2 lists the conditions in each category.

**Table 2.** Hoof lesion classification system

Claw Horn Lesions	Infectious Lesions	Other Lesions
Sole hemorrhage	Digital Dermatitis (Heel Warts)	Interdigital Hyperplasia (Corn)
Sole ulcer	Interdigital Phlegmon (Foot Rot)	
Toe ulcer	Heel Horn Erosion	
Heel ulcer (Sole fracture)		
White line disease		
Hemorrhage		
Fissure		
Abscess		
Horizontal fissure		
Vertical fissure		

## **Trigger Factors**

Digital dermatitis (DD or heel warts) is by far the most common infectious lesion found in dairy herds and is controlled through herd biosecurity, leg hygiene and foot-bath programs.

The most common claw horn lesions are sole hemorrhage, sole ulcer and white line disease (which consists of a group of conditions affecting the white line including hemorrhage, fissure and abscess). These conditions were associated with the condition known as ‘laminitis’, however it is now clear that these lesions are merely ‘clinical signs’ observed on the surface of the claw, triggered by a variety of different factors.

The three main trigger factors that must be considered where claw horn lesions predominate include:

1. Calving – the bond between the pedal bone and the claw horn capsule is loosened by the activation of metalloprotease enzymes in the corium of the claw, leading to pedal bone instability
2. Nutrition – various changes associated with over-feeding of the carbohydrate fraction of the ration, or other components of the ration, also result in an increase in pedal bone instability
3. Trauma – either due to excessive removal of horn (due to the walking surfaces or due to overzealous trimming), or over-growth of horn, resulting in damage to the corium

These three trigger factors, combined with poor cow comfort may result in very similar lesions on the claw surface. Practically, it is very difficult to distinguish between these differing causes. However, examination of 5-10 lame cows along-side the trimmer serves two functions:

1. To confirm that lesions are being correctly identified and recorded
2. To determine whether over-trimming, or excessive hoof wear are possible triggers for claw horn lesion development

## **Assessment of Hoof-Trimming**

The normal bovine foot should have two healthy claws, with dorsal walls 3 inches from coronary band to toe, with a 50 degree foot angle. The sole surface should be level from toe to heel and flat from axial to abaxial sides, with no concavity. Weight should be evenly distributed between inner and outer claw. The axial groove area should be modeled out to allow drainage between the claws.

Observation of the work of the hoof-trimmer is an essential part of the lameness investigation. While it is true that a good hoof-trimmer saves cows’ lives and prevents problems developing, a poor hoof-trimmer will lead to lame cows and early culling.

Common problems that need to be identified include:

1. Trimming the claws shorter than the recommended 3 inches from coronary band to toe
2. Trimming the heel of the inner claw of the rear foot – this must never be trimmed down
3. Trimming the soles too thin – so that they give under firm thumb pressure after trimming
4. Trimming the soles concave – forcing weight onto the wall and leading to spreading of the claws during weight bearing on firm surfaces
5. Rounding the toe off excessively – removing weight bearing wall from the toe and side wall
6. Trimming the axial wall at the toe
7. Failing to recognize that the inner claw is already excessively worn and trimming the outer claw to match it

It is very important not to confuse lesions resulting from excessive wear of horn from lesions caused by excessive removal of horn – they are both very similar.

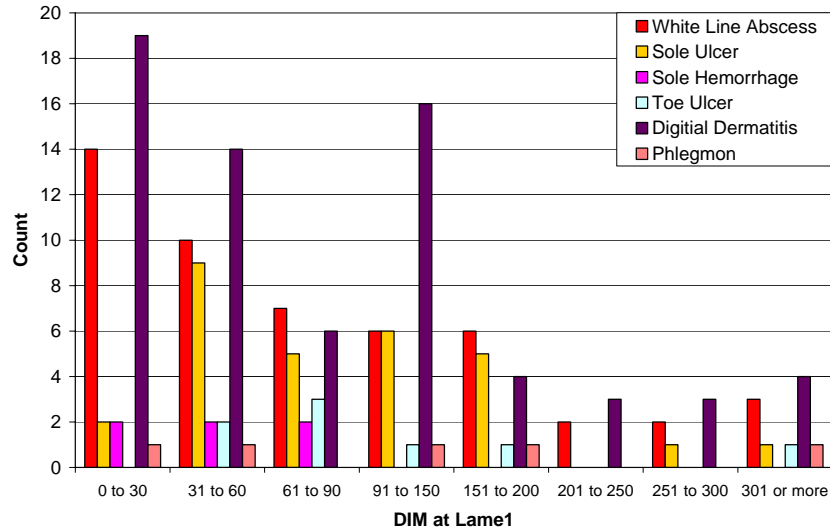
Once trauma has been ruled in or ruled out as a potential trigger factor, the next step is to consider calving and nutrition triggers. If the recording system allows, the time of onset of the first lesion by lesion type can be used to help examine the epidemiology of lameness in a herd.

### **The First Case of Lameness**

The timing of the onset of the first case of lameness is an important measure which may help us focus our attention on one or more trigger factors.

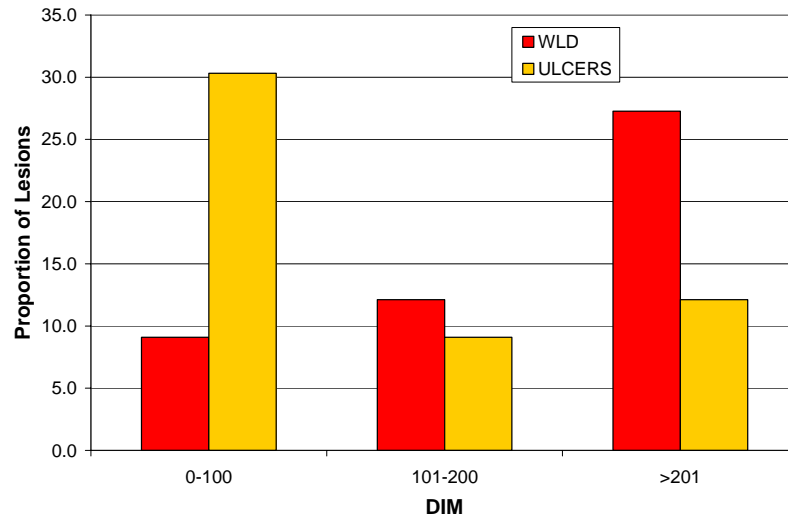
1. It is very common to see a large number of new DD lesions in early lactation (Figure 2). Transition cows appear to be most susceptible to new infection probably due to a combination of lowered immunity, a changing environment and the absence of any foot-bathing program during the dry period. This may be remedied by foot-bathing the close-up cows once a week.
2. In most herds, sole ulcers should be 1.5 to 2 times more prevalent than white line disease. Ulcers appear to develop in the first 30-60 days post-partum most commonly, suggesting calving is the predominant trigger. If the peak in first ulcer case treatments is closer to peak yield, then a nutritional trigger may be worthy of investigation.
3. Where heifers are reared optimally we should see very few lame animals throughout the first lactation. In herds where heifers are suffering DD lesions, consider risk factors associated with poor hygiene and mixing with infected mature cows. Where claw horn lesions are occurring, cow comfort and poor feeding in the transition period are most commonly to blame. Fewer problems are seen where heifers are reared with exposure to concrete prior to calving, where overgrown claws are trimmed pre-calving, where heifer groups are split from mature cow groups pre and post-partum and where heifers are provided excellent cow comfort in the form of bedded packs or well designed free stalls.

**Figure 2.** Examination of the first case of lameness for the mature cows in this 1400 cow dairy shows problems with digital dermatitis and white line disease in early lactation – a result of transition cow housing on a slatted floor, with no foot bath program before calving.



- In herds where white line disease is as prevalent, or more common than sole ulcers, floor surfaces should be examined as a potential cause of trauma. While loosening of the connection between the pedal bone and claw capsule may make the claw more susceptible to white line disease, other forces related to the standing and walking environment appear necessary to create white line lesions. Where the peak is early in lactation, consider the flooring throughout the transition cow facility – slatted floors in particular, as a risk factor (Figure 2). Where the peak occurs later in lactation, excessive hoof wear maybe an additional problem, leading to low heel height (Figure 3). Look for areas where cows must make sharp turns and are being hurried – such as the exit lanes from the parlor and crossovers next to water troughs in the free stall pens, or the walking lanes in grazing herds.

**Figure 3.** This DIM distribution of the two major causes of lameness in a 200 cow dairy shows that sole ulcers are occurring in early lactation, while white line disease is a greater problem in late lactation – due to very rough flooring in the lactating cow barn.



5. Sole fractures or heel ulcers are commonly seen in the midst of the summer heat stress period. Where they occur on the medial claws of the rear foot they are often associated with prolonged daily standing times.
6. Claw horn lesions occurring on the front feet, rather than the rear are unusual. Where these predominate over a short period of time, a nutritional trigger, or a dramatic reduction in cow comfort may be the cause.

Once the timing and location of hoof lesions have been examined, the lameness investigation branches in one of two directions.

1. Where infectious lesions dominate, leg hygiene and foot-bathing programs must be closely examined.
2. Where claw horn lesions are the predominant causes of lameness, transition cow comfort, feeding practices, floor surfaces, heat abatement and factors which result in prolonged standing must be considered

### Leg Hygiene and Foot-Bathing Program

Lower limb hygiene is a particular problem in free stall barns. Loose manure in early lactation, overstocking of pens, infrequent removal of manure, narrow alleys (less than 10 feet), inadequate slopes on the alleys (less than 1.5%), 3-row pens rather than 2-row pens (20% less surface area) and groups with lots of cows coming into heat at the same time, are the commonest factors which lead to poorer hygiene levels.

Using a 4-point system of leg hygiene scoring, the best free stall herds will have around 25% of cows scoring 'too dirty' (scores 3 and 4), with average herds scoring 55%. The limb hygiene scoring system used is shown in Figure 4.

**Figure 4.** Hoof and Leg Hygiene Scoring Chart for determining frequency of foot-bathing



### Hoof and Leg Hygiene Scoring Chart

Score at least 20% of the cows in each pen in a free stall herd or all of the cows in a tie stall herd



#### Interpretation

Proportion of cows scoring 3 and 4	Comment	Your Herd	Suggested Foot Bath Frequency
<25	Good		As required
25-50	Fair		2 days per week
51-75	Poor		5 days per week
>75	Very Poor		7 days per week

We can use limb hygiene to determine how frequently we need to foot-bath. If the legs are clean and there are few DD lesions – there is little reason to foot-bath. However, if lower leg hygiene is very poor and little can practically be done in the short-term to improve the situation, then frequent foot-bathing is our main control point for infectious causes of lameness.

The leg hygiene scoring form in Figure 4 provides suggestions regarding the frequency of foot-bathing. Typically, foot-baths are run at least twice a day and they should be located where we may choose to use the bath or not. When located in the return lanes from the parlor, it is ideal for the lane to be split into a footbath lane and a by-pass lane, so that cows may be directed using a simple gate switch. Walking cows through a footbath of manure does little to help control infectious causes of lameness.

Most footbath arrangements suggest a wash bath preceding a treatment bath, separated by a gap of around 6 feet. It has never been proven whether the wash bath is necessary or not, and it probably does little to wash the foot before treatment. The treatment bath is therefore the most important component. It must be long enough for all four feet to be immersed at least once during passage through the bath and deep enough so that the interdigital space is completely immersed. Baths that are 10 feet long, at least 5 inches deep and as wide as the lane the cows are walking through appear optimal. A bath 10 feet long, by 3 feet wide, filled 5 inches deep would contain 94 gallons of solution ( $120 \times 36 \times 5 / 231 = 94$  gallons).

A range of antibacterial products are available to use – some of which are listed in table 3, along with dose rates for a 94 gallon foot bath.

**Table 3.** Foot bathing products and dose rates for a footbath 10' long, 3' wide and 5 inches deep.

### Volume of Foot Bath

$$\begin{array}{c} \text{Length (ft)} \\ \hline 10 \end{array} \times \begin{array}{c} \text{Width (ft)} \\ \hline 3 \end{array} \times \begin{array}{c} \text{Depth (ft)} \\ \hline 0.42 \end{array} \times 7.46 = \begin{array}{c} \text{Gallons} \\ \hline 94.0 \end{array}$$

### Amount of Chemical

Chemical	%	Dose (quarts per gallon)	g per gallon	Lbs/bath	Quarts/bath	Sachets / Packs/bath
Copper sulfate	5			39.1		
Copper sulfate	10			78.3		
Golden Hoof	10			78.3		
Copper Hoof		0.04			3.8	
Healthy Foot + Copper	1.7	0.04		13.3	3.8	
Zinc sulfate	5			39.1		
Zinc sulfate	10			78.3		
Super Zinc	10			78.3		
Rotational Zinc		0.04			3.8	
Provita Hoofsure						
Endurance	1	0.04			3.8	
37% formalin	0.5	0.02			1.9	
37% formalin	2	0.08			7.5	
37% formalin	3	0.12			11.3	
37% formalin	5	0.2			18.8	
New-Hoof Concentrate		0.02			1.9	
Double Action		0.08			7.5	
Victory		0.02			1.9	
HoofPro+		0.04			3.8	
Mild soap		0.04			3.8	
Hydrated Lime	6			47.0		
Rock Salt	6			47.0		
Lincomix 16g	0.01		0.46			2.7
Lincomix 16g	1		4.6			27.0
Oxytetracycline 102.4g	0.1		3.94			3.6
Oxytetracycline 102.4g	0.8		31.5			28.9
Bovi-Foam				no specific dose		
Kovex Foam				no specific dose		

Typically antibiotics are reserved for situations where the prevalence of DD is very high. In a free stall with poor leg hygiene, where the footbath is being used 5 days per week, a cleaning agent may be used for 2 days (soap or salt), followed by an antibacterial bath. Copper sulfate is very effective and cheap to use, but concerns over the amount of copper being returned to the environment are growing. There are numerous copper substitutes which work at lower copper concentrations, and some commercial products such as Victory and Double Action which are specifically marketed for DD control. Foaming products may fit into the rotation, but are expensive to use. Formalin is very effective and appears to harden the hoof, but it is a carcinogen and must be handled with great care. Most chemicals remain active for approximately 200 cow passes.

Because lesions are more predominant in early lactation, different groups in a free stall barn may be bathed at different frequencies. For example, the close-up group should be foot-bathed at least once a week. Early lactation cows should be bathed at a frequency determined by leg hygiene. Finally, it may be possible to foot bath late lactation cows at half the frequency of early lactation cows.

### Walking Surfaces

Concrete is not an ideal surface for dairy cows to walk on. It lacks sufficient grip for cows to move around comfortably without fear of slipping. Grooving is therefore essential, but a compromise has to be struck between sufficient grooves to allow traction, without too many grooves which would promote excessive wear.

An ideal pattern would typically have 3/8 inch wide and deep grooves spaced 3 inches on center running parallel to the length of the pen, with an additional oblique groove added to create a diamond pattern in high traffic areas where cows must turn sharply – such as by water troughs and exits from lanes. Many grooves are spaced too far apart, are too wide and are too shallow. Cutting the grooves into cured concrete appears to be the most reliable way of ending up with an ideal final product. Floating grooves into wet concrete is a job for experts in order to avoid rough edges, exposed aggregate and convex surfaces between the grooves.

Steep slopes must also be avoided. Holding areas should slope 2% maximum and pen alleys should slope 1.5%. Steep return lanes from the parlor either side of the holding area are a common problem resulting in excessive loss of sole horn.

The use of rubber floor surfaces have become common place in many US free stall barns. They are ideal where cows must walk down excessively sloped lanes, make long walks to and from the parlor, and in places such as the holding area, where we force cows to stand for prolonged periods. In these areas, rubber is primarily making it easier for lame cows to move around, and reducing hoof wear rates.

Whether or not we should spend large amounts of money on rubber flooring in the pens is less clear. Several studies have shown that if stall design is compromised, cows spend more time standing on the rubber floor, and less time lying in the stalls. This is not what we want to do to reduce lameness in dairy herds! Not surprisingly, many farms with rubber floors and poor stalls still have lots of lame cows. My advice is to spend the money on the stalls first and make no compromises. If there is money left over, put rubber in the feed alley.

## **Nutrition**

Feeding practices which promote sub-acute ruminal acidosis (SARA) appear to be associated with lameness problems. Whether or not it is actually SARA which triggers the lameness is a matter of current debate – it may simply occur at the same time as other changes in the GI tract which actually trigger claw horn lesion development.

Until the pathways connecting nutrition with lameness are fully elucidated, it seems prudent to follow guidelines for preventing SARA which center around the concept of allowing cows to ‘eat when they want to eat’ – so that they avoid becoming hungry and consuming meals of variable size. These guidelines are:

1. Utilize 2-row pen designs which provide greater feed space per cow and avoid overcrowding.

*Measure the number of cows in each pen, the number of stalls and the amount of bunk space per cow. Targets are 1 cow per stall with 24 to 30 inches of bunk space per cow*

2. Deliver fresh feed twice daily with at least one feed delivery not coinciding with milking.

*Feeding only once a day in a situation with limited bunk space is a high risk strategy that will lead to uneven intakes between cows within the pen.*

3. Feed ad-lib, with 5% refusal and avoid long periods with the bunk empty.

*Estimate the amount of refusals and the period of time spent with the bunk empty. In particular, avoid situations where cows return from milking to an empty bunk.*

4. Feed levels of NFC, starch, NDF and ADF within the guidelines of the NRC (2001).

*Check the paper ration and then re-formulate the actual ration being fed to the cows – using updated forage DMs and analyses.*

5. Provide adequate fiber length in the diet.

*Use the Pen State Shaker Box to estimate the fiber length of the ration – aim for 7-15% long particles in the top box.*

6. Prevent sorting by avoiding diets which are excessively dry or poorly mixed with long fiber.

*Again, using the Pen State Shaker Box, if the refusals have 10% more long particles than the original TMR offered, sorting is likely a problem.*

7. If SARA presents as a real possibility, have a veterinarian perform ruminocentesis on 12 cows and check ruminal pH.

*The cut-point used is pH less than or equal to 5.5. If 2 or more cows are at or below 5.5, the herd is likely at increased risk for SARA. If 5 or more cows are at or below 5.5, the test is highly predictive of a problem.*

Rations should also contain adequate levels of trace elements such as zinc, and where white line disease in older mature cows is presenting as a problem, 20mg per cow per day of biotin may be beneficial.

## **Cow Comfort**

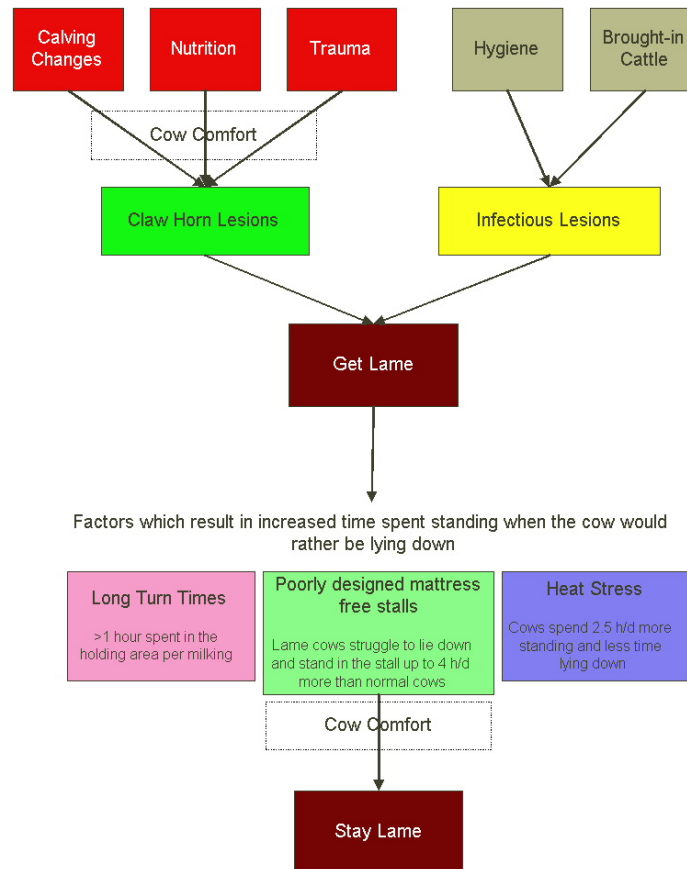
Cow comfort has a complex role to play not only in interacting with trigger factors to ensure that lesions occur in the first place - resulting in cows that 'get lame', but also in the response of the lame cow to the environment once her gait is modified by the pain associated with lameness, which results in cows that 'stay lame'. This concept is shown in Figure 5.

### **a. Cow Comfort and 'Getting Lame'**

It is essential that cows around calving time are provided with a comfortable environment in which to lie down. Significant improvements in sole hemorrhages have been shown in first lactation heifers after calving when provided with a straw yard pre and post-partum compared to a poorly designed free stall barn.

Several herds have been documented with significant SARA problems, but without associated lameness problems. These herds are either grazing pasture, or have excellent sand bedded stalls. This suggests that we need poor comfort combined with a trigger factor to damage the claw and develop claw horn lesions and lameness.

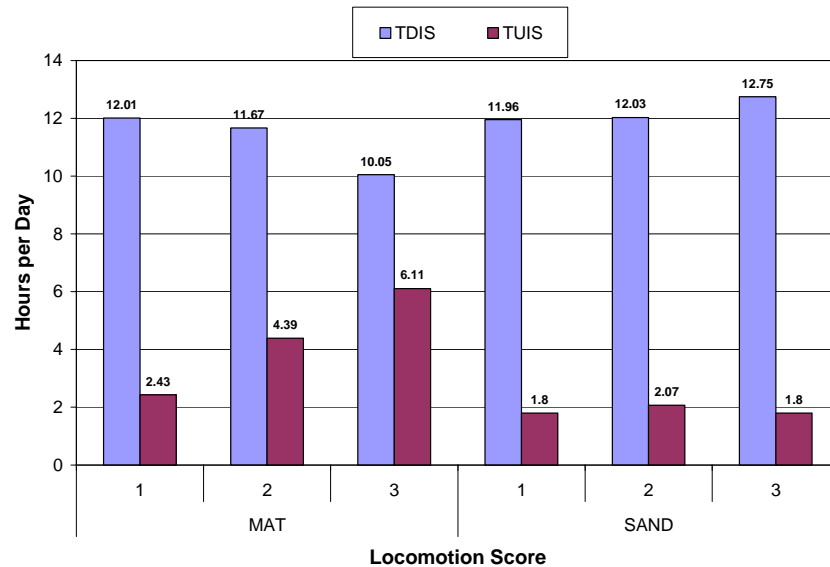
**Figure 5.** The role of trigger factors and cow comfort in the ‘Get Lamé – Stay Lamé’ concept.



### b. Cow Comfort and ‘Staying Lamé’

Lame cows modify their stall use behavior compared to non-lame cows in poorly designed stalls. The acts of rising and lying down become incredibly difficult when cows develop a sore foot, and in poorly designed mattress stalls they spend much longer standing in the stall at the start and during a stall use session than non-lame cows. Moderately lame cows in poorly designed mattress stalls remain standing in the stall for up to 6h/d on average and show a reduction in lying time to only 10h/d from an average of 12h/d. In contrast, in deeply bedded, well managed sand stalls, lame cows show no such modification in behavior – they maintain resting times at around 12 h/d and stand in the stall typically less than 2h/d (Figure 6).

**Figure 6.** Least squares means time up in stall (TUIS) and time down in stall (TDIS) for cows with different locomotion scores (1-3) in herds with sand free stalls (SAND) or mattress free stalls (MAT).



We believe that this difference in lame cow behavior between the two types of stall is related to surface traction. The rear foot is cushioned and gains traction in a deep loose bed of sand, making standing, even with a sore foot, relatively easy (Figure 7).

**Figure 7.** Sequence showing how the rear foot sinks into a deep bed of sand, facilitating rising



In contrast on a smooth surface mattress stall, the toe of the weight-bearing rear foot is driven into the surface, making rising much more challenging to a cow with a sore foot (Figure 8).

**Figure 8.** Sequence showing how the toe of the rear foot is driven into the mattress surface at the rear of the stall – potentially carrying the risk of slipping, and creating pain if the claw is compromised by disease.



Although we do not know the time budgets of the cows in the barns that we visit, we can use an index of comfort to tell us whether lameness is a significant problem. The Stall Standing index (proportion of cows touching a stall that are standing half in or completely in a stall) may be measured at 2 hours before the morning or afternoon milking. If more than 20% of the cows are standing, this is associated with herd mean daily stall standing times greater than 2 h/d, which would be abnormal. This index captures prolonged stall standing behavior by lame cows and is therefore associated with the prevalence of lameness and the comfort of the stalls.

We believe that these poor environments in which lame cows struggle to gain appropriate periods of rest result in a failure to cure and extended periods of lameness – effectively making sure that if a cow becomes lame, she ‘Stays Lame’.

Improved stall designs and use of sand bedding may break this cycle of ‘Get Lame – Stay lame’ by allowing lame cows to rest and recover. Stall design must therefore be assessed in free stall barns, with the focus being on ease of use for lame cows. Use of deep sand bedding appears to help compensate for design inadequacies.

The possibility exists that improved mattress stall designs – without obstruction to the lunge and bob movement of the head, which allow a forward stride with the front leg over the top of the brisket locator and which allow the cow more space between the dividers, will make stall use by lame cows easier. However, whatever the stall design, lame cows probably benefit from a recovery period on a bedded pack area, free of the obstructions and challenges of using a free stall.

Time spent standing when the cow would rather be lying down not only occurs where stall design is poor, but in two other situations:

1. During periods of heat stress

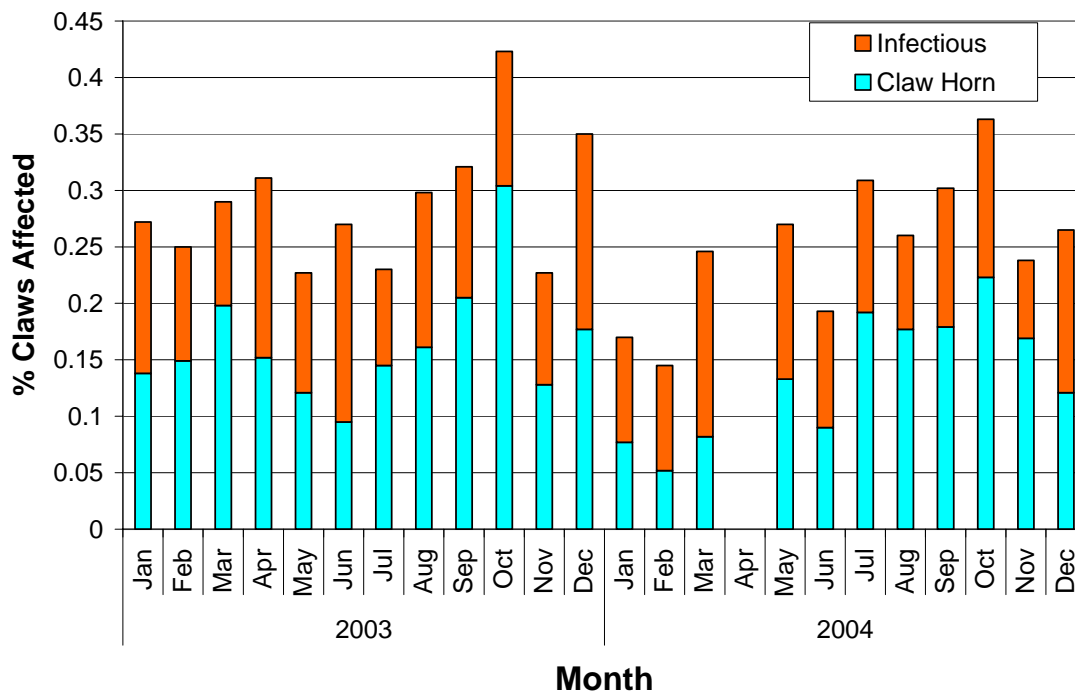
- When there is a mis-match between pen size and parlor capacity and cows are forced to stand more than one hour away from the pen each milking

## Heat Stress

Cows modify their behavior when heat stressed. In a recent study in a 3-row free stall pen with fans and sprinklers along the feed bunk, cows spent over 2 h/d more standing in the alley and in the stall in periods of heat stress compared to periods spent within their thermoneutral zone. This observation appears to justify the placement of fans over stalls to improve air movement while the cows are lying down.

The increased time spent standing may contribute to the increased prevalence of claw horn lesions observed in the late summer months in many herds (Figure 9).

**Figure 9.** Monthly variation in infectious and claw horn lesions in a 350 cow free stall housed Wisconsin dairy herd showing typical peaks in claw horn lesions in October.



## Group Size

Groups should be sized so that no cow spends more than one hour per milking away from the pen. In free stall herds this can be done by sizing the pen according to the capacity and rate of milking cows in the parlor. It is suggested that groups be no larger than 4.5 times the capacity of the parlor as a rule of thumb. Thus for a dairy milking with a double 8 parlor, group size maximum is 72 cows (16 x 4.5).



Standing times in the holding area can be excessive in grazing herds, as the whole herd is typically milked in one group. Parlor design and rapid throughput is therefore a very important component of lameness prevention.

## Conclusions

A greater understanding of the dynamics of lameness in dairy herds can be obtained from improved record keeping systems and a comprehension of how lame cows interact with the environment. The herd trouble-shooter needs to determine the extent of the lameness problem, the predominant causes and their trigger factors, and understand the role of cow comfort and adequate hoof care in resolving existing lameness. The overall plan for the investigation is shown in Figure 10.

**Figure 10.** A plan for investigating a herd lameness problem

