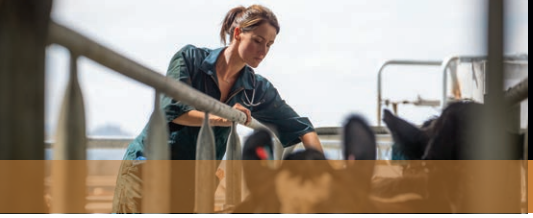

LAMENESS MANAGEMENT IN NZ DAIRY COWS

Lameness negatively impacts cow wellbeing and efficiency, along with farm profitability both here in New Zealand and internationally. Lameness is painful and has the potential to reduce the overall lifetime performance, and hence efficiency of dairy cows due to milk production loss and culling. The financial impact of lameness in NZ dairy cows is conservatively estimated at $250 per lameness case, or ~$15,000 for a 420-cow herd annually.[1]

Reducing lameness benefits the cow, the farm business and the dairy industry. Over the last five years there has been significant research and new understanding of the pathogenesis of lameness. This raises the opportunity for new approaches to lameness management on-farm.

Lameness in New Zealand dairy cows

The incidence of lameness (the number of cows identified and treated over 12 months) is estimated at 14%, with top farmers achieving 8% or less.[1] The prevalence of lameness (the number of cows identified as lameness score 2 or 3 on a given day) is estimated at an average of 8%, with top farmers achieving 4% or less.[1]

However, on-farm lameness is likely to be under-reported. An NZ study showed the mean herd prevalence of lame cows as detected by expert lameness scoring was 8.3% yet lameness prevalence as identified by farmers was only 2.3%.[2] Another notable factor was the variation in expert detection of lameness ranging from 1 to 36%, and 0 to 20% by farmers. Fonterra data also showed most farmers record fewer than expected lame cows in their Dairy Diary[3] (Figure 1).

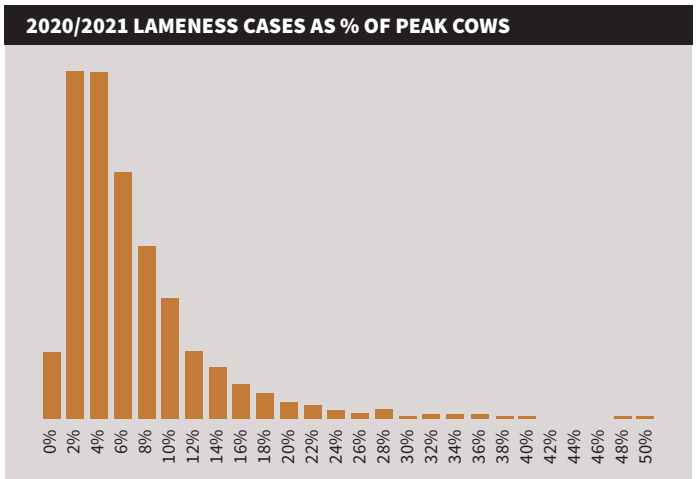

Figure 1. Lameness incidence as % of peak cows reported by farmers (Fonterra, 2022).[3]

The types of lameness can be classified into claw horn lesions (CHL; e.g. white line disease, sole haemorrhage, sole abscess, sole ulceration), or infectious conditions (e.g. footrot, digital dermatitis). In New Zealand approximately 80% of lameness cases are CHL, with white line disease the most common.[4]

CHL are observed when pain is experienced by the cow as a result of inflammation of the corium. Lameness is most commonly observed around mating with a second peak in late summer (Figure 2). The greatest period of risk for the development of CHL starts at least 2 weeks before calving and continues for at least 12 weeks after calving.[5]

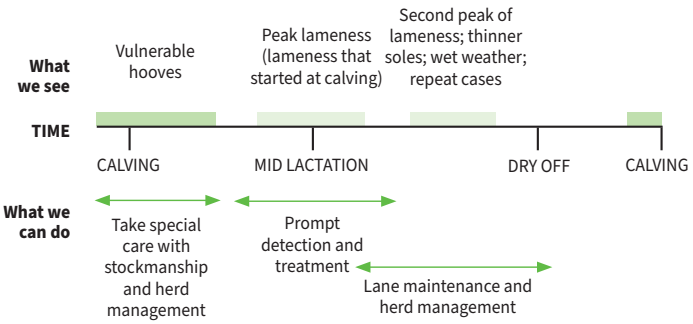

Figure 2. Observations of lameness in NZ dairy herds.[1]

The sections below outline the 3 key steps that can be taken to reduce lameness on-farm: minimise, monitor and manage.

Minimising lameness

Minimising the risk of lameness occurring in the first place is the ultimate goal. The risk factors for lameness are multifactorial and vary from farm to farm (Figure 4). It is the interaction of the cow, her environment and management that leads to lameness.[1]

Key risk factors for claw horn lesions include:[1]

1. Calving effect: Leading up to calving the cow's pelvic ligaments relax to aid calving. However, this ligament relaxation occurs across the whole body including within the hoof, where the suspensory apparatus attaching the pedal bone to the hoof wall weakens and means that the pedal bone is not held in place as tightly and can move around. This movement puts pressure on the live tissue (corium) causing inflammation and interrupting production of the hoof tissue, making the hoof more vulnerable to claw horn lesions. The calving effect cannot be stopped; hence the focus needs to be on good management of the risk factors outlined below, especially from 2 weeks before calving until 12 weeks after calving.

2. Mobilisation of fat from the digital cushion post calving: The digital cushion sits between the pedal bone and the corium, and helps to dissipate force when the claw is bearing weight. If the amount of fat decreases, the risk of lameness is increased.[6] Mobilisation of fat from the digital cushion can occur during early-peak lactation when cows naturally lose body condition. Loss of body condition also occurs when a cow becomes sick (e.g. mastitis or lameness). The risk is

higher for heifers as they have less fat in their digital cushion than older cows.[7] Meeting body condition score (BCS) targets throughout the season, carefully managing cow nutrition from transition through to peak milk, including preferential feeding of sick and at-risk cows, will help minimise BCS loss post-calving.

3. Previous lameness: Following a case of lameness, there can be permanent bony changes to the pedal bone (exostosis) as a result of the inflammation. These changes are irreversible, and significantly increase the risk of a cow becoming lame again in the future[8] (Figure 3).

In an NZ study based in the Waikato, dairy cows over 7 years old were seven times more likely to be recorded as lame compared with 2 and 3 year old cows ($p<0.001$).[9] It was hypothesised that, along with degenerative changes in the pedal bone as dairy cows increase in age, suboptimal lameness treatment and perhaps overgrowth of hooves resulted in permanent changes in the cows' feet, meaning a higher prevalence of lameness in older cattle and a high recurrence rate of lameness within and between seasons. This highlights the importance of prompt identification and treatment of lame cows.[9]

4. Management and environmental factors: Minimising time spent out of the paddock on hard surfaces (including walking to the shed, waiting on the yards and being milked) will help ensure cows have adequate time to eat and rest, particularly in the first 3 months after calving. Gentle handling will allow cows to move at their own pace. This is particularly important when the walking surface is less than optimal (e.g. in wet weather or if races are poorly maintained), as cows will need more time to navigate the challenging conditions underfoot. Maintaining races, shed entrances and gateways in good condition will help improve cow flow. Focus on newly calved heifers, as young cows are at increased risk as they adjust to the herd hierarchy and adapt to the milking routine.

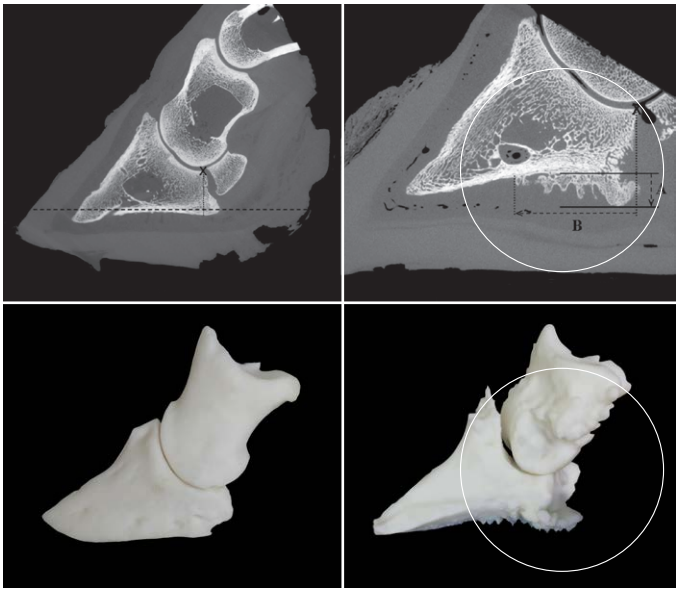

Figure 3. Sagittal x-ray views (top) and 3 dimensional models (bottom) of normal (left) and diseased bovine digits (right) showing extensive exostoses.[8]

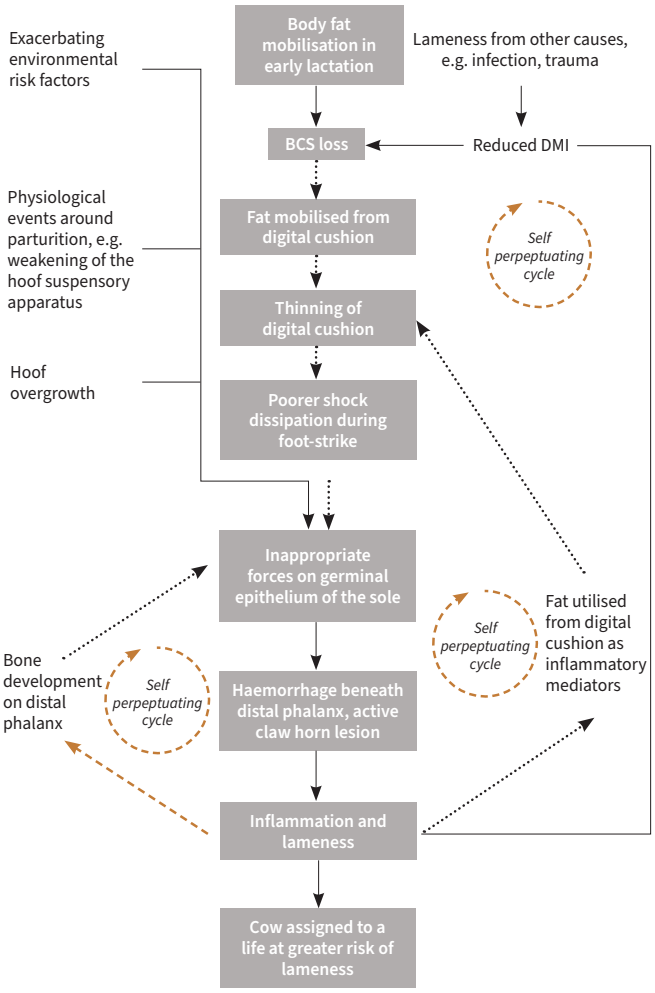

Figure 4. Pathogenesis of claw horn lesions in dairy cows.[8]

Monitoring lameness

Identifying and treating cows as soon as they become lame increases the cure rate [10,11] and reduces the number and severity of new cases.[12] However, identifying lame cows promptly remains one of the biggest hurdles to reducing lameness.[13]

Australian and NZ studies have shown that on any given day, approximately 75% of clinically lame cows are walking in the main herd, undiagnosed and untreated [2,14] (Figure 5).

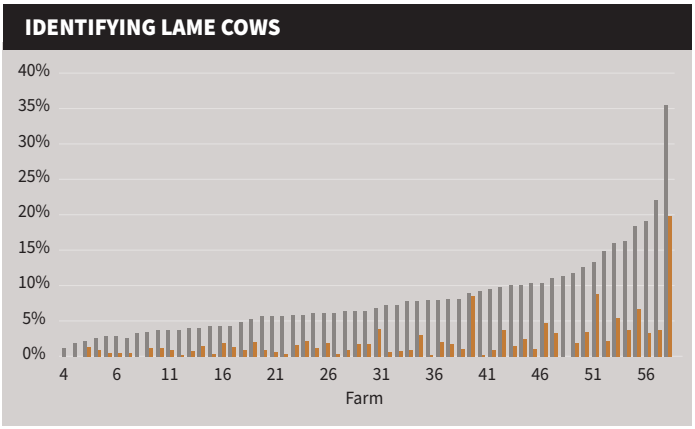

Figure 5. Percentage of lame cows across 59 New Zealand dairy farms identified as lame on the day by farmers (brown line) versus trained observers (grey line).[2]

Currently most lame cows are identified by farmers because they are lagging behind at the back of herd. However, in an Australian study, relying on examining only the last 30% of the herd would have missed 40% of the lame animals.[14] Lame cows may also be identified in the dairy shed because of uneven weight bearing when entering/exiting or while being milked. In both these situations, the cows are likely to be severely lame, and farmers may miss the lame cows with a lesser lameness score. Additionally, how we define lameness can also create a challenge, as less severely lame cows are often labelled as "just walking funny".[13]

As with other diseases such as mastitis, regular on-farm monitoring for lameness needs to become the norm.[13] Regular lameness scoring is one of the best ways to identify and manage lame cows earlier. Posters and demonstration videos have been developed to assist with this.[15] New on-farm technologies currently being developed may be able to assist with and improve prompt identification of lame cows in the near future.

Managing lameness

1. Take the weight off the affected claw

Claw horn lesions are the result of inflammation of the corium, so it is important to reduce the weight on the affected claw, typically using the 5-step hoof trimming process and application of a hoof block. It is not possible to therapeutically repair the pedal bone, the digital cushion or corium. The protective sole only grows at 5mm per month so trimming the hoof of a lame cow aims to remove the underrun horn and redistribute weight to the healthy claw. This improves cow comfort and allows time for the corium to generate new horn tissue to cover the sole.

In a UK study, dairy cows acutely lame with claw horn lesions that were treated with a therapeutic trim and a block applied to the healthy claw, along with 3 days of ketoprofen were significantly less likely to be lame five weeks after treatment than a trim alone[11] (Figure 6).

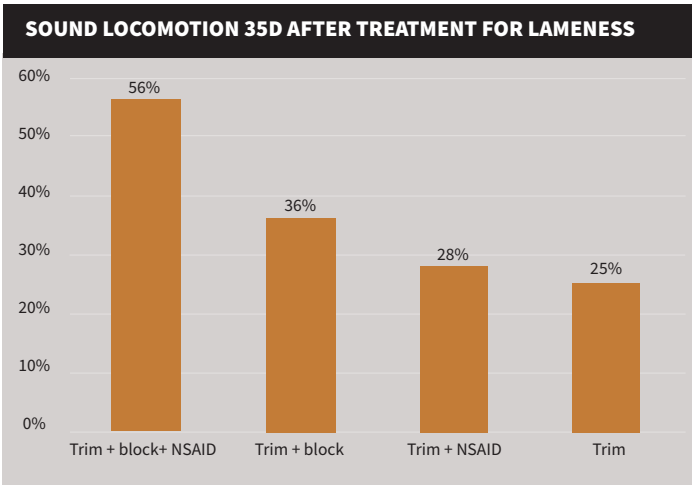

Figure 6. Lameness cure is maximised when ketoprofen is administered along with therapeutic trimming and elevation of the affected claw using a block.[11]

2. Reduce pain and inflammation

Lameness is a painful condition. Non-steroidal anti-inflammatory drugs (NSAIDs) reduce the physiological and psychological effects of pain, so cows can return to normal function and behaviour, and production, faster.[16] Inflammation associated with claw horn lesions has been postulated to stimulate exostosis development in the pedal bone[8] and lead to fat mobilisation in the digital cushion.[6] Hence the anti-inflammatory effect of NSAIDs is also key in managing lameness.

A recent 3-year longitudinal, randomised, controlled UK study assessed the role of ketoprofen (sold as KetoMax 15% in NZ) in lameness treatment.[17] Heifers were assigned into one of 4 treatment groups and remained in this group for the duration of the study. All groups were lameness scored fortnightly to identify lame cows. Treatment variables included a corrective trim and block for all Group 1, 2, or 3 animals; ketoprofen for three days following identification of each lameness event in all Group 2, 3, or 4 animals; and ketoprofen for three days following every calving for Group 3 only.

By the end of the three-year study, twice as many animals in Group 1 were lost from the herd (culled for any reason) during the study, compared with Group 2 and 3. Group 3 cows had reduced risk of any lameness and severe lameness when compared to their Group 1 herdmates[17] (Figure 7).

	TREATMENT			RESULTS		
	Every calving	When detected as lame		Risk of any lameness	Risk of severe lameness	Risk of culling
	3 days Ketoprofen	Trim + Block	3 days Ketoprofen	odds ratio *(p value)*	odds ratio *(p value)*	hazard ratio *(p value)*
Group 1	✖	✔	✖	Reference	Reference	Reference
Group 2	✖	✔	✔	0.75 *(0.1)*	0.61 *(0.32)*	0.55 *(0.02)**
Group 3	✔	✔	✔	0.66 *(0.03)**	0.28 *(0.04)**	0.56 *(<0.01)***
Group 4	✖	✖	✔	1.04 *(0.83)*	0.74 *(0.57)*	0.75 *(0.25)*

*Figure 7. Three-year study results for heifers treated with ketoprofen when lame and at calving[17] (*P <0.05).*

Groups 2, 3 and 4 were only compared to the reference group 1, and not to each other. Further research is needed to assess the impact of NSAIDs administered at calving. However, several studies now demonstrate the benefits of promptly identifying lame cows and treating them with a trim, block and three days of ketoprofen.

In a recent literature review "NSAID use for claw horn lameness" published in Journal of Dairy Science 2022, the authors noted "If the limited published data reflect the lack of effect of NSAID on the locomotion score, nociceptive threshold, and lying times of lame cows, it is because these are insensitive measures of assessing whether NSAID use is beneficial for the cow rather than accurate assessments of NSAID efficacy".[18]

The authors concluded they "strongly supported the use of NSAID in even the mildest clinical lame case, as the anti-inflammatory effects are likely to have benefits during the acute and chronic phases. Furthermore, the act of trimming lame cows is a painful act and should warrant NSAID treatment."[18]

Summary and take-home messages

- Lameness impacts cow wellbeing, animal efficiency and farm profitability
- The true lameness incidence is much higher than reported by most NZ farmers
- The greatest risk period for claw horn lesions is from 2 weeks before calving until at least 12 weeks after calving, hence this is the time to be most vigilant
- Left untreated, inflammation of the corium can lead to permanent changes within the hoof structure resulting in more lameness in a cow's future
- To minimise lameness on-farm, focus on:
  - Reducing pressure on the corium through good management of cow and environmental factors (minimising time out of paddock, gentle handling and maintenance of races, shed entrances and gateways)
  - Carefully managing cow nutrition from transition to peak lactation to help minimise BCS loss post calving
  - Looking after heifers - they are at higher risk of lameness due to a thinner digital cushion and challenges with adjusting to the herd hierarchy and routine. Preventing any first lifetime case of lameness will reduce the risk of future lameness
- To monitor and manage lameness on-farm, focus on:
  - Getting to lame cows earlier - identify promptly with regular lameness scoring, and treat them effectively. You have to do both to improve cure rates and reduce the risk of future lameness!
  - Effective treatment includes a trim, block and 3 days of ketoprofen to reduce pain and inflammation

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