THE SOUTH ISLAND DAIRY LAMENESS GROUP PROJECT

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Introduction

Lameness is an important issue wherever dairy production occurs. It is consistently placed after infertility and mastitis in the top three cow health issues for farmers both internationally and in New Zealand (NZ). Compared with northern hemisphere dairying, lower lameness levels are usually observed in pasture based systems like NZ (Chesterton, et al., 1989, Tranter and Morris, 1991). However, it has been a commonly held view in the South Island (SI) industry that there is more lameness here than in the North Island (NI), and that the problem has been growing in recent years. There are strong opinions in the SI industry suggesting there are important local influences on lameness.

This is often explained in reference to differences between the NI and SI climate, herds, and management. The current SI herd has a cluster of features linked to the recent history of dairying here. In the past 15 years there has been strong expansion of the NZ dairy industry into the SI, where cheaper land and the availability of extensive, dependable irrigation have enabled a sustained increase in the number of dairy farms and cows (Anonymous, 2006). Despite the obvious similarities of grass based dairying between the NI and SI, there are several observed differences. The average farm in the SI has a greater herd size and greater per cow and per hectare production, and this high production is particularly pronounced in some regions (eg. Canterbury). Over the period of expansion there has often been emphasis on increasing herd size, which can reduce options around culling of cows. Many SI farms are conversions and irrigation along with intensive, recent pasture refurbishment are common features. Pasture management is often a top tier priority, and very intensive systems, to increase utilisation and maintain high quality (high energy, low fibre) across the season are commonplace. In addition, the long daylight hours and cooler nights are thought to promote higher sugar content in the pastures.

Against that background, the origins of the most common and longstanding explanations within the SI industry for high lameness – particularly the role of nutrition – can be better understood. In brief summary, the popular idea of the influence of nutrition, the high energy and low fibre pastures are thought to induce rumen dysfunction resulting in secondary weakness in the hooves.

Nutrition and lameness

While there are numerous pathways by which nutrition may impact on lameness, the explanation most frequently advanced for the specific influence of nutrition on dairy lameness involves the idea of rumen dysfunction at the sub-clinical level (Marie Krause and Oetzel, 2006). In this theory, high intake levels of quickly digestible carbohydrates – grain starch overseas or pasture sugars in the SI – are said to lead to high rumen acid loads (low pH) when insufficient rumen fibre reduces rumination and therefore the saliva available to buffer this effect. These acid loads are said to quickly change the rumen environment in several ways: changing the sub-populations of microbes by killing off some bacteria and causing others to increase in number; producing compounds (eg. histamine or endotoxins) that can leave the rumen to act elsewhere (eg. tightening blood vessels around the hoof horn tissue); or reducing the production of needed compounds (eg. biotin) that act elsewhere (eg. hoof horn tissue). It is postulated that the influence of nutrition in general dairy lameness is through mild and subtle rumen 'acidosis' causing these 'extra – rumen' effects on the hoof horn tissue, resulting in softer, slower growing hooves that are more easily worn and damaged. For the SI, this theory assumes the high intakes of high sugar, low fibre pastures initiate these processes.

It is important to note some vital limitations of this rumen 'acidosis' theory in grass based systems. The understanding of the events and processes involved in 'rumen overload' was obtained by observation of acute grain poisoning in cattle, and extended to include sub-clinical cases by the simple, but largely untested assumption that the same processes operate in both situations. This has been further extended to grass based rumen systems, which have important differences in rumen function, with almost no research done in the area to support it.

Evaluating South Island lameness

One immediate difficulty in investigating any local causes of lameness in the SI was the lack of research available. To assess if lameness is greater in the SI and if nutrition was a significant influence on lameness here, accurate and dependable figures on lameness, pasture quality and rumen function under those conditions are needed. However, this was not available. There was limited formal research on SI lameness to indicate either the level of lameness or the types of lameness seen, no research on the pasture quality on commercial SI farms, and no work

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on rumen function (pH, activity and microbe shifts) of cows managed under the typical SI grazing strategies. Without solid figures for these, any conclusions about SI lameness and influences on it were highly speculative.

In response to these significant gaps in the knowledge a collaborative group of interested parties was established to develop research around this area, based at Lincoln University. This initial research as outlined here was designed as the first phase of a larger investigation of SI lameness, and particularly of any association with grass based nutrition.

The South Island Dairy Lameness Group (SIDLG) was formed to begin this necessary, fundamental research into SI lameness. The project is a collaborative effort between a large group of dairy farmers, SIDE, SIDDC, Lincoln University Dairy Science, Farm Right dairy consultancy, and the senior partners of several SI dairy practices. It is funded by the NZ Ministry of Agriculture Sustainable Farming Fund, Dairy InSight, Lincoln University and SIDE. The initial objectives were clear and simple: establish how much and what types of lameness were present on SI farms; what pasture quality was across the season; describe the rumen function of high production cows under typical SI management and grazing systems; and from this information, establish any local 'risk factors' for lameness and develop specific local strategies to reduce it.

To do this, the project used two 'arms'. In the first arm, a large number (40+) of SI farms were enrolled in the project. A good representation of the Canterbury and Otago industry in terms of total cow sample number (> 32 000), herd size, breed, production, management, and physical infrastructure was obtained. A new method of recording lameness was developed for the project to make recording lameness cases rapid and accurate for on-farm use. This was a diary used to record the cow, the claw affected, the type of lameness and the treatment given. These were collected each month, and at that time pasture samples were taken from each farm. The recorded information was entered into a large database that was created for this project. Through the season, detailed information on nutrition, production, reproduction, and herd health was collected, and physical infrastructure (sheds/yards/tracks etc) recorded on video.

From the recorded information, a report was generated each month for the participant farms to use. In this, each farm had displayed the observed lameness as a percentage of their herd, with benchmarking against their local region and the whole SI. The pasture quality report, done by the Lincoln University Feed Analysis Laboratory, was also included. At the end of the season, a report on the cows affected, and how often each was seen, was provided to the farms.

The second 'arm' of the project was experimental work undertaken on the 650 cow Lincoln University Dairy Farm (LUDF). All of the current suggestions about how nutrition may influence lameness, in NZ and overseas, pivot on some variation of the idea that the rumen is negatively impacted by the diet, and then 'poisons' the feet. To establish what impact SI pastures have, actual rumen function was measured under typical nutritional management in this high production commercial herd. The LUDF is a commercial operation in the upper decile of

NZ grass based production, run jointly by Lincoln University and SIDDC. One traditional problem with research on rumen function in pasture based cows is how to access the rumen and measure parameters while they are out on pasture. This research developed a new method of directly and continuously measuring rumen pH, temperature and activity in typical cows that were not restricted, but ran freely in the LUDF herd. To do this, unique backpack computers and special probes placed in the rumens of five fistulated cows that were surgically modified for this work were used. To evaluate any shifts in microbe populations, rumen samples were obtained and specialised molecular techniques of DNA analysis were introduced for this purpose.

Results

The project is ongoing but a summary of the preliminary results to date will be given here and updated in the presentation.

Lameness on farms

The total lameness cases treated on the participant farms in 2005/06 season averaged above 20% of the herd, which is considerably higher than previous estimates for the SI, or the previous research from the NI and Australia, where there is some consensus around the figures 7-14% (Harris, et al., 1988, Jubb and Malmo, 1991, Sauter-Louis, et al., 2004), and is approaching some figures given for the northern hemisphere (Nocek, 1997). There was a marked variation in lameness between farms (5 - 55%), and Jersey herds were observed to have lower lameness and a different lameness 'profile'. There was a distinct seasonal trend in recorded lameness, with most cases recorded in the middle of the season when average temperatures are highest and rainfall lowest, and fewer cases at either end of the season. Projections from the preliminary results of the 2006/07 season to date suggest a general decrease in lameness across the SI to approximately two thirds of that of the 05/06 season, and lower in some regions, despite increased rainfall.

White line lesions were the dominant lameness (60%), with sole injury (20%) and interdigital lesions (10%) the next most frequent. The hind legs were the site of lameness in approximately 80% of cases, and the outside claw in 85% of cases. These lameness 'profiles' are similar to previous lameness studies in NZ and Australia (Jubb and Malmo, 1991).

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Pasture quality was measured as very high and consistent across the entire season(s), with little variation beyond a decrease in mid summer. The average monthly value trends across the season to date are as follows: metabolisable energy (ME) 11.5 – 12.5 MJ/ kg DM; crude protein (CP) 21 - 26% DM; neutral detergent fibre (NDF) between 36-40%; and water soluble carbohydrates (WSC) 14-22%. Farms with above average pasture quality recorded above average lameness incidences.

In addition, summaries of the association of recorded lameness on participant farms with herd size, nutritional management, cow age, production, fertility, genotype, physical infrastructure and farm lameness awareness will be included in the presentation.

LUDF rumen function experiments

Rumen pH was demonstrated to fall to lower levels for longer periods of time than has previously been assumed in grass based systems (Wales and Doyle, 2003). For example, in some measurement periods cows were observed to spend approximately 80% of their time under pH 6.0, 20% under 5.5 and 10% under 5.0, with no obvious ill effect. Cows were commonly observed to have pH values below 5.5 at some point each day. There was a stable, repeatable pattern to daily pH changes that appeared strongly linked to the daily grazing management at LUDF (fresh evening break, daylight clean up paddocks). The cows were recorded with more frequent daily pH 'swings' than has been reported for ration fed cows overseas (Marie Krause and Oetzel, 2006).

The analysis of the rumen samples suggested there were no substantial changes in the profiles of the sub-populations of the rumen microbes across the season, with no evidence of a spring 'crash' in these or any other aspect of rumen function. There was no clinical evidence in any of the cows of illness or sub-optimal welfare despite the consistently low pH values recorded.

Conclusions

The South Island has a significant problem with lameness, which appears to be higher than that in similar pasture based systems of the NI and Australia, while the profile of recorded lameness is similar. Marked variations in the incidence between seasons and between similar farms suggests there are novel, important influences on SI lameness that have not been understood. The results to date suggest herd size, nutritional management and genotype in particular are three potential influences that warrant further attention.

The results from the LUDF experiments suggest rumen function in high production, grass based SI cows is at present poorly understood, and guidelines for 'normal' rumen function that are developed from specific local research are required. Although rumen function under the characteristic SI nutritional management was atypical, there was no evidence on the results to date that it was dysfunctional, and it appeared stable and well adapted across the season.

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