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Countdown to calving

The transition period starts now!

DairyNZ

SWEDE DISEASE LESSONS | DIGITAL DERMATITIS SPREADS | SUPPLEMENT RESEARCH SURPRISES

Contents

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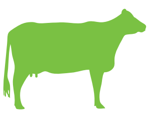
The transition period starts now!

March is the time to start focusing on calving, particulary assessing how to manage your herd's body condition score (BCS). BCS is the single most important factor influencing the health of the transition cow and her milk production and reproductive success following calving. DairyNZ principal scientist John Roche explains.

Key points

- Body condition score at calving is the most important factor affecting the health of a transition cow and her performance post-calving.
- March is the time to assess how to manage your herd's BCS.
- Drying-off cows is the best way to increase BCS. For late calvers, once-a-day-milking (OAD) and supplementary feed can also help.



The optimum BCS at calving for mature cows is 5. Heifers and second calvers should be 5.5 at calving.

John Roche, DairyNZ

When most people hear the term 'transition cow' or 'transition period', they immediately think of short days and cold wet weather – calving time. However, research in New Zealand and internationally has now identified that the transition period actually starts much earlier[1,2,3,4].

The most important management factor influencing the incidence of metabolic disease at calving, and levels of milk production and reproductive success in lactation, is body condition score (BCS) at calving. The optimum BCS at calving for mature cows is 5. Heifers and second calvers should be 5.5 BCS at calving.

The second factor influencing cow health around calving is pre-calving feeding.

So, management decisions for calving BCS and feeding cows around calving should be considered at the same time.

Calving BCS and transition cow health

Although the effect of BCS on milk production and reproduction has been accepted for decades, much less was known about the effect of BCS on transition cow health, because it was unclear whether poor health caused thin cows, or thin cows were simply more likely to get sick. Recent DairyNZ experiments were designed to answer this question[3,4].

The results indicate that cows were healthiest if they calved between BCS 4.5 and 5. If thinner than BCS 4.5, they had poorer immune function and were more at risk of a uterine infection. However, if fatter than this (i.e. BCS 5.5), there was an increased risk of ketosis and other metabolic diseases, particularly if they were being fed high quality feed during the weeks before calving (i.e. consuming more than 100 MJ metabolisable energy/day). These metabolic diseases also increase the risk of uterine infections and mastitis.

Therefore, *the cow's calving BCS determines the effect of transition cow nutrition on the incidence of disease.*

Achieving optimum BCS

From March, most cows are 120 to 150 days (North Island) or 150 to 180 days (South Island) away from the planned start of calving. Generally, cows lose a little BCS during the two weeks following dry-off and *cows do not gain BCS in the month before calving*. Therefore, early-calving cows only have 75 to 100 days during which they can gain BCS.

A cow will gain BCS if:

- she eats more and does not produce more milk, or
- she eats the same amount but produces less milk.

There are, therefore, three strategies for BCS gain:

1. changing from twice-a-day to once-a-day (OAD) milking
2. feeding supplementary feeds to milking cows and dry cows
3. drying off cows early.

An effective strategy to achieve calving BCS generally involves a mix of all three.

Changing cows from twice-a-day to OAD milking

Cows milked OAD in late lactation gain about 0.25 BCS units more in three months than cows milked twice a day over the same period[5]. This can be part of an effective strategy to keep cows milking and gain BCS if OAD milking starts in January/February. However, cows must be offered the same amount of feed as if milked twice a day. At this stage (i.e. March), changing from twice-a-day to OAD milking is only an option if cows are BCS 4 or greater, as the amount of BCS that will be gained before dry-off is very small.

Feeding supplement to milking cows and dry cows

When fed supplements and presuming pasture is not wasted (i.e. grazing residuals are no higher than 3.5-4 cm or 7-8 clicks on the plate meter), cows will partition the extra energy into producing more milk. This means that providing supplements to milking cows is not a very effective strategy for gaining BCS[6], although it can prevent BCS loss when grazing residuals are less than 3.5-4 cm (7-8 clicks on the plate meter).

Offering supplements to dry cows will increase BCS, but different feed types have different effects on the amount of BCS cows gain/100kg DM of supplement fed. For more information on the effect of different supplements on BCS gain, refer to *DairyNZ Body Condition Scoring – the reference guide for New Zealand dairy farmers* (dairynz.co.nz/publications/animal/body-condition-scoring-reference-guide/).

Drying-off cows early

Cows need time to gain BCS as well as more energy. Therefore, drying-off thin cows (i.e. less than BCS 4) at least 14 weeks before the planned start of calving is required to achieve BCS targets[7]. A maximum gain of 0.5 BCS units/month is a good rule of thumb, taking account of no BCS gain in the final month of pregnancy.

The best strategy for BCS gain

To manage calving BCS targets, the herd must be assessed in early March. OAD milking and feeding milkers supplements are not effective ways to gain BCS in early-calving cows at this time. To hit targets, cows should be dried-off based on their individual BCS, their approximate calving date, and the amount of supplementary feed available for autumn feeding. A timeline relative to calving date is presented in Table 1.

For later-calving cows, OAD milking and supplementary feeds can form a part of the strategy for BCS management. But the time taken to gain the necessary BCS must be considered. Particular attention must be paid to R2s and heifers finishing their first lactation.

For more information on dry cow feeding requirements refer to the April 2014 *Technical Series* article – Feeding for BCS gain.

Table 1. Days required from drying-off until calving to achieve the target calving BCS, based on cow age and BCS at dry-off, when fed pasture only or pasture and a high quality supplement.

Body condition score		Days cow need to be dry before calving	
Mature cows	Rising three-year-old	Autumn pasture (days)	Autumn pasture and high quality supplement (days)
3	3.5	160	120
3.5	4	130	100
4	4.5	100	80
4.5	5	70	60

Note: Includes 10 days when cows are being dried off and not gaining BCS and 30 days when cows do not gain BCS before calving. For this strategy to work, dry cows must be allocated a minimum of 9-11kg DM/day (depending on breed).

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Supplement research surprises

When fed the same amount of metabolisable energy (ME) in late lactation from either palm kernel extract (PKE) or maize grain, cows gained the same amount of body condition. However, there was an unexplained increase in milksolids yield in cows fed PKE. The research was conducted by DairyNZ senior scientists Jane Kay and Claire Phyn, post-doctoral scientist Talia Grala, and principal scientist John Roche.

Key points

- Late lactation cows were fed 55 MJ metabolisable energy a day from palm kernel extract (PKE; a high-fibre supplementary feed) or maize grain (a high-starch feed).
- Cows fed PKE produced more milksolids than those fed maize grain.
- Body condition gain did not differ between the two groups.
- The reason for the milksolids difference is unknown; however, possible reasons include:
  - there may be less substitution of pasture in cows fed PKE compared with maize grain,
  - the ME content of PKE may be greater than currently predicted, based on laboratory analyses.

Jane Kay, DairyNZ

A question often asked is "What is the impact of feeding different supplements on cow performance during late lactation?"

Based on previous research conducted in early lactation[1] and during the dry period[2], it was believed that feeding a starch-based supplement, such as maize or barley grain, would increase milk volume and milk protein yields, whereas a high fibre supplement, such as PKE, would increase milk fat percentage and body condition score (BCS).

When carbohydrates (e.g. fibre, sugar or starch) are fed, they are fermented in the rumen by micro-organisms and the by-products (which include volatile fatty acids) provide energy for the dairy cow. There are three main volatile fatty acids produced in the rumen: acetic, propionic and butyric acids, and the relative proportion of these are influenced by the types of carbohydrate that are fed.

When a high sugar or starch supplement is fed, the production of propionic acid increases. This is a precursor for glucose synthesis, which is then used to produce lactose in the mammary gland, increasing milk volume. In addition, the increased glucose synthesis is associated with a greater uptake of amino acids by the mammary gland, and this increases milk protein synthesis.

In contrast, a high fibre supplement, such as PKE or pasture silage, increases the proportion of acetic acid produced in the rumen, which is the building block for milk fat and body fat synthesis.

Therefore, people have concluded that feeding a high starch supplement in late lactation would promote milk protein and milk yield, whereas a high fibre supplement would increase BCS gain and milk fat yield.

As there has been limited research on the effect of these supplements in late lactation, a DairyNZ experiment was conducted in March-May 2014 to quantify the milk production and BCS response to dietary energy provided as either a fibre- (PKE) or starch-based (maize grain) supplement.

Cross-bred cows, grazing pasture, were allocated to one of two treatment groups; one group was supplemented with maize grain (high starch), and the other with PKE (high fibre and fat) for eight weeks until dry off.

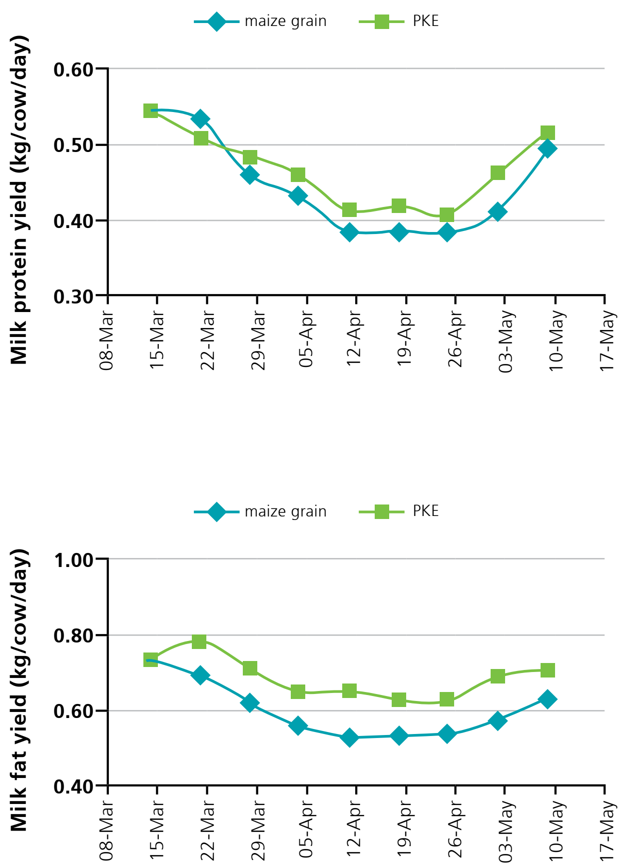
To ensure that the predicted ME supplied from the two feed sources was equal (approximately 55 ME; MJ), cows were fed either 4kg DM/d maize grain (13.5 MJ ME/kg DM) or 5kg DM/d PKE (11.0 MJ ME/kg DM). The daily supplement allowance was split evenly between the morning and afternoon milkings.

Uncovering the unexpected

BCS gain did not differ between cows supplemented with PKE or maize grain. On average, all cows gained approximately 0.25 BCS over the eight week period.

In addition, there was no difference in milk yield between cows fed PKE or maize grain; however, milk protein and milk fat concentrations were greater in milk from cows fed PKE, resulting in 0.1kg/cow/d more milk fat and 0.02kg/cow/d more milk protein (Figure 1). Over the eight week period, this amounted to 6.7kg more milksolids produced from cows fed PKE compared with cows fed the same estimated amount of ME from maize grain. This result was not anticipated.

Figure 1. Milk fat and protein production from late lactation cows fed similar energy from PKE or maize grain (55 MJ ME/cow/day).



So what caused the difference?

Because the ME of the supplementary feeds was predicted to be the same for both treatments, DairyNZ researchers did not expect to see a difference in total milksolids production. This hypothesis was based on previous research: when starch has replaced fibre in the diet, milk protein yield increased while milk fat yield decreased, resulting in no net change in total milksolids[1]. However, in this experiment, feeding a fibre-based supplement (PKE) increased both milk fat and milk protein yields, resulting in an increase in total milksolids production. Possible explanations for why this occurred are:

Did cows fed PKE eat more pasture?

Feeding cows maize grain may have resulted in greater pasture substitution compared with feeding PKE due to the increased satiety signals that are released when starch-based supplements are fed. The satiety signals tell the cow that she is not hungry and does not need to spend any more energy grazing. If there was increased substitution when maize grain was fed, this would result in a lower pasture intake and, therefore, a lower total energy intake compared with cows that were supplemented with PKE[2].

However, the difference in milksolids production between cows fed PKE and maize grain was equivalent to approximately 12 MJ ME or 1kg DM pasture/cow/d. This would be less than 100kg DM/ha difference in post-grazing pasture residuals and would be difficult to detect. Unsurprisingly, therefore, the pre and post-grazing measurements taken during the study did not indicate any differences in pasture intake between the different supplements.

Are our estimates of the ME of PKE accurate?

Currently, there is no equation available to calculate the ME of PKE accurately. Therefore, it is possible that current laboratory predictions are incorrect. Further work is required to determine the true ME of PKE, as the milk production responses in this trial, as well as the efficiency of BCS gain in dry cows reported previously[3], are greater than current ME estimates would indicate.

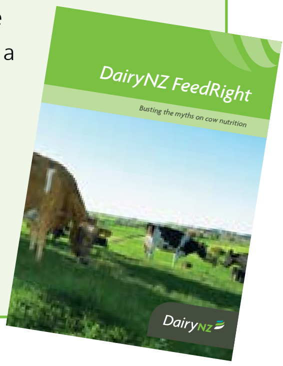
Was the maize grain diet deficient in protein?

Maize grain is lower in crude protein (CP) than PKE (approximately 9% vs. 18% CP); therefore, total dietary CP content was lower for cows fed maize grain than PKE (15% vs 18% CP). However, the total CP content of both diets was greater than the typical dietary recommendations for late lactation cows of 14% CP. A protein deficiency is therefore, unlikely to have contributed to the difference in total milksolids production between the two treatments.

Conclusion and implications

Further research is required to confirm the underlying reason(s) for the unexpected response. DairyNZ's recommendations remain that if supplements are required to fill a feed deficit during late lactation, they should be purchased on a cents/MJ ME basis.

For more information on feeding maize grain or PKE refer to the DairyNZ FeedRight booklet: dairynz.co.nz/publications/feed/



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Digital dermatitis: What you need to know

Digital dermatitis is the most important infectious cause of lameness in dairy cattle worldwide. It is now affecting New Zealand dairy herds. Richard Laven, associate professor in Production Animal Health at Massey University, explains.

Key points

- Digital dermatitis is a bacterial infection on the feet of cattle.
- It is increasing in New Zealand.
- To prevent your stock getting digital dermatitis, avoid buying cattle from farms with the infection.
- Ensure transporters disinfect stock crates and disinfect on-farm equipment.
- Improve slurry management and focus on reducing faecal contamination of feet.
- Check rear feet frequently for signs of digital dermatitis.
- Housed cows present a risk, especially in cubicle housing.
- Feed pads and stand-off pads should drain well and be cleaned regularly.

Richard Laven, Massey University

Digital dermatitis – a global issue now affecting New Zealand dairy herds

Digital dermatitis was first identified in Northern Italy in 1974, and has now been reported across the world[1]. The first New Zealand case occurred in 2004[2], with sporadic reports until around 2011 when the number increased markedly. In a study in North Taranaki in 2015, two-thirds of the 224 herds visited had at least one cow with digital dermatitis. New Zealand dairy farmers need to be prepared for digitial dermatitis; to know how to prevent the disease getting on farm, and how to diagnose and control it if it does. ▶

What does digital dermatitis look like?

Typically, digital dermatitis is found on the skin just above the interdigital space (Figure 1); however, it can also be found along the coronary band (Figure 2). Digital dermatitis is most commonly found on the hind feet; fewer than 3% of affected cattle have lesions on the front feet only[3].

The classical lesion of digital dermatitis is a moist ulcer (Figure 1). However, digital dermatitis is a cyclical disease with lesions forming, healing and then returning, so it has multiple stages. The most persistent stage (often called M4[4]; Figure 1B) is a chronic thickening of the skin with rapidly spreading growths, which can often resemble hairs (in some countries these are called hairy hoof warts). In New Zealand, the most common appearance of digital dermatitis is a small lesion less than 1 cm in size (R. Laven, unpublished data; Figure 3).

Larger lesions, either when they develop into ulcers or when they are growing, tend to be extremely painful. Affected cows will often stand with only the tip of the toe touching the ground with the heel bulb raised, and may shake the infected foot repeatedly, while others might only appear lame when walking. However, many cows with visible digital dermatitis lesions show no sign of lameness and the lesions do not appear to be painful.

What causes digital dermatitis?

The current consensus is that treponemes are the primary bacteria responsible for the development of digital dermatitis. Research indicates that prolonged standing in wet, dirty conditions that result in softened and broken skin on the cow's heel will increase the risk of digital dermatitis.

Figure 1. Typical appearance of digital dermatitis lesions in typical site. A, moist ulcerative lesion; B, chronic proliferative lesion; C, healing lesion with prominent black scab.

Figure 2. Digital dermatitis lesion on coronary band showing ulceration and proliferative changes.
Photo courtesy of Neil Chesterton.

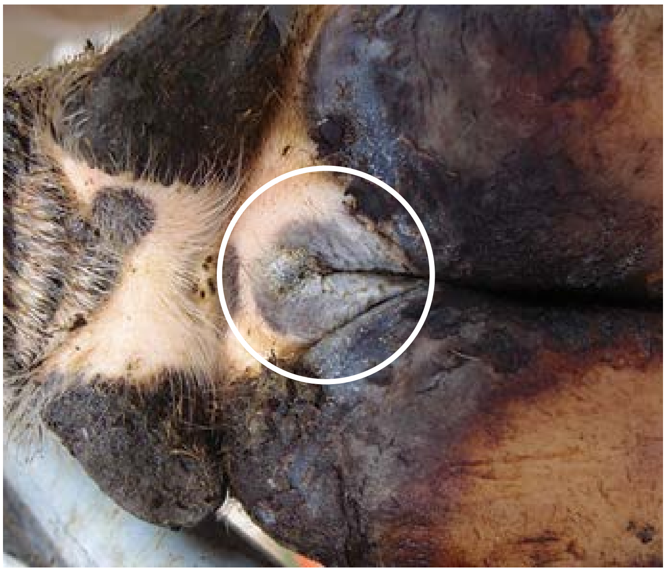

Figure 3. The most common lesion seen in New Zealand is a small proliferative lesion.
Photograph courtesy of Kristina Mueller.

How to keep your farm digital dermatitis-free

Imported animals

The biggest risk of introducing digital dermatitis onto the farm comes from importing infected cattle, including replacement heifers and bulls. Cows or bulls should only be bought from farms that are free of the disease, as simply identifying and purchasing cows without visible lesions will miss carriers who are infected but do not have lesions. This is particularly important when purchasing groups of cattle; if one cow has visible lesions then the whole group must be rejected.

Whenever transporting stock between properties or purchasing digital dermatitis-free stock, ensure they don't travel with stock from infected herds or in trucks that have not been cleaned effectively after carrying cattle of unknown status. Transfer of digital dermatitis can also occur via contaminated hoof trimming equipment, knives, ropes, buckets and clothing[5]. Ensure they are disinfected before use and that footwear is clean.

Slurry the biggest risk

The treponemes bacteria found in digital dermatitis lesions are present in the gut of the cow and therefore, in cattle faeces and slurry[5]. Slurry, which is a mix of urine, water and faeces, is the most potent means of spreading digital dermatitis because it contains both the treponemes and water; the latter moistens the skin and makes bacterial invasion easier. Urea (from the urine) breaks down skin keratin, allowing even easier entry for bacteria. *Minimising contact with slurry is crucial to reducing the prevalence of digital dermatitis on-farm. Cows with clean, dry feet have a lower risk of digital dermatitis*[1].

Housed cows more susceptible

The number of dairy farms in New Zealand that house cows for a significant proportion of the year is small (about 530). However, housed cows can act as incubators for digital dermatitis, building up higher levels of infection that can spread through transfer of cows between farms. If the number of cows housed in New Zealand increases, the risk of this spread will also increase.

Cubicle housing high risk

In New Zealand, there are more than 60 farms using cubicle housing, which is known to have a particularly high risk of digital dermatitis.

If houses have concrete flooring, farmers should at least monthly, during milking, examine the hind feet of all cattle for signs of digital dermatitis.

Cattle loose-housed in straw yards have a lower risk of digital dermatitis as there is less contact between slurry and feet in loose-housed systems[1].

Clean stand-off and feed pads

Around a quarter of New Zealand farms (24%) use stand-off or feed pad facilities. Slurry control for concrete stand-off/feed pad facilities is often poor, with cleaning of these areas often being less than once a week, despite intensive use. If infected cattle are present on such farms, then spread of digital dermatitis will occur via the stand-off/feed pad facilities. For infected herds, concrete areas should be cleaned at least once every 12 hours; this will minimise the build-up of slurry and the risk of spreading digital dermatitis. Another key feature is drainage. Wet slurry, as discussed earlier, increases the risk of digital dermatitis. If the feed pad is poorly drained, it will need more frequent cleaning. Make good drainage a priority when building a new feed pad.

Slurry management is not just about housing and feed pads; collecting yards can also be an important source of slurry. Ensure that they are cleaned thoroughly after every milking.

If suspicious lesions are detected then veterinary advice should be sought to confirm it is digital dermatitis. Infected cows can be treated with a topical antibiotic spray. Antiseptic footbaths, used for every animal in the herd, can help control the spread of the disease.

For more information on practical measures to identify and manage digital dermatitis, go to dairynz.co.nz/animal/health-conditions/lameness/

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Lessons from swedes disease outbreak

In the winter of 2014, dairy farmers across Southland and South Otago encountered high incidences of illness and death in cattle grazing on swede crops. DairyNZ senior scientist Dawn Dalley and project manager Sue Petch explain the findings of DairyNZ's investigation into the event.

Key points

- High concentrations of glucosinolates (GSL; a family of compounds found in brassicas) can cause brassica toxicity. Leaves and flowers of swedes have higher GSL concentrations relative to the bulb/crown.
- All cultivars of swedes can cause liver damage in cattle. The severity of toxicity is influenced by multiple factors.
- The higher disease incidence reported in Southland and South Otago in 2014 was largely caused by feeding swede crops that were reproductive ('bolting'). Herbicide Tolerant (HT®) variety swedes, shown to have higher concentrations of GSL, exacerbated the problem.
- Air temperatures in winter and spring of 2014 were warmer than normal for the area, which probably increased the proportion of leaf in swede crops and caused crops to bolt earlier than normal.

Dawn Dalley, DairyNZ

Brassicas known to cause toxicity

Brassica crops are a valuable source of supplementary forage for dairy cows in pasture-grazing systems, particularly as winter feed in cooler regions of New Zealand[1]. However, brassicas contain glucosinolates (GSL), many of which are pre-toxins and break down to actively toxic products when plant tissue is damaged. When ingested by cows, they may cause a variety of brassica-associated diseases[2].

Reports of sick cattle spark investigation

During the winter of 2014, dairy farmers across Southland and South Otago encountered unusual patterns of illness and deaths of cattle grazing on swede crops. Sporadic reports and cases of dead or sick animals were first received by veterinarians from mid-July. DairyNZ collaborated with other organisations to:

1. support affected farmers through the rest of the season
2. understand the cause of problems, and
3. develop management strategies to mitigate the risk of brassica toxicity.

Researchers initially suspected brassica toxicity was the cause of the problems given that clinical signs closely matched descriptions in the veterinary literature. The basis of the research hypotheses to be tested was:

- the unusual patterns of illness and death in cattle grazing on swede crops was due to liver damage from toxic compounds formed following the consumption and digestion of GSL
- concentrations of GSL were higher in the reproductive parts of the swede
- the Herbicide Tolerant® (HT®) swede variety could be a contributing factor.

The DairyNZ-led research plan fell into three main phases:

1. collection and analysis of animal (i.e. blood) and plant samples from the event
2. review of scientific literature and an in-depth farmer survey
3. timely dissemination of findings and recommendations for farmers and rural professionals.

Results of the investigation

The analysis of blood samples collected from affected and unaffected herds indicated there was subclinical disease with all swede varieties, irrespective of whether or not cows suffered ill health. This result was deduced from the concentration of the enzyme, γ-glutamyl transferase (GGT), which is an indicator of liver damage. When damage occurs, GGT is secreted at higher amounts from the bile duct linings. As GGT concentrations in blood were elevated in cows fed swedes, this backed up the theory that the disease outbreak was due to toxins causing liver damage.

An important result from the farmer survey was a strong correlation between disease incidence and consumption of the HT® swede variety when cows were fed swedes on the milking platform during calving or in early lactation. Weeks on crop did not appear to be a major contributing factor to the disease incidence.

Climatic conditions were also thought to have influenced growth and maturity of swedes, with autumn through spring 2014 being much warmer than normal; at times and in places by as much as 1.5°C[4]. Also more rain fell than usual in April, May and July[4]. Farmers reported visual differences in their crops compared with other seasons, with stems elongated and plants in the reproductive (bolted) phase (Figure 1). ▶

Figure 1. Comparison of swede physical appearance: mid September 2014 and late August 2015.

September 2014

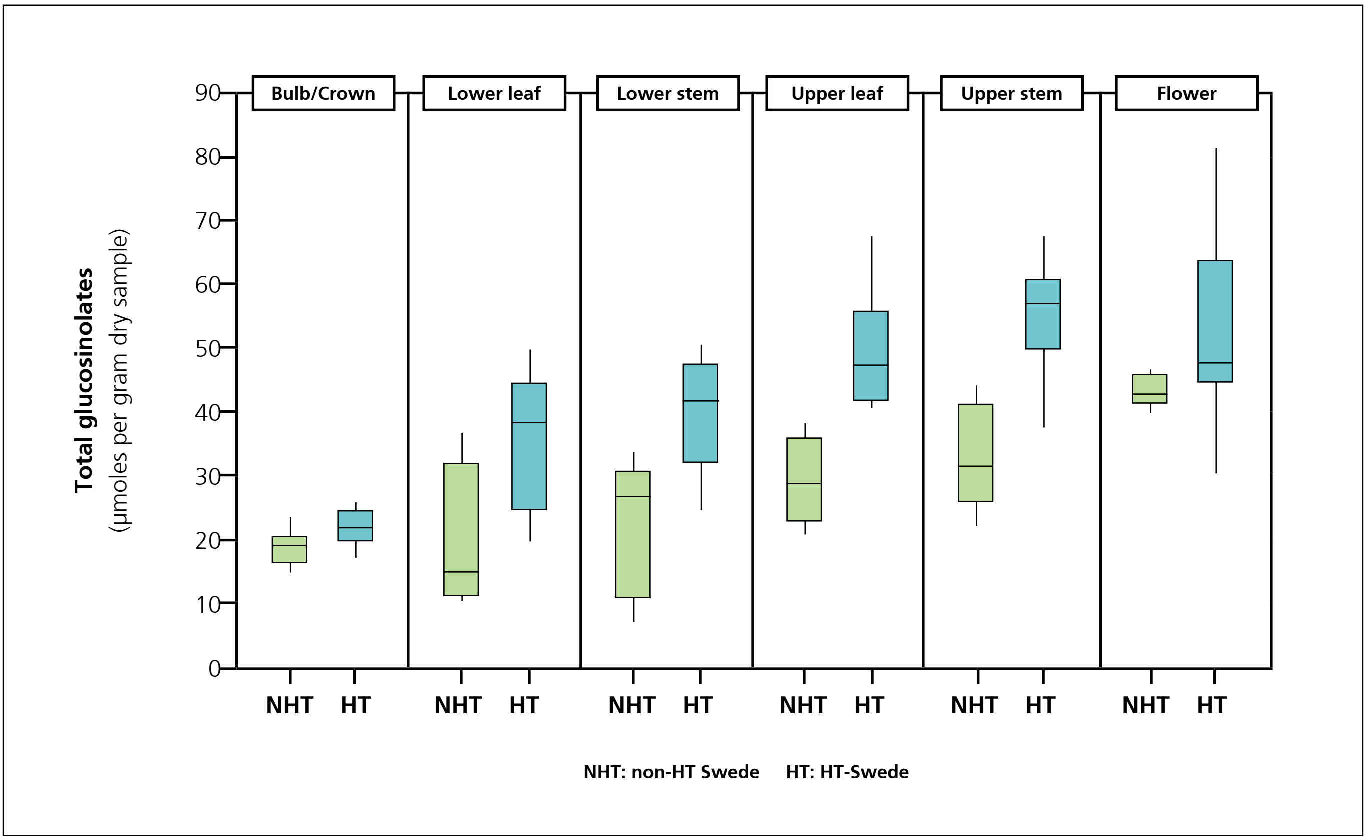
August 2015

Analyses of swede plant samples indicated significant differences in GSL concentrations between different plant parts and between HT® and non-HT® swede varieties (Figure 2). For all plant parts, except bulb/crown, the average GSL concentration was greater in HT® than non-HT® swedes. In non-HT® swedes, the bulb/crown and lower leaf GSL concentrations were similar, but there was a steady increase in GSL concentration moving up the plant from lower stem, upper leaf, upper stem to the flower. In HT® swedes, there was an increase from bulb/crown, but upper leaf, upper stem and flower were similar for GSL concentrations.

The now common practice of feeding swedes during calving and early lactation was, in the researchers' opinion, a major contributor to this disease outbreak as it increased the risk of feeding crop with higher concentrations of GSL.

Over the last 10-20 years, swede use has changed from being primarily a wintering crop to one now often used to fill the feed deficit on the milking platform in early lactation. As swede crops for both scenarios are sown at the same time, cows will be exposed to a more mature crop during calving and early lactation, and their GSL intake will be higher. In 2014 this effect was probably exacerbated by crops reaching maturity more quickly due to the unusually warm winter with fewer frosts.

Figure 2. Concentration of total glucosinolates in swede plant parts collected from Herbicide tolerant (HT®) and non HT® swede varieties.



DairyNZ recommendations to farmers

- Do not feed HT® swedes on the milking platform in late August/early September (i.e. late pregnancy, early lactation). This period is when many of the factors that lead to ill-heath and potential cow death (warmer temperatures, new leaf growth, bolting) can rapidly combine.
- Do not feed swede crops in their reproductive growth phase, which can be recognised when the stem of the swede elongates, new growth appears and the swede plant develops flowers and a seed head.
- Be cautious when grazing animals on swede crops in autumn, before the first frosts, as they may eat more leaves than bulbs as the bulbs are hard and difficult to eat.
- Be cautious, at any time during the season, when grazing animals on swede crops with a high leaf to bulb ratio as cows may preferentially graze leaf.
- Observe the physical characteristics of the crop being fed, monitor the health of cows and adjust their feed management if ill-health is observed. For more information around feeding management go to dairynz.co.nz/swedes and refer to *Advisory #11.*
- Follow PGG Wrightson Seeds' advice regarding HT® swedes and their use.

These recommendations are based on the following factors:

- Warmer weather will stimulate swedes to enter the reproductive phase.
- HT® swedes have a higher concentration of GSL in the plant parts where re-growth occurs. This may occur with other leafy swede varieties.
- Cows that are under metabolic stress, due to late pregnancy and early lactation, are less able to cope with toxins arising from high concentrations of total GSL in their diet.

Managing risk in the future

- Simplify winter feeding systems to minimise the transitioning requirements for animals as they change feeds (i.e. pasture to crop; crop to crop; crop to pasture). For more information go to dairynz.co.nz/swedes and refer to *Advisory #12.*
- Use farm management practices (e.g. mob age structure, feeding frequency, and break dimensions) that reduce the potential for individual cows to graze proportionately more leaf.

References

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Science *snapshot*

DairyNZ levy funded or supported science

Source of metabolisable energy (ME) affects gene transcription in metabolic pathways in adipose and liver tissue of nonlactating, pregnant dairy cows

(Crookenden et al[1])

- This study investigated the efficiency of five different feeds for gaining body condition during the dry period, and how these feeds affected gene expression in liver and adipose (subcutaneous body fat) tissue.
- Feeds compared were maize silage, pasture silage, palm kernel expeller (PKE), maize grain, and fresh autumn pasture.
- All cows were offered autumn pasture to maintenance requirements. One group (control) only received pasture to maintenance, whereas the other groups received pasture to maintenance plus one of the five different feeds.
- The five different feeds were offered at two levels (2.5kg DM/day or 5.0kgDM /day).
- Liver and adipose tissue samples were collected during the fourth week of the study to analyse the expression of genes involved in energy metabolism.
- As expected, cows offered additional feed had increased body weight (BW) and body condition score (BCS) than control cows that were fed to maintenance requirements.
- This effect was supported by increased expression of genes involved in fatty acid synthesis and fat deposition in adipose tissue with increasing energy intake. Interestingly, there was also greater fatty acid breakdown in adipose tissue with increasing energy intake, indicating greater metabolic activity.
- Of the five feeds, autumn pasture was not used as efficiently for BW gain as the other feeds; this has often been referred to as ‘autumn ill thrift’ in growing cattle and fattening lambs. In fact, the expression of genes involved in nutritional signalling in the liver was lower in cows fed autumn pasture.

- When cows were fed high starch feeds (maize grain and maize silage) there appeared to be greater transport of fat from the liver to adipose tissue for storage compared with low-starch supplements (pasture, PKE, and pasture silage), indicated by changes in gene expression in the liver.
- Cows fed 5kg DM/d of maize grain had the greatest energy intake and also the greatest increase in BW and BCS during the dry period. However, on a ME basis, PKE was the most efficient for BW gain (kg BW gain/MJ ME). The reason for this, however, could not be explained by the gene expression profiles. On a ME basis, maize silage and pasture silage were used with similar efficiency for BCS gain.

References

1. Crookenden, M. A., K. S. Mandok, T. M. Grala, C. V. C. Phyn, J. K. Kay, S. L. Greenwood, J. R. Roche. 2015. Source of metabolizable energy affects gene transcription in metabolic pathways in adipose and liver tissue of nonlactating, pregnant dairy cows. Journal of Animal Science 93: 685-698.