

DairyNZ FeedRight

Busting the myths on cow nutrition



DairyNZ 

Foreword

This booklet contains the most frequently asked questions and considered responses given at FeedRight events held throughout New Zealand in 2014 and 2015. It is not intended to be a comprehensive guide to cow nutrition.

During these events farmers had the opportunity to ask specific questions about what, when and how to feed their cows. Four of New Zealand's leading experts on cow nutrition, DairyNZ's Drs John Roche and Jane Kay, Lincoln University's Dr Jim Gibbs and independent consultant Dr Terry Hughes used evidenced based knowledge to answer these questions and to separate fact from fallacy.

These events form part of the FeedRight initiative, funded by DairyNZ and the Sustainable Farming Fund, that is running from 2014 to 2017. An objective of the FeedRight programme is to provide farmers with knowledge and resources that enable them to make profitable and sustainable feed management decisions.



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Rumen

What differences exist in the rumens of cows fed pasture compared with a total mixed ration?

There are three main differences in rumens of pasture-based cows compared with rumens of cows fed a total mixed ration (TMR): water intake, rumen size, and rumen content.

1. Water intake

If cows have a high intake of good-quality pasture, they consume a greater volume of water (due to the high water content of pasture) compared with cows fed a total mixed ration. A cow eating 18 kg DM/day of a high quality pasture can consume about 100 to 120 litres of water a day.

In a pasture-based diet, loose faeces (as is often seen in spring) is typically associated with the high water content of the pasture and does not indicate health issues. The loose faeces are simply a consequence of the high water intake, rapid passage rate and fast rumen turnover.

2. Rumen size

Rumens from pasture-fed cows tend to be larger than from cows fed a TMR (approximately 20-25 % of liveweight for cows grazing pasture compared with 10% of liveweight for cows fed a TMR).

3. Rumen content

In the rumens of cows fed a TMR there are three distinct layers; however, these do not exist in the rumens of pasture-fed cows. In the rumen of a pasture-fed cow, there is no floating layer (i.e. no rumen mat) and everything is mixed together like lawn clippings.

Does rumen size limit intake in cows grazing high quality pasture?

No. Although there are stretch receptors in the rumen, abomasum and intestine, research data indicate that there is no relationship between gut capacity and total intake when feeding high quality forages.

However if the quality of the feed drops (i.e. neutral detergent fibre (NDF) is greater than 50% and digestibility drops below 70%), physical factors such as gut fill become more influential, and in this scenario there is probably a small relationship between gut capacity and intake.

When cows are grazing high quality pasture, intake is primarily controlled by hormones and not by rumen size (volume). These hormones are released due to the products of digestion (i.e. volatile fatty acids) and inform the brain about:

- The nutrient content of the food the cow has eaten
- The amount of nutrients that are circulating in blood, and
- The energy stores that the cow has.

This is why a cow will sit down and stop eating, particularly after the morning grazing, even when her rumen is not full.

Because intake is not primarily regulated by rumen size, there is no benefit of trying to “stretch the rumen” as is sometimes advocated during the dry period.

Is the rumen the best mixer wagon?

Yes. The rumen is perfectly capable of mixing all ingested feeds.

Some people will tell you that rumen function is improved when all feeds are mixed and ingested by the cow at the same time. However, there is no evidence to support this and you will not see a difference or increase in milk production by doing so.

Research currently on-going in Australia, where grazing cows were supplemented up to 14kg DM/d of grass silage and wheat, had no milk production or rumen advantage to mixing the feeds compared with feeding them on their own (i.e. wheat in the shed and silage in the paddock).

The only benefit to mixing feeds before consumption is if there are multiple feeds being fed, and in particular if some of these feeds are a potential health risk to the cow (e.g. feeds high in starch such as barley). Mixing these feeds together into a ration can help ensure that each cow receives its allocated amount of forage and concentrate, and avoid cows over eating certain feeds.

Do you get a better feed utilisation, if drier material is fed with grass to slow down the passage rate of the diet?

No. Feeding drier feeds with high quality low DM pasture does not slow down the passage rate it simply removes water from the diet, and in a lot of cases, reduces the metabolisable energy (ME) of the diet, by replacing the higher ME feed.

Starch

Does feeding starch after calving/before mating improve fertility?

If cows are eating sufficient good quality pasture (i.e. residuals of 1500 to 1600kg DM/ha, with good pasture utilisation), supplementing with a starch-based concentrate will not improve reproduction.

Recently, on-farm trials were conducted to investigate the effect on reproduction of feeding a high starch supplement compared with a high fibre supplement. These trials involved 950 cows and three dairy herds and it was concluded from the results that increasing the amount of starch (non-structural carbohydrates) in the diet did not improve reproductive performance.

The theory behind using starch-based concentrates (e.g. maize grain or barley) or sugar-based feeds (e.g. molasses) to improve reproduction is based on increased concentrations of circulating hormones such as insulin and IGF-I, which, in theory, can lead to earlier cycling. However, the effect of increasing IGF-I on cycling is inconsistent and research in New Zealand indicates that 97% of the variation in time to first oestrus in New Zealand cows is related to things other than IGF-I levels. Additionally, increased IGF-I levels post-mating can lead to embryo death.

Reproductive performance above industry targets can be achieved when cows are fed solely on good quality pastures. If intake is restricted during the mating period either due to a pasture deficit (i.e. residuals are less than 1500 to 1600kg DM/ha) or prolonged adverse weather, then reproductive performance can be reduced. However, the effect is relatively small. In an experiment where cows were fed 55% of requirements for two weeks at the start of mating, the 6-week in-calf rate dropped by 7% and there was no difference in final pregnancy rate percentage.

If there is a pasture deficit during mating, the focus should be on increasing the energy (MJ ME) available to the cow. The type of supplement used to achieve this is secondary and, therefore, supplement purchase decisions should still be based on cents/MJ ME.

Protein

Does a high protein pasture diet need supplementary carbohydrate to improve protein utilisation?

No. Good-quality high-protein pasture is highly digestible by rumen microbes.

You cannot significantly improve the efficiency of protein, or more specifically, nitrogen use in the rumen by increasing the carbohydrate load. You can improve nitrogen-use efficiency by feeding low nitrogen feeds to your cows, but this is not due to improved utilisation of nitrogen. It is due to the removal of surplus nitrogen from the diet. So reduced nitrogen excretion when feeding more carbohydrates (e.g. maize with pasture) has very little to do with the carbohydrates, but with the reduced amount of nitrogen eaten by the cow.

When is protein (in a pasture diet) limiting?

There is no one answer to this question, as it differs from farm to farm depending on what is being fed as the base diet. Typically protein is not limiting when the diet is primarily high-quality pasture.

Recommended crude protein contents in the diet are:

- 18% in early lactation
- 16% in mid lactation
- 14% in late lactation
- 12% when dry.

These recommendations are not always exact, as the protein requirements of the cow depend on many factors including whether the cow is gaining or losing BCS and whether the cow is heat stressed. Even if crude protein is limiting milk production, it is often not profitable to add in expensive protein supplements.

For information on milksolids responses to additional dietary protein in summer, check out the DairyNZ Technical Series (Nov 2011).



What is the formula or equation to use to know if it is worth adding protein to the diet and how much should I pay?

There is no one equation to calculate if it is worth adding protein to the diet. The milk production response to additional protein will differ depending on the type of protein available (rumen degradable or undegradable) and the amino acid composition of the feeds.

Even if crude protein is limiting milk production, protein supplements are typically very expensive and if the system is not set up to feed protein supplements (i.e. in-shed feeding and appropriate storage), then wastage of this expensive supplement will be high. As with feeding any supplement, any potential increase in milk revenue needs to be greater than the cost of adding the extra protein to the diet.

For example in a research experiment, cows were fed a diet containing 50% summer pasture and 50% maize silage (crude protein = 11%). When approximately 1.3kg DM of the maize silage was replaced with 1.0kg DM soyabean meal (so that energy intake remained the same), the crude protein content of the diet increased to 16% and milksolids increased by 80g MS/kg DM soyabean meal.

However, the increased milk revenue (i.e. \$0.40 at a milk price of \$5.00) and the savings from spared maize silage (approximately \$0.39), did not offset the cost of the soyabean meal (\$0.99/kg DM). See examples in table below.

Milk price	\$5.00	\$6.50	\$8.00
Revenue from MS response	0.40	0.52	0.64
Savings from maize not fed	0.39	0.39	0.39
Revenue + savings	0.79	0.91	1.00
Cost of soyabean meal	0.90	0.90	0.90
Cost of wastage at 10%	0.09	0.09	0.09
Total cost of soyabean meal	0.99	0.99	0.99
Revenue over feed costs	-0.20	-0.09	0.01

Therefore, when it comes to supplementing with protein, profitability depends on:

- the base diet being fed
- the protein supplement used
- the total cost of feeding the supplement
- any increase in milk revenue.

When should I use urea as a protein supplement?

In most instances, in a pasture-based diet, urea or other sources of non-protein nitrogen will not improve milk production.

In a research trial, where cows were fed a diet containing 50% pasture and 50% maize silage, there was no milk production response when cows were supplemented with urea in either spring, summer or autumn.

This is because the protein that is available to the cow for milk production/liveweight gain (metabolisable protein) comes from two sources: microbial protein (protein and nitrogen that is produced by the rumen bugs) and by-pass protein (feed protein that passes through the rumen undegraded).

There is a limit to the amount of microbial protein that the cow can produce and, typically, there is almost never a shortage of nitrogen available for microbial protein in pasture-based systems. Therefore, adding urea to the diet, (a source for microbial protein) will not increase the metabolisable protein available to the cow or increase milk production.

Also adding urea to the diet can be risky. It depends on your feeding system and how the urea is mixed in with other feeds, but you have to be very careful and accurate (150g/cow per day might be okay, but 200 to 300g can kill cows).

Does protein increase appetite?

As a rule of thumb, no.

Adding more protein to the diet than what the cow requires does not increase intake. The only situation where this might occur is if protein was limiting milk production. In this situation, if protein was added to the diet, and milk production increased, then this may increase intake.

Protein:fat ratio

Is protein:fat (P:F) ratio a measure of adequacy of feeding?

Yes and No.

Yes, the P:F ratio can indicate the energy status of the cow but it can also be influenced by the dietary composition and is therefore not a sensitive measure of cow nutritional status.

If a cow's intake is restricted, the P:F ratio will generally decrease and when extra energy is added to the diet, the P:F ratio will increase. However, the type of carbohydrate fed to the cow can also affect both milk protein and fat production, irrespective of energy balance.

A much better measure of whether cows have adequate feed is to look at post-grazing residuals and milksolids yield in conjunction with the P:F ratio. This will help determine if cows are underfed and whether it would be profitable to give them additional feed.

Are milksolids worth more when the P:F ratio is greater?

Yes. Protein is worth more than fat in most milk payment systems; therefore, the value of each kg of milksolids increases as the P:F ratio increases.

However, the increase in milk revenue when the P:F ratio is increased is not large. For example, if protein is worth twice the value of fat, increasing the P:F ratio from 0.75 to 0.80 increases the milksolids revenue from \$5.93 to \$5.99 at a payout of \$6/kg MS and from \$7.90 to \$7.99 at a payout of \$8/kg MS. As the milksolids price declines, so does the price advantage of a high P:F ratio.

Does the P:F ratio influence reproduction?

Feeding cows to increase protein content or the P:F ratio, by itself, does not improve reproduction. However, in a herd of cows, those cows with a higher milk protein percentage (and typically a higher P:F ratio) are more likely to get pregnant. The reasons for this are not known, but likely reflect animal genetics and physiology that increases the protein content and improves reproduction as well.



Milk urea

When should I change a diet based on milk urea (MU)?

Never, based solely on MU concentrations. Milk urea (MU) is not an accurate indicator of dietary protein content and is very variable. “Up and down like a toilet seat” is an analogy that has been used to describe the variation.

The only time that MU concentrations can be useful is when supplements make up a large proportion of the diet. In this instance, a high MU concentration (greater than approximately 30 mg/dL) may indicate the cow is being fed more protein than required. A re-evaluation of the dietary protein relative to cow requirements may allow expensive protein supplements to be removed from the diet.

What is milk urea (MU)?

MU is a by-product of the breakdown of dietary protein in the rumen, and although MU concentration is associated with the protein content of the diet, it is not an accurate indicator of dietary protein adequacy.

The digestion of protein in the rumen releases ammonia. Excess ammonia is absorbed through the rumen wall into the blood stream and converted to urea in the liver. Most of the urea is excreted in the cow's urine although some passes into the milk.

How is MU expressed in New Zealand?

Be aware of what values you are looking at: milk companies, New Zealand labs, and universities may use different units for MU or MU nitrogen (MUN). Information from other countries is often expressed differently to what is on the milk docket here.

MUN is 47% of MU. The conversion equations are:

- $\text{MU (mg/dL)} = \text{MUN (mg/dL)} \times 2.14$
- $\text{MUN (mg/dL)} = \text{MU (mg/dL)} \times 0.47$

(mg/dL = milligrams per decilitre)

High MU

Due to the crude protein content of high quality pastures, MU concentrations are typically higher in cows grazing pasture compared with cows fed a total mixed ration or high levels of supplementary feeds and can reach levels of 50 mg/dL or more.

High MU concentrations are not detrimental to milk production, cow health or reproduction and the process of converting ammonia to urea is not energetically expensive.

Low MU

If MU concentrations are low (approximately less than 20 mg /dL) this may indicate there is not enough protein in the diet. As there are other factors that alter MU concentrations, laboratory analysis of feed ingredients and/or an assessment of the complete diet for protein (and amino acid availability) should be undertaken, before any nutritional changes are made.

Even, where dietary protein levels are lower than recommended, the total cost of feeding the additional protein must be considered and compared with the predicted milksolids response before protein supplements are purchased and fed.

Can MU values help to improve environmental footprint?

Although MU concentrations are positively associated with urinary nitrogen concentrations, the implications of small changes in the urinary nitrogen concentration on environmental nitrogen loading need to be considered with other system factors.

Numerous management and resource factors determine the environmental outcome on farm and the impact of any change needs to be determined by taking into account the whole farm system (e.g. stocking rate and DMI). The addition of low protein supplements to reduce MU and subsequent intensification in the absence of changes in other inputs, management practices or infrastructure, could actually lead to increased nitrogen leaching per hectare.



Fibre

Do cows need hay/straw during spring in a pasture-based diet?

No. There is adequate fibre in spring pasture (also adequate “effective” fibre) for the rumen to function properly.

The myth that “soft” pasture or the appearance of loose dung indicates a rumen upset or acidosis is associated with TMR or high-input systems and does not relate to cows eating a diet of at least 60% grazed grass. The DM percentage of the pasture is lower during spring, which means that extra water passes through the rumen. This water is not absorbed in the third stomach (omasum), and results in loose dung. Loose faeces is not a concern, unless the system is high input, in which case the amount of non-fibre carbohydrates, the fibre content (NDF) and the chop length of the diet should be checked (NDF should be at least 30% of diet).

Previous research investigating the role of fibre in maintaining an effective rumen environment was conducted with cows fed a TMR. From this work, some ideas have been introduced to New Zealand pasture-based systems. However, the rumen environment of a cow fed a TMR is very different to that of a pasture-based cow (see introduction). Cows that are fed a pasture-based diet have no floating “raft-layer” in the rumen. Therefore, the theory that straw will help form the raft layer and improve rumen function in pasture-based cows is not true.

Research data indicate that there is no benefit to rumen function or milk production when fibre (straw/hay) is added to a pasture-based diet. In fact, it can actually cause a drop in production, as a low quality (low ME) feed (e.g. straw) replaces high quality (high ME) feed (e.g. pasture). Additionally, the slower passage rate of straw can increase rumen fill and reduce DM intake.

How important is fibre in TMR cows and how much fibre should be in a TMR?

If NDF content drops below 30% in a TMR, you will likely see undesirable changes in rumen volatile fatty acid patterns and rumen pH. However, this is also dependent on the amount of non-structural carbohydrates in the diet (the technical term for soluble sugars and starch). There are simplistic rules of thumbs for the amount of fibre needed in a TMR diet, for example, non-structural carbohydrates should not exceed 38% of the diet and NDF should not be lower than 30%. However, if feeding a TMR, then a qualified nutritionist should be used to balance the ration.

How does fibre affect intake?

Poorly digestible forages that have a low ME (i.e. straw) take a longer time to digest in the rumen, have a slow passage rate and can thereby reduce DM intake.

What is the minimum dietary fibre requirement in drought situations to maintain rumen function?

It is recommended that the fibre content of the diet (NDF) is at least 30%. In addition, the rumen needs “effective” fibre to stay healthy and function properly.

Effective fibre describes the fibre that is most effective at promoting chewing and saliva production in the rumen and usually comes from a forage source (e.g. pasture, hay, silage, straw). In a TMR system, approximately 60% of the forage fibre is effective; whereas, it is estimated that about 50% of the fibre in pasture is effective. Ground feeds (e.g. PKE or cereal grains) have no “effective” fibre. Therefore, it is important to look at the effective fibre content and not just the NDF content of the diet.

In a drought situation it depends which supplement you are feeding to your cows. If feeding silage, there should be sufficient effective fibre in your diet. If you are feeding cereal grains or PKE, additional effective fibre (pasture, silage, straw) will need to be added to the diet.

A rule of thumb is that approximately 20% of the diet should be effective fibre.

Is hay/straw during the dry period beneficial?

It depends on what it is being used for.

There is no requirement for hay or straw as a source of fibre during the dry period. On the other hand, hay/straw can be used to lower the energy content of the diet for springer cows (a tool to prevent milk fever if cows are at or above target body condition score) while keeping cows feeling full and not walking the fence line and damaging paddocks.

What can we tell from the faeces of the cow? Does it give us clues about whether dietary fibre is sufficient?

When cows are fed a TMR, the consistency of the faeces can be an indicator of rumen health.

Loose, shiny faeces or the presence of bubbles in the faeces of a TMR-fed cow, indicates a rumen upset such as acidosis and the occurrence of hind-gut fermentation. Undigested feed (grain or fibre) passes into the large intestine where it is fermented and lactic acid is produced. The cow then brings in additional water from the bloodstream to offset the starch in the small intestine and the build-up of lactic acid. This creates watery faeces that are often pale in colour. The acid produced in the large intestine shows up as tiny bubbles in the manure. If enough lactic acid passes through the large intestine, it damages the lining and the cow produces mucus to offset this. When this passes out, the manure has a shiny appearance.

In contrast when a cow is primarily fed pasture, loose faeces and bubbles are not an indication of rumen upset. Especially in spring, the loose faeces is primarily due to the low DM content (or high water content) of pasture. As mentioned in the Introduction, the extra water is not absorbed and is excreted in the faeces.

In addition, carbohydrates can pass through the rumen into the large intestine of the cow due to the fast rumen passage rates of pasture-fed cows in spring. Active fermentation occurs and acids (not lactic acid) are produced, which can appear as gas bubbles in the faeces. Adding fibre (e.g. straw/hay) to pasture-based diets will not benefit rumen function; it will merely reduce the water intake and can slow passage rate.



Pasture

Is there a difference between Northland and South Island pastures (i.e. lignin content)?

Yes, the greatest difference is the pasture species that grow in these regions.

Northland pastures will typically contain quite a lot of C4 grasses that are high in lignin, whereas South Island pastures are C3 grasses that have lower lignin content. The difference will be greatest in summer/autumn, and less so in winter.

If the question is “would the same grass (i.e. cultivar) grown in Northland and Southland differ in lignin content?”, then the answer is still yes, albeit to a smaller extent. This is because the Northland environment will put plants under greater heat and drought stress, to which a common plant response is an increase in structural carbohydrate content including lignin.

Can I achieve 500kg milksolids/cow on pasture only?

Yes, this is possible; however, profitable pasture-based systems are reliant on achieving high MS production per ha from pasture and there is a trade-off between this and maximum per cow production.

High yields of milksolids from a pasture diet are dependent on maintaining high quality pastures throughout the season and achieving a long lactation length. Factors such as pre-grazing yield, amount of leaf material available and grazing residuals all affect pasture quality and energy intake and need to be considered.

For information on grazing management and pasture as a feed, check out the DairyNZ Technical Series (Aug 2014).

Why is production increased when cows eat more clover?

This is primarily due to a combination of increased voluntary intake and diet quality. Clover generally has a higher ME, lower NDF content and a faster passage rate through the rumen than perennial ryegrass, which results in increased energy intake when cows eat clover. Typically, the clover content of the sward needs to be greater than 25% before differences in milk production occur.

Does clover provide more minerals to the cow?

Clover is typically higher in nitrogen, calcium, magnesium, copper and cobalt than perennial ryegrass. However, the impact on the cow depends on the proportion of clover in the sward.

Can cows physically eat 4% of their body weight as pasture?

Yes, but the amount of pasture eaten will vary with the size of the cow and the quality of the pasture. A smaller 400kg Jersey can eat approximately 4% of her body weight (16kg DM) of good quality pasture compared with a larger 550kg Holstein Friesian, which would eat approximately 3.3% (18kg DM).

As the quality of the pasture drops (less leaf and more stem and dead material) bite rate, bite size, eating time and intake decrease.

For information on grazing management and pasture as a feed, check out the DairyNZ Technical Series (Aug 2014).

What controls intake in a pasture-based system?

Intake control involves complex processes. There are several factors that control a cow's intake.

- Chemical feedback mechanisms: hunger or satiety hormones are produced in response to products of digestion and signal the brain whether the cow should continue grazing or stop
- Feedback from post-rumen processing (e.g. passage rate)
- Grazing time: a cow is often limited by the number of hours in the day for grazing. Time spent ruminating, walking, milking, lying will determine how many hours the cow has available to graze pasture
- Physical rumen fill: although there are distension/stretch receptors in the rumen, when cows are fed high quality forages, these have little impact on intake. If the quality of feed drops (NDF greater than 50%) then these physical factors play a bigger role.

How fast can a cow eat her daily intake (pasture only)?

Cows typically graze for 8 to 10 hours per day, consuming approximately 2kg DM/hr. Cows can adapt their grazing behaviour relatively quickly and increase the efficiency with which they graze. Research data indicate that when cows were offered two 4-hour bouts on pasture, they consumed approximately 90% of what they ate when on the pasture for 22 hours.

Does pre-mowing increase intake? What are all the pros and cons of pre-mowing?

Mowing of pastures pre-grazing (pre-mowing) has been implemented on some farms in an attempt to increase intake. However, previous experiments showed no increase in energy intake or milk production.

Data from these experiments indicated that pre-mowing can decrease pasture quality and available ME. In addition, the effects of pre-mowing on subsequent pasture growth were variable, but generally suggested a decrease of total feed grown.

Like topping, tactical use of pre-mowing can help to meet target residuals and improve subsequent pasture quality, but it is not likely to be of benefit when used regularly to try and increase energy intake and milksolids production.

Are supplements needed to balance a pasture diet?

No, supplements should only be used to fill true feed deficits in a grazing system and not to try and balance the diet. Good quality pasture provides a well-balanced feed for dairy cows, supplying energy, protein, lipids, vitamins and minerals. It is true that cows fed a TMR will produce more milk than cows grazing pastures; however, the majority of the difference in milk production is due to the increased DM intake and reduced activity in a TMR system, and not the composition of the diet. Therefore in a pasture based system if supplements are required they should be purchased on a cents/MJ ME basis.

In dairy systems, where supplements make up a high proportion of the diet and cows are producing high levels of milksolids (e.g. in excess of 2.5kg MS/d), factors other than energy may be limiting milk production. In these scenarios, the specific diet requirements should be considered and the type of supplement that is purchased should be determined by the nutrient that is limiting milk production (e.g. amino acids, starches) and the cost/benefit of feeding that supplement.

For more information on pasture as a feed for the dairy cow, check out the DairyNZ Technical series (Aug 2014).

Is there enough sugar in pasture?

Yes. Even though, in theory, milk production is maximised when soluble sugars and starches are 35-40% of the diet and spring pastures contain less than this, the structural carbohydrates (fibre) in good quality, leafy pastures are highly digestible (70-85%) and degraded relatively quickly, thus supplying similar energy to sugar.

This is because the building blocks of carbohydrates (soluble sugars, starches and fibre) are essentially the same, simple sugars, and it is the bond that joins these sugar molecules together that is different.

The different carbohydrates can be compared with lego blocks. Sugar such as is found in molasses is like having a pile of lego blocks, pulled apart and all ready to go. Then starch, which is found in cereal grains and vegetable wastes, is like lego blocks that have been loosely joined together, you have to pull them apart before you can use them. Finally, fibre as in pasture, is like having an object constructed from the lego blocks that takes time to pull apart before they can be used.

Thankfully, the bugs in the rumen are capable of breaking all of these bonds so the sugar molecules can be used for energy. Thus replacing pasture with feeds that are high in sugar or starch does not improve the energy generated from the rumen bugs, unless it increases the total amount of energy supplied.



Supplements

When is the best time to add supplements to a lower input system?

The best time to feed supplements is when there is not enough pasture.

High quality pasture is the cheapest, most valuable and profitable feed. When supplements are added to the diet, the cow will leave more pasture in the paddock.

The milk production response to supplements is greater in late lactation than in early lactation. This is due to increased days in milk, rather than per day production.

What level of supplement should I feed to my cows when there is enough grass around?

If residuals indicate that there is enough pasture available (1500 to 1600kg DM/ha), then it is rarely profitable to feed supplements. In autumn, supplements can sometimes be used to push out the round, allow re-grassing or increase pasture cover going into winter.

Are kiwi cows that are producing 2+ kg milksolids in spring lacking energy? Will they respond to increasing energy in their diet (i.e. adding supplements to pasture)?

If cows are grazing high quality pasture to residuals of 1500 to 1600kg DM/ha, which optimises pasture regrowth and quality, they will not be eating to maximum potential intake. So yes, they will produce more milk if supplements are added to the system.

However, they will leave more pasture behind in the paddock, and if pasture management is not altered, residuals will increase and subsequent pasture quality will decline. All the costs/benefits of adding supplements into the system need to be considered

For information on grazing management and pasture as a feed, check out the DairyNZ Technical Series (Aug 2014).

For information on feeding supplements and making money, check out the SIDE proceedings (Kay et al., 2014).

How much Palm Kernel Expeller (PKE) can I feed my cows? What percentage of the diet?

From a rumen health point of view, PKE is a safe feed as it contains very little starch and there is no risk of acidosis.

It does have a relatively high fat content (8 to 10% DM), but due to the saturated form of these fats, there doesn't appear to be a negative effect on fibre digestion.

Although PKE is high in fibre (70% NDF), it does not contain any effective fibre (the fibre that stimulates rumination and saliva production); so, from a health perspective, PKE should not make up more than approximately 60% of the diet.

From a milk production perspective, PKE contains approximately 18% crude protein, but is low in the amino acid lysine. This means that if it was fed at more than 50% of the diet to lactating cows, a lysine deficiency may limit milk production.

Is grazed pasture more expensive than supplements?

No. You need to consider this in the context of can you eat more pasture, grow more pasture or do you need to buy more. There are only minor costs associated with eating more pasture include upskilling and allocated time for pasture management. The next cheapest option is to grow more pasture. Additional costs here include regrassing, weed control and fertiliser, and this is still typically cheaper than purchasing supplements. When no more pasture can be grown or eaten on farm, then the next option is to buy more land. The correct decision in this situation will depend on the cost/return of the land compared with the cost of buying and feeding supplements.

For information on the cost of pasture, check out Inside Dairy (May 2015, page 24)

Is PKE a quality feed?

PKE is a by-product and the quality can therefore vary with each batch.

As it is an unusual feed, (high in short and medium chain saturated fatty acids) there is no equation developed to determine ME accurately. Using other similar feedstuffs, ME is estimated to be between 10 and 11.5 MJ ME/kg DM.

There are two forms of PKE, solvent extracted and physical/mechanical extracted. Although the fat content of solvent extracted PKE is much lower, there does not appear to be a large difference in milksolids response to these two products. Why this is the case is not known, but may be due to the chemicals used during the solvent extraction improving the digestibility of fibre.

Are there any short or long term detrimental effects of PKE on animal health?

No, there are no long term detrimental effects of PKE that have been reported. If cows are prone to milkfever, then PKE should be limited (approximately 3kg DM) to springing cows due to the high phosphorus content.



How can I limit copper toxicity with PKE?

There isn't enough copper in PKE to cause copper toxicity. It does not meet the daily copper requirements.

However, PKE does have reasonably high levels of copper; so, be careful offering additional copper supplements, such as copper bullets. Make sure you take all dietary copper sources into account when assessing the need for copper supplementation.

What percentage of PKE is digestible by the cow?

Approximately 60% of PKE is digestible in the cow. This digestibility factor is taken into account in the ME value of PKE (approximately 11 MJ ME).

Does molasses fed with PKE improve PKE digestibility?

No, feeding high sugar feeds such as molasses with PKE does not increase digestibility.

It may increase the ME of the feed slightly, but this will come at an increased cost. There are other reasons that people may choose to feed molasses with PKE such as to improve palatability of PKE or to reduce dust and wastage.

Is there an advantage to having tapioca mixed in with PKE?

As with molasses, there is no physiological advantage of mixing tapioca to PKE.

The additional tapioca will increase the ME of the diet, but as with molasses this will usually come at an increased cost. In addition, it is not recommended that you feed blends containing tapioca in trailers in the paddock. Ingestion of too much tapioca can result in rumen acidosis and cow death. If feeding via in-shed systems, mixing other feeds with PKE can allow the feed to pass through the auger easier and allow the cows to consume their allocated feed without having to slow the platform down.

How much maize can you feed to autumn calving cows when you do not have enough pasture?

Hard to give a generic answer, as this will depend on what else is being fed in the diet.

Limitations of maize are that it has a low crude protein content (approximately 8%), and it is deficient in some amino acids and minerals.

For information on feeding maize silage, check out the DairyNZ farmfact 1-60.

How essential is it to feed minerals with maize at different times of the year?

Depending on the stage of lactation and the amount of maize silage being fed, cows will require additional minerals. For example if you are feeding more than 5kg/day of maize silage to a lactating cow, it is recommended that cows are provided with magnesium, calcium, sodium and DCP.

What is the value of maize silage in spring to balance high protein pasture?

Unless there is a shortage of pasture, there is no animal or financial benefit of adding maize silage in spring.

High quality pasture is a good feed for cows in spring. It is not necessary to 'balance' pasture by adding high carbohydrate supplements to the system, as is sometimes suggested. If there is enough pasture, introducing supplements will simply lead to pasture wastage and add extra costs.

How much maize silage is required per day to put on 1 BCS unit in three months?

Research from DairyNZ indicated that a non-lactating cow required about 160kg DM maize silage to gain 1 BCS unit.

The required daily amount will depend on the length of the dry period and this needs to take into account that the cow will not gain BCS in the first 10-14 days dry and will gain very little in the last 25-30 days dry. This means that if a cow was dried off 90 days prior to calving, there would be about 50 days available for BCS gain. If the cow needed to gain 1 BCS unit, then she would need to eat 3.2kg DM maize silage/day for 50 days, over and above the feed required to for maintenance, pregnancy and activity requirements.

For information on time required to gain BCS in dry cow, check out the DairyNZ technical series (April 2014).

What is more efficient in term of weight gain?

While only a limited amount of research has been undertaken, it appears that PKE is approximately 20% more efficient than maize silage for BCS gain in the dry cow.

What is best – PKE or barley?

This depends on your motive for feeding supplements.

If you want to increase milk protein percentage then barley (a starch-based feed) will be better than PKE (a fibre-based feed), which will increase milk fat percentage.

If you want to make money, then all DairyNZ data indicate that your key driver for purchasing supplements should be cents/MJ ME. In this case, barley is rarely as good value as PKE.

Use the online Supplement Price Calculator to determine which supplement will be the most profitable dairynz.co.nz/supplement-calc

How fast can I introduce supplements into the diet? PKE vs. maize grain vs. barley vs. wheat?

The speed at which supplements can be introduced into the diet depends on the rate at which the starch is degraded (broken down) or made available to the rumen bugs.

The rate at which the starch is broken down depends on the protein structure of the specific grain. For example, the protein structure of maize grain holds the starch in place for a lot longer than wheat and, therefore, the starch in maize grain is broken down at a slower rate.

As a rule of thumb:

- Starch breaks down in maize grain at about 20 %/hour
- Starch breaks down in barley at about 25-30 %/hour
- Starch breaks down in wheat at about 40-50 %/hour.

However, these figures depend on the processing of the grain.

Therefore maize grain is a safer feed and can be introduced into the diet at a faster rate than wheat. However, it will still require a transition period. A safe rule of thumb is 2kg for the first day and then increase by 1kg every two to three days, until you reach maximum recommended intakes.

In contrast, as PKE is low in starch it can be introduced into and removed from the diet without a transition period.

Do we need to keep feeding grain all year round to keep the rumen adjusted?

No. You can take grain in and out of the system in small amounts (up to about 2kg DM/day) without metabolic issues, as the microbes in the rumen that digest starch are always there and multiply rapidly. At low grain feeding levels, optimal rumen microbe performance is regained in about 48 hours.

When grain intake exceeds 2kg DM/day, acidosis could become a problem if the grain is introduced too quickly.

What is the benefit of feeding molasses?

Benefits of molasses include improved shed flow, carrier for minerals, and increased palatability of other feeds.

In terms of production, it is difficult to claim benefits, as research on molasses is very limited. Research conducted at DairyNZ indicated no increase in milk production or BCS gain from feeding liquid molasses to early lactating cows. This may be, because rumen passage rate of molasses is fast and the inlet and outlet of the rumen are very close to each other, thus the molasses may have passed through undigested. Alternatively, this may have been due to high levels of substitution. Because molasses is a sugar, the satiety signals sent to the brain would reduce pasture intake.

What feed value is there in molasses?

The energy value of molasses is approximately 11.5 MJ ME /kg DM

Is there truth that molasses will increase the conversion of feed in the rumen?

No, molasses supplies additional energy, in the form of soluble sugars, but is no better than other sources of energy (i.e. pasture, maize grain, PKE) if energy is the limiting factor and it may in fact be worse.



Substitution

What affects substitution?

Any system of feeding that increases total nutrient intake has the potential to increase production. This occurs when supplements are introduced into a pasture-based system; however, there will always be some level of substitution or reduction in pasture intake when supplement is eaten.

Substitution can be negative (pasture wasted) or positive (pasture spared).

Predicting short term responses to supplement feeding depends on accurate estimates of substitution. On average, grazing time is reduced by 12 minutes for every kg of supplement that is added into the system. However, the rate of substitution can differ and is influenced by factors such as:

- season (spring vs. summer vs. autumn)
- pasture residuals and supplement intake
- type of pasture (grass-dominant vs. clover-dominant)
- supplement type and quality
- animal factors (e.g. BCS, Breeding Worth).

Substitution means that:

- less pasture will be consumed and if management is not altered, post grazing residuals will increase
- total intake is less than expected
- the milk response is less than the theoretical maximum.

How do pasture and supplement intake affect substitution?

The more pasture that is offered the greater the potential level of substitution when supplements are introduced into the system. Similarly, with increasing amounts of concentrates offered, the level of substitution typically increases.

How does the time of year affect substitution?

Substitution is greatest in spring and lowest in autumn.

Research indicates that for each kg DM of supplement eaten, substitution is 0.1kg DM greater in spring than in summer and 0.1kg DM greater in summer than in autumn.

For example, if the substitution rate was 0.5 in spring, for every 1kg DM of supplement eaten, cows would reduce their pasture intake by 0.5kg DM. In summer, for every 1kg supplement fed pasture intake would be reduced by 0.4kg DM, and in autumn 0.3kg DM.

Does the type of pasture affect substitution?

Yes. Research indicates that the type of pasture offered to cows also has an effect on substitution.

At any level of pasture intake, there was greater substitution when pasture consisted of grass-dominant species than when grazing white-clover pastures. Within the same species of pasture, the greater the digestibility, the greater the substitution rate when concentrates are fed. This may be one of the reasons why substitution is greater in spring than in autumn.

Are there different levels of substitution when feeding different supplements?

Yes. Substitution is affected by supplement type. On average, cows will eat for 10 to 12 minutes less with each kg DM concentrate fed, and substitution is about 10% greater with a forage (e.g. maize silage) compared with a concentrate (e.g. maize grain).

The effect of feeding different concentrates on substitution rate is not consistent.

Some research did not find any differences between concentrate types on substitution, while other research indicates that:

- starch-based concentrates result in greater substitution than fibre-based concentrates, which is likely due to differences in the production of “satiety-” and “hunger-” hormones (such as insulin or leptin) from these feeds
- substitution is greater with highly digestible concentrates (such as cereal grains), compared with whole grains or protein-based supplements.

Note: If not transitioned onto the diet properly, high amounts of soluble sugars and starches can cause rumen acidosis, which ultimately will decrease intake.

What animal factors affect substitution?

Animal factors such as body condition score (i.e. energy state) or breeding worth (i.e. genetics) can affect the level of substitution. If offered the same amount of feed, a cow with lower body condition will generally substitute less pasture than a cow with greater body condition, because the drive to eat is generally greater.





Winter crops

Fodder beet: is dicalcium phosphate (DCP) necessary with fodder beet?

The phosphorus content of fodder beet is less than that considered adequate for pregnant cows (less than 0.24% DM); however, if grass silage is used as the supplement with fodder beet, this has a moderate phosphorus content and a deficiency is rare.

In some instances, some regions appear to produce fodder beet with very low phosphorus content (less than 0.1% DM) and a deficiency can occur.

An effective prevention strategy is the use of 50g DCP which supplies 9g phosphorus daily and is usually applied as slurry.

Fodder beet: diet balancing and harvesting vs. feeding in the paddock?

By grazing tops and roots together it is possible to largely overcome the crude protein deficiency of the root. If beets are lifted, the crude protein content of the diet will be lower and other feeds in the diet may be altered (i.e. more pasture silage and less straw) to overcome this.

Fodder beet: What is the role of feeding straw to prevent acidosis/laminitis?

In order to avoid rumen acidosis, cows must be transitioned properly onto a fodder beet diet. The first 14 days of transition is very important to the success of the winter feeding regime.

The cows should be introduced to the crop slowly, starting with about 2kg DM fodder beet/cow/day with the supplement (straw, hay, silage) fed before the cows are given access to the crop. When cows are fully transitioned, DairyNZ recommends that cows eat a diet of no more than two thirds fodder beet and one third supplement (straw, hay or silage).

Fodder beet: how much fodder beet can be fed with pasture over late autumn without causing any problems (to put on BCS before winter)?

Because of the very low fibre and phosphorus contents and the high sugar content, the use of fodder beet should be limited to 5kg DM/day for lactating cows. Anything above that requires other dietary changes to maintain rumen health and production.

Fodder beet: do I have to transition the cows back from fodder beet to pasture?

No. You will have to transition your cows from pasture onto fodder beet, which takes about 14 days, but there is no need to transition them from fodder beet back onto pasture.

Kale: why do we need to transition from ryegrass to kale?

Kale can also cause rumen acidosis if cows are not transitioned onto it slowly.

What is a reasonable transition time from pasture onto winter crops?

As a rule of thumb, it will take about 14 days for the rumen to fully adapt to the winter crop and to optimise efficient digestion.

Transition cow

How do I transition my cows? Is it true that I should underfeed my cows before calving?

If cows are at or above their target BCS, (5 for mature cows and 5.5 for first and second calvers) prior to calving, then research suggests they should be fed about 80% to 90% of their energy requirements for one to two weeks pre-calving to reduce the risk of metabolic diseases after calving. If cows are below their BCS targets, they should be fed 100% of their energy requirements.

For example, a 500kg cow at BCS 5.0 or above, needs to eat about 100 MJ ME for one to two weeks pre-calving.

For more information on feeding the transition cow, check out the DairyNZ Inside Dairy (June 2014).

Minerals

What is dietary cation-anion difference (DCAD)?

DCAD refers to the difference in the concentration of specific minerals in the diet; for example, sodium and potassium (cations) and chlorine and sulphur (anions). These minerals regulate the alkalinity of the blood, which in turn regulates calcium absorption from the intestine and possibly calcium mobilisation from bone. When DCAD is reduced to negative values (less than -100 meq/kg DM) intestinal calcium absorption is increased.

Can we alter the dietary cation-anion difference (DCAD) in NZ pasture-based cows?

Yes we can; however, in pasture-based systems it is very hard to achieve a negative DCAD; therefore, the DCAD concept is virtually irrelevant. In systems where cows are offered large proportions of maize silage, brewers grain, molasses, or other low DCAD feed ingredients, a small amount of anionic salts (magnesium sulphate or magnesium chloride) may reduce the DCAD sufficiently to help prevent milk fever.

What is the best way to get minerals into cows?

This depends on each individual farm system.

Farms with reticulated water supplies are able to get adequate levels of trace elements and, to a lesser extent, magnesium into cows through the water supply. Where water systems do not have a central allocation point, simple dispensers in the troughs can work, but they require more effort.

If in-shed feeding is available, then it is easy to include minerals. However, the requirement for trace elements is usually longer than the requirement for feeding supplements in the shed and sticking to this methodology can lead to feeding expensive supplements unnecessarily.

Licks can be used, but they are hit and miss. For more extensive grazing systems (e.g. young stock), they can be an appropriate way of supplementing with trace elements; however, in most circumstances, young stock do not need additional supplements. Check with your vet. Licks are not likely to provide animals with sufficient magnesium or calcium during the main challenge periods.

Dusting is a very appropriate method of supplementing cows with magnesium and calcium on pasture or silage.

Selenium and Cobalt: How much does a modern dairy cow need?

In general, selenium concentrations in pastures tend to be low (approximately 25% of requirements) and are not increased sufficiently with fertiliser; so, supplementation is recommended.

The actual requirement for selenium is difficult to predict, because many of its functions are in conjunction with vitamin E, which is available in very large quantities in fresh forages. The general feeling globally is that by supplying 3 to 5mg/day of supplemental selenium, cow requirements will be met.

The primary reason for supplementing cows with cobalt is to ensure adequate vitamin B12 is produced by the rumen microorganisms; however, there are other advantages reported for cobalt, such as enhancing digestion of fibrous feeds. The current recommendation is to supplement cows with 8 to 10mg of cobalt/day. This is equivalent to 40 to 50mg cobalt sulphate/cow per day or 5g cobalt sulphate per 100 cows.

Should we supplement with mineral salts when it is cold/wet to prevent downer cows (as cows are not drinking enough to get the minerals through the dosatron)?

In stressful periods, it is often better to try a number of options to get magnesium into the cows. Dusting is very effective except in exceptionally wet weather. In those situations, supplements are often being fed (e.g. maize or grass silage), and magnesium can be added to this. Magnesium is the most important mineral for supplementing daily through the winter and spring (and calcium to colostrum cows).

Is it OK to put on lime at 2.5t/ha in the autumn or will it cause milk fever in spring?

You can apply lime early in the autumn (e.g. March), with little risk of an increase in milk fever. However, late application (e.g. May) will increase the risk of springer cows eating grass with high levels of calcium and, thereby, increase the risk of milk fever. The later in the autumn the greater the increased risk of milk fever. So, if the soil tests recommendation is to apply lime, apply it between November and March, as conditions allow.

Is there a certain level of salt at which production will be impacted by?

Dietary sodium levels should be greater than 0.12% DM and ideally closer to 0.2% DM. Cows grazing most dairy pastures will have adequate salt. Grains and maize silage are low in sodium. If fed at greater than 5kg DM/day, there may be a need for salt supplementation.

Are probiotics of any use? Do they have any benefits?

There is limited evidence of a benefit to probiotics and even the evidence that exists suggests that it is impossible to predict when or if they will be of benefit. There are millions of rumen microorganisms in the dairy cow and adding in a small amount by way of probiotics is unlikely to benefit the cow.

It is an increasing area of research and modern techniques will allow us to determine the most effective technologies to enhance specific microbial colonies.

Health

Is it possible to get subclinical acidosis in grazing dairy cows?

No. Not unless large quantities of high starch/sugar feeds are included in the diet (e.g. greater than 6kg barley) or cows are not transitioned properly onto high starch/sugar feeds. In some cases, rumen acidosis will be diagnosed based on rumen pH measurements. However, the rumen pH of cows fed a pasture-based diet can be lower than is recommended for cows fed a TMR, or high levels of grain, without any detrimental effects. This is because a decrease in rumen pH in pasture-based cows is usually caused by an increase in acetic acid (such as in vinegar) and does not adversely affect digestion or microbial growth. In comparison, a drop in rumen pH in a TMR-fed cow is usually associated with increased lactic acid which can have detrimental health effects (e.g. rumen acidosis, lameness).

Can heat stress be minimised by the type of supplement you feed to the cows?

Theoretically yes, practically no.

Different feeds generate different amounts of heat in the rumen. For example, feeding wheat will produce more heat than maize grain. However, you need to be careful when people are trying to sell feed to minimise heat stress.

Research suggests that animals will prioritise shade over food when temperatures exceed 25 to 30°C (depending on humidity). In these cases do whatever you can to cool the cows down, e.g. get cows to the yard and turn on sprinklers or change feeding/walking/milking times to suit the climate.

How do we build up body condition in late lactation?

It is difficult to put body condition on in a lactating cow.

Once-a-day milking for about 100 days only increases BCS gain by approximately 0.2 BCS unit compared to twice daily milking.

Feeding a late lactation cow more energy will improve milk production, but you will have to feed roughly 300kg DM maize grain over 100 days in late lactation to achieve an extra 0.3 BCS.

Even though lactating cows can be more efficient at storing body reserves, these cows partition most of their energy to milk production and to the demands for maintenance and activity which are greater in a lactating cow.

Therefore, it is more economical to put body condition on your cows during the dry period, when a lot more energy is directed towards body condition gain (no energy required for milk production or walking to the shed and back).

What impact does nutrition have on lameness and mastitis?

In our pasture-based systems, there is minimal impact.

In very high input or TMR systems lameness called 'laminitis' can be associated with too much grain in the diet.

Is rumensin ever worth adding to feed?

Rumensin can be an effective bloat control agent. Even though it cannot prevent acute/severe bloat, it can be used as a mild bloat control or prevention agent.

In terms of milk production, results are variable. The average milksolids response to 300 mg of rumensin is about 30g of extra milksolids. However, responses range from -80g to +80g of milksolids. To date, it is not known how and why rumensin causes negative or positive production responses and more experiments are necessary to gain a better understanding of the effects of rumensin in pasture-fed dairy cows and the interactions with fibre and starch.

In terms of reproduction or BCS, rumensin has no benefits in the New Zealand pasture-based system.

For more information on Rumensin, check out the DairyNZ Technical series (Dec 2011).

If BOH or BHBA (β -hydroxybutyrate) levels are high, does this mean my cows have ketosis?

No, not always. Overseas data indicate that a cow has ketosis when blood BOH levels are greater than 2 mmol/L, and sub-clinical ketosis when BOH levels are greater than 1.2 mmol/L. However, BOH levels are also affected by the diet, and pasture-based cows have a greater basal concentration of BOH than those fed a high proportion of starch-based supplements or a TMR.

Therefore when the diet is predominantly pasture, ketosis cannot be diagnosed based on BOH concentrations alone. Additional indicators of energy balance, in particular free fatty acids (NEFA) and if possible, glucose should be measured in the blood. If NEFA levels are greater, and glucose levels are lower than recommended, then the risk of clinical and sub-clinical ketosis is increased. Other symptoms of ketosis include decreased DM intake and milk production and sometimes a sweet smell on the breath.

There are three main causes of ketosis:

1. Type 1 ketosis is a result of a sudden drop in energy intake. This can be due to underfeeding or adverse weather events (e.g. floods, snow storms).
2. Type 2 ketosis generally occurs post-calving when the cow is mobilising body fat to meet the demands of milk production. Cows that are too fat at calving (BCS > 5.0) are particularly at risk.
3. Silage ketosis is due to cows ingesting poor quality silage. The silage undergoes a secondary fermentation and when ingested increases the risk of ketosis.

Environment

Should supplements be used to reduce nitrogen leaching?

While the amount of nitrogen in the urine is related to how much protein the cow is eating, adding low protein supplements into a pasture diet does not necessarily lower nitrogen leaching. This is because adding supplements into the diet can impact on the farm system, changing stocking rate, milksolids production, pasture eaten and lactation length. All of these factors impact on nitrogen leaching and need to be taken into consideration. There is no one solution to lowering nitrogen leaching on farm and consequently there is a lot of current and planned research focusing on this area.

Drought

What should I feed my cows during a drought when I have no grass available? Maize? PKE? Grass silage? Minerals?

The cheapest feed available (on a cents/MJ ME basis) as long as the diet has enough fibre, in particular enough effective fibre. For example if feeding PKE, the cows require an effective fibre source as well (e.g. silage, hay, straw).

If there is no grass available and low protein feeds are being fed (e.g. maize silage) then milk production may be limited by dietary protein content. The cost/benefit of adding protein to the diet needs to be calculated for each farm (see earlier section on protein). In addition depending on the milk price and the total cost of feeding supplement, it may be more profitable to dry some cows off, rather than try to continue milking. Depending on the type of feed (e.g. maize silage) minerals may need to be added to the diet.

During a drought, with an in-shed feeding system, is it better to feed a cheaper, lower protein feed at 4kg/cow/day or a higher quality, high protein feed at 3kg/cow/day? What has the better cost:benefit ratio?

The answer to this question will vary with each individual situation. In the majority of instances, milk production is limited by metabolisable energy; therefore, decisions to purchase supplements need to be based on cents/MJ ME. If supplements are making up a large proportion of the diet, and milk production is high (e.g. greater than 2.5kg MS/day) then specific diet requirements should to be considered (e.g. effective fibre, soluble sugars and starches).

When it comes to the make up or composition of the feed, most research evidence suggests there is little effect of energy type, (see sections on starch and protein) on milksolids production and milk revenue.

The cost/benefit of supplementary feeds can be determined by using the DairyNZ supplement calculator (dairynz.co.nz/supplement-calc). This is based on milk price and the valued components ratio (VCR) of each milk company, post-grazing residuals and supplement composition. It contains a library of feeds and also allows you to enter in a customised feed product if desired. The calculator assumes ME is the first limiting nutrient, but also takes into account the type of energy and the effect this has on milk composition (i.e. milk fat and milk protein yield). It is a great tool to allow you to look at the cost/benefit of different feeds.

In a drought situation with minimal pasture available: is it still worth feeding cows with supplements and milking them as long as possible (vs drying off)? What is the break-even point per kg DM?

Once again the answer to this question will vary with each individual situation.

Whether it is worth feeding supplements and continuing to milk cows will depend on numerous factors. These include:

- current annual pasture cover (APC) and predicted growth rates
- milksolids production of the herd
- size of the feed deficit
- BCS of the cows and time to planned start of calving (with the aim to reach target BCS a month prior to calving)
- management strategies over winter (cows grazed on or off)
- price and availability of supplement.

These factors are taking into consideration in a new DairyNZ resource: the "milk on vs. dry off" calculator. This will calculate the cost/benefit of different milking/drying off scenarios. Ask your DairyNZ consulting officer to run your scenario through the calculator.

dairynz.co.nz