TechNote 28

Use crops and supplements profitably

IN THIS TECHNOTE

Supplements are generally used in late lactation to extend lactation length, increase body condition gain and achieve pasture management targets. As with other times in the season, before supplements are considered, you should:

1. determine the limiting nutrient,
2. calculate the milksolids response,
3. calculate the impact on other factors (body condition score, average pasture cover)
4. calculate the true cost of feeding the supplements.

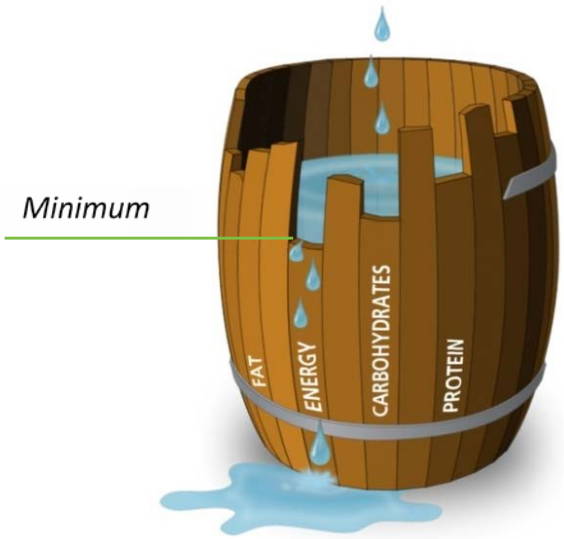
For more details see TechNotes 10: Response to supplements, 19: Use supplements profitably and 23: Allocate required nutrients.

28.1 Use supplements profitably

Determine the limiting nutrient

If considering supplement use in a pasture-based system, the first step is to determine the limiting nutrient. The analogy of the barrel with staves of unequal length (Figure1) and determining the limiting nutrient in the dairy cow is explained in more detail in TechNotes 10, 18, and 23. In Figure 1, energy is the limiting nutrient which is typical during the autumn period in pasture-based systems. Therefore, milk production will only increase if energy is increased. Increasing the supply of other, non-limiting nutrients will not increase production.

Figure 1. Liebig's law of the minimum with energy as the limiting factor.



Calculate the milksolids response

Once the limiting nutrient has been determined, the next step is to calculate the expected milksolids response. In autumn, the response to supplements is generally higher than at other times of the year. A primary reason for this is that substitution is lower in autumn than in spring or summer.

In addition, the substitution that does occur can be managed in a positive manner. Positive use of substitution, is ensuring pasture targets are still met, and grass that is not eaten by the cow during the grazing event, is spared and carried forward to be eaten later. Autumn pastures have a "longer shelf life" (slower leaf emergence rate compared with spring), thus when supplements are used during this period to slow down the rotation, and pastures are well managed, the extra pasture will help build cover for the winter months.

For more details see TechNotes 9: Pasture management; 10: Response to supplements; and 26: Allocate autumn pastures correctly.

Managing pastures well and feeding supplements (if required) during autumn, can also extend lactation length and increase days in milk. This can contribute to a greater milksolids response, compared with spring or summer. Remember, this strategy should only be used if the milksolids response is greater than the cost of incorporating the supplement, and if cow body condition score (BCS) and average pasture cover (APC) targets are not compromised. These two targets should be non-negotiable and management during late lactation should ensure they are met at calving.

More information on how to determine the milksolids response and calculate the true cost of feeding supplements can be found in TechNote 10. Additionally, there are resources available to help calculate this for different supplements in pasture-based systems at different stages of lactation.

To use the DairyNZ Supplement Price Calculator see www.dairynz.co.nz/feed/feed-management-tools/supplement-price-calculator/

28.2 Understand the impact of feeding different supplements

Feeding supplements high in non-structural carbohydrates (e.g. maize grain, barley) will increase the production of milk protein, more than milk fat, while feeds high in non-structural carbohydrates (e.g. pasture silage, palm kernel expeller; PKE) will increase milk fat more than milk protein. However, often the increase in revenue from the change in milk composition, does not offset the extra cost of supplements that are high in non-structural carbohydrates.

Therefore, it is important to determine the total cost and response of feeding different supplements.

For more details see TechNotes 10: Response to supplements, and 25: Determine nutrient requirements.

Some commonly used supplements during the late lactation period are maize and pasture silage, maize grain, PKE and in some regions fodder beet.

28.2.1 Understand impact of feeding palm kernel expeller (PKE)

Palm kernel expeller is a unique feed in that it contains high levels of structural carbohydrates, and relatively high levels of protein and saturated fats. Of note is the short and medium chain saturated fatty acids which are not generally found in other dairy cow feeds.

Fonterra, a milk supply company, has placed a limit on the amount of PKE that can be fed to dairy cows to keep some of these fatty acids below a threshold. This threshold will ensure products meet manufacturing and export criteria. A new measure "Fat Evaluation Index" or FEI is appearing on milk dockets and will be used to regulate the use of PKE to avoid excess levels of specific fatty acids in milk products.

The Fat Evaluation Index (FEI) will be used to regulate the use of PKE in dairy businesses that supply Fonterra.

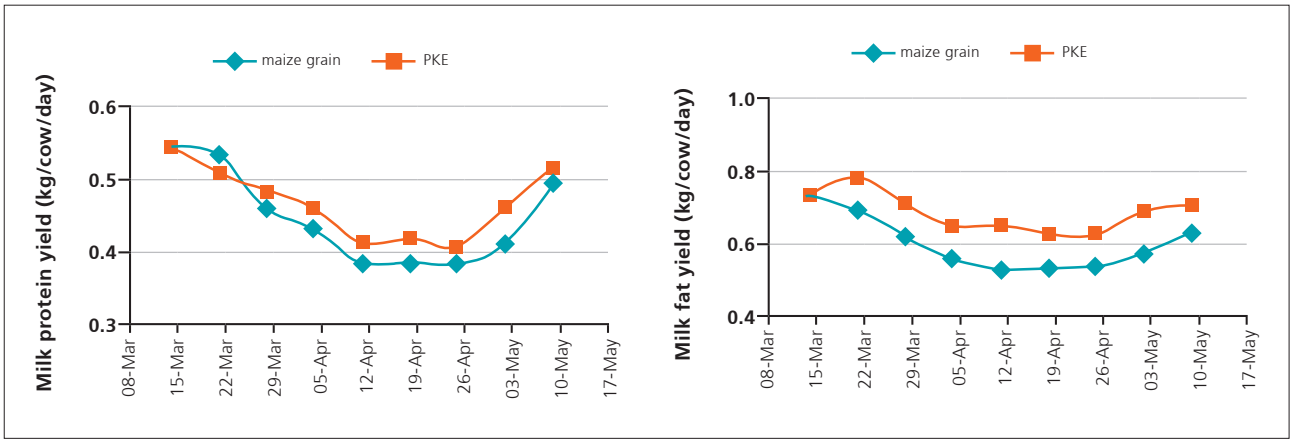
For more details see TechNotes 3: Feed components and 7: Lipid metabolism.

Research investigating the effect of feeding PKE through the late lactation period indicated it was more efficient for milk production than feeing similar energy from a high starch feed (maize grain). When PKE (high in structural carbohydrates) was added to the diet, cows produced more milk fat (0.1 kg/day) and more milk protein (0.02 kg/cow/day) compared with cows that were fed similar energy from maize grain (high in non-structural carbohydrates). This amounted to 7 kg MS more from cows fed PKE compared with maize grain during the 8 weeks of supplementary feeding (Figure 1).

Feeding PKE reduced the P:F ratio from 80% (with maize grain) to 67%. However, total milksolids production (and revenue from milksolids) was greater with the PKE feeding.

In addition, although PKE is high in NDF (70% NDF), it contains no effective fibre (eNDF) so must be fed in conjunction with a long chopped forage source (e.g. pasture, pasture silage, maize silage) to ensure fibre requirements are met.

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



Maize silage

Good quality maize silage is a high quality forage supplement; however, it is low in protein, and many minerals (e.g. sodium calcium and phosphorus). More information on mineral requirements when feeding maize silage are in TechNote 23 and key recommendations on how to ensile, store, and feed maize silage can be found on the DairyNZ website: www.dairynz.co.nz/feed/supplements/maize-silage/ .

There is a wide range in the reported milksolids responses to feeding maize silage in autumn (32 g – 178 g MS/kg DM) with the largest response primarily due to maize silage supplements enabling cows to continue milking after a dry summer. In this scenario, the deferred milksolds response (response from new pasture supply after maize silage feeding had ceased) was greater than would be predicted as the control herd with no supplement were dried off.

Data from 600 NZ dairy farms indicate an average response of 50 g MS/kg DM supplement fed, which is closer to predicted values from feeding supplements during this period. As always t is important to manage supplements and pastures (e.g. wastage, substitution) to ensure it is a profitable decision.

For more details see TechNotes 3: Feed components, and 23: Allocate required nutrients.

Pasture silage

High quality pasture silage is a good source of energy and protein for the late lactation cow; however, silage quality can vary greatly, depending on pasture quality and ensiling processes. Low quality silage is best kept for dry cows or as a fibre source for feeding with high sugar or starch feeds. For more information on harvesting, ensiling, analysing and feeding pasture silage visit DairyNZ website www.dairynz.co.nz/feed/supplements/grass-silage/

If diets contain low protein feeds, e.g. barley, fodder beet, pasture silage is a good source of protein and fibre to feed with these.

28.3 Meet protein requirements

Generally, if cows are eating a diet that contains a large proportion of autum/winter pasture, protein requirements will be met.

As a rule of thumb, protein requirements for a late-lactation cow are 12 - 14% CP. However, it is difficult to determine exact requirements for dietary protein due to the many factors that affect cow requirements (Table 1).

For more details see TechNotes 23 : Allocate required nutrients.

Table 1. Factors that affect protein requirements in late lactation.

Milk production level	The greater the milk production the greater the demand for dietary protein
Energy content of the feed (MJ ME/kg DM)	Cows offered high ME feeds require greater levels of dietary protein and in particular, rumen degradable protein
Amino acid profile of the diet	Some supplements may be deficient in specific amino acids, even if they met crude protein requirements
Activity	Cows that walk further distances expend energy on activity and are less likely to require additional protein

Although autumn pasture contains a good source of protein, if large quantities of maize silage and or other low protein feeds are being fed during this period, then dietary protein may be deficient (Table 2).

The impact of a diet deficient in protein is:

- reduced milk production (less volume and milksolids),
- increase in BCS gain due to extra energy partitioned to body reserves

If dietary protein is deficient, consider the economics of altering feeds or adding supplements before changing the diet. More details on the milksolids response to, and economics of protein supplementation, are in TechNote 24.

Table 2. Ranges of crude protein and fibre (NDF) in autumn pastures and maize silage.

	Pasture			Maize silage
	North Island/dryland Southland	Irrigated South Island	Southland	
CP %	15 - 20	18 - 30	18 – 32	8
NDF %	40 - 47	30 - 45	35 - 50	42 - 50

Table 3. Dietary crude protein content for a late lactation cow eating 14.5 kg DM with different proportions of pasture and maize silage.

Maize silage (kg DM/cow)	Crude protein content of pasture (%CP/kg DM)				
	12	16	20	24	28
2	11.4%	14.9%	18.3%	21.8%	25.2%
4	10.9%	13.8%	16.7%	19.6%	22.5%
6	10.3%	12.7%	15.0%	17.4%	19.7%
8	9.8%	11.6%	13.4%	15.2%	17.0%
10	9.2%	10.5%	11.7%	13.0%	14.2%

= dietary protein is deficient = dietary protein is marginal = dietary protein is adequate

For more details see TechNotes 3: Feed components; 6: Protein metabolism; 10: Response to supplements; 23: Allocate required nutrients, and 24: Use supplements profitably.

28.4 Meet fibre requirements

Fibre includes the structural carbohydrates (cellulose and hemicellulose) plus lignin. The lactating dairy cow has a minimum requirement for fibre to ensure efficient rumen function. Generally, good quality autumn pastures will provide enough fibre (NDF ~ 35% DM) and effective fibre (eNDF ~ 18% DM) to ensure optimal rumen function.

In addition, providing pasture quality has been maintained, NDF levels of autumn pastures (Table 1) will not negatively affect DMI during autumn.

For more details see TechNotes 3: Feed components; 8: Fibre metabolism; and 23: Allocate required nutrients.

28.5 Further reading

DairyNZ body condition scoring. The reference guide for New Zealand dairy farmers. ww.dairynz.co.nz/publications/animal/body-condition-scoring-reference-guide/

DairyNZ Facts and Figures. dairynz.co.nz/publications/dairy-industry/facts-and figures/

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