TechNote 24

Use supplements profitably

IN THIS TECHNOTE

Decisions on purchasing and feeding supplements in mid lactation should consider the milksolids response and the total cost of feeding the supplement. Rarely will supplementation be profitable unless there is an energy deficit. Even if feed is limiting production, removing culls, empties and non-productive cows is the first action to be considered.

There are resources available to help calculate the cost/benefit of adding supplements to the system:

The DNZ Supplement Price Calculator dairynz.co.nz/feed/feed-management-tools/supplement-price-calculator/

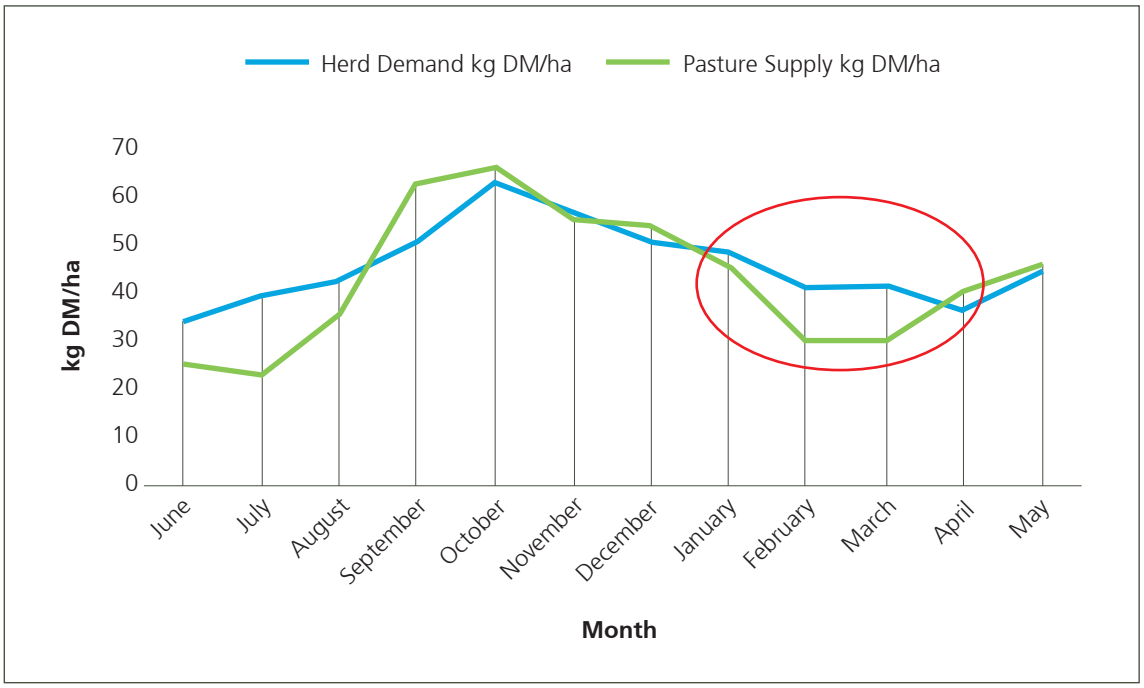
Summer Feeding Check dairynz.co.nz/publications/feed/

If supplementary feeds are introduced into the system, they should be used to:

- Increase feed supply to meet feed demand, in particular if weather limits pasture growth (Figure 1).
- Achieve pasture management targets including pre-grazing yields, leaf stage/round length and/or pasture residuals.

In some circumstances, specifically during summer, protein may be limiting production, therefore the cost of, and response to, protein supplementation should be considered. This is covered in the following sections.

Figure 1. Example of pasture supply and herd demand profiles for a 100 ha farm with 280 cows. Summer months are highlighted.



For more details see TechNote 10: Response to supplements.

24.1 Understand which crops/herbs fit which system

Summer crops and herbs can provide a good source of energy (and protein) during the summer months in regions where pasture growth rates decline (Figure 1). They can also provide an alternative feed source if toxins (e.g. facial eczema spores) are high in pastures.

Choosing the crop that suits your farming system depends on several factors:

1. Region and climate.
2. When you will require the feed source (e.g. when do you expect the feed deficit to occur).
3. Previous experience (knowledge and skill) with different crops.

Three of the more common crops used during a dry summer are turnips, chicory and fodder beet.

Table 1. Nutrient composition of turnips, chicory and fodder beet.

	DM (%)	ME (MJ/kg DM)	CP (% DM)	NDF (% DM)	SSS (% DM)
Turnips	9 – 11	12.0	12 – 18	27	17
Chicory	8 – 19	12.5 – 13.0	20 – 26	30 – 38	4 – 9
Fodder Beet	14 – 20	12.0 – 12.5	9 – 14	11 – 16	55 – 70

24.2 Understand implications of feeding turnips

Turnips are a high energy crop, with moderate protein that can be used to fill a short-term feed deficit (Figure 2 and Table 2).

Figure 2. Example of pasture and turnip supply (7.5 ha) and herd demand profiles for a 100 ha farm with 280 cows. Summer months are highlighted.

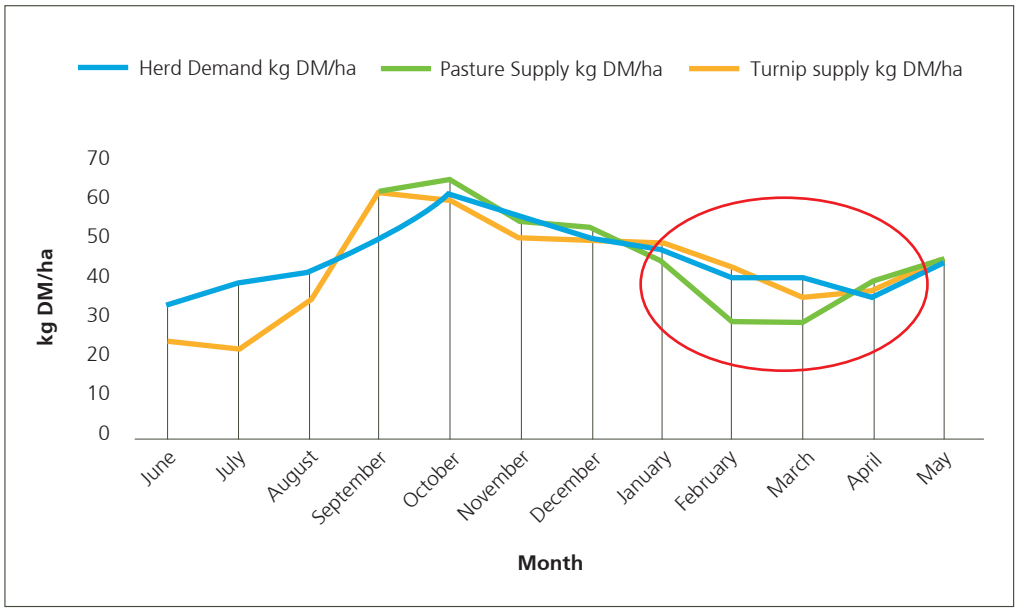


Table 2. Attributes to consider when feeding turnips.

***Average yield**	Barkant: 10 - 12 t DM/ha Green Globe: 8 – 10 t DM/ha
Feed supply	Sown in September Generally grazed during Jan – Feb **Barkant:** Mature 60 – 90 days after sowing Graze crops from day 70-100 (after day 90 quality declines) **Green Globe:** Later maturing variety Ready to be grazed from 100 days Recommendations are 2/3 crop Barkant and 1/3 crop Green Globe to extend supply period
Feeding considerations	Break feed using long narrow breaks to minimise wastage Turnips should not exceed 1/3 of the diet (~5 kg DM) Feed after cows have grazed pasture to prevent gorging Transition slowly • 2 kg DM/cow for first 5 days (~2 – 3 m^2/cow/day) • Increase over the next 5 days up to 5 kg DM/cow/day
Health risks	**Risk:** Bloat **Prevention:** Feed turnips after cows have grazed pasture Drenching **Risk:** Rumen acidosis **Prevention:** Transition onto crop slowly
****Milk response**	35 – 45g MS/kg DM during summer

*Actual yield will depend on climate, region and management practices.

**Actual responses will depend on feed and animal factors such as feed quality, wastage, total DMI intakes, cow BCS and current milk production.

For more details see TechNote 10: Response to supplements.

24.3 Understand implications of feeding chicory

Chicory is a high energy, high protein forage that can be grazed more than once (Figure 3 and Table 3). This results in additional feed for a longer interval compared with turnips.

Figure 3. Example of pasture and chicory supply (10 ha) and herd demand profiles for a 100 ha farm with 280 cows. Summer months are highlighted.

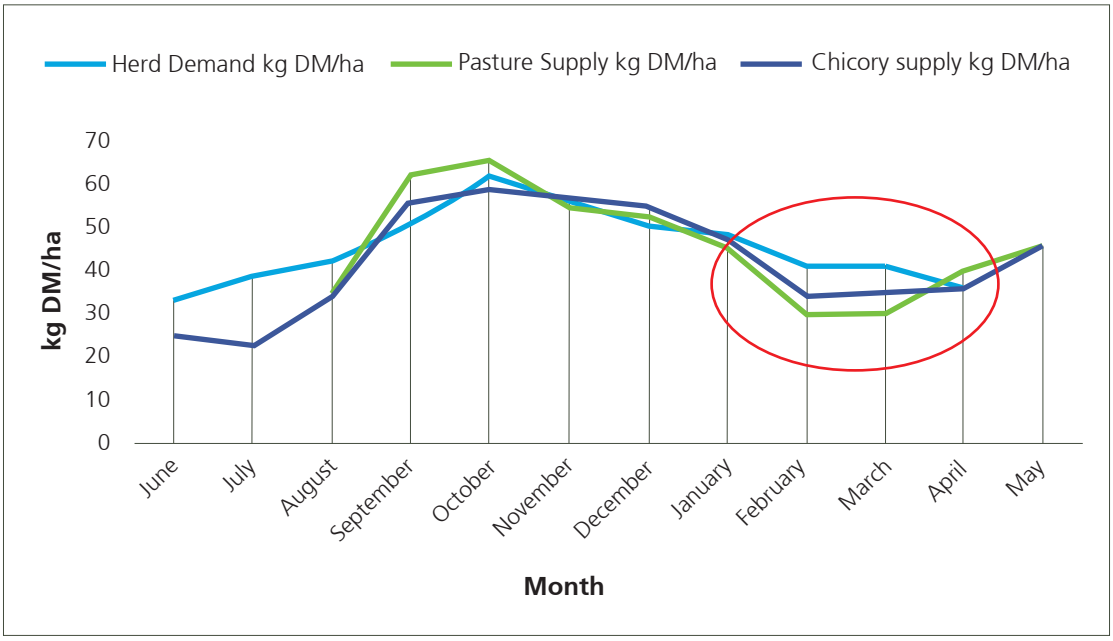


Table 3. Attributes to consider when feeding chicory

***Average yield**	11 t DM/ha
Feed supply	Sown in September Multiple grazing in rotational system from September – May Generally, no more than 2 productive summers Reduced yield in second year Graze 60 days after sowing • don't graze before plants have 7 fully grown leaves • don't graze during winter (June – August)
Feeding considerations	Target heights • pre-grazing 25 – 35 cm • post-grazing residual 5 cm Can't be fed as the sole diet due to low fibre content
Health risks	**Risk:** Nitrate poisoning if period of rapid growth or during cold or overcast weather **Prevention:** Test for nitrate levels if conditions favour increased nitrates
****Milk response**	35 – 45g MS/kg DM during summer

*Actual yield will depend on climate, region and management practices.

**Actual responses will depend on feed and animal factors such as feed quality, wastage, total DMI intakes, cow BCS and current milk production.

For more details see TechNote 10: Response to supplements.

24.4 Understand implications of feeding fodder beet

Although more typically a winter crop, fodder beet can also provide feed during late summer. If grazed at this time (e.g. Feb - Mar) then yields will be approximately 10 tonne DM less than if left until Autumn/Winter. Fodder beet is a high energy, low protein feed that requires careful management and should not be incorporated into the diet at more than 5 kg DM/cow/day.

Figure 4. *Example of pasture and fodder beet supply (5 ha) and herd demand profiles for a 100 ha farm with 280 cows. Summer months are highlighted.*

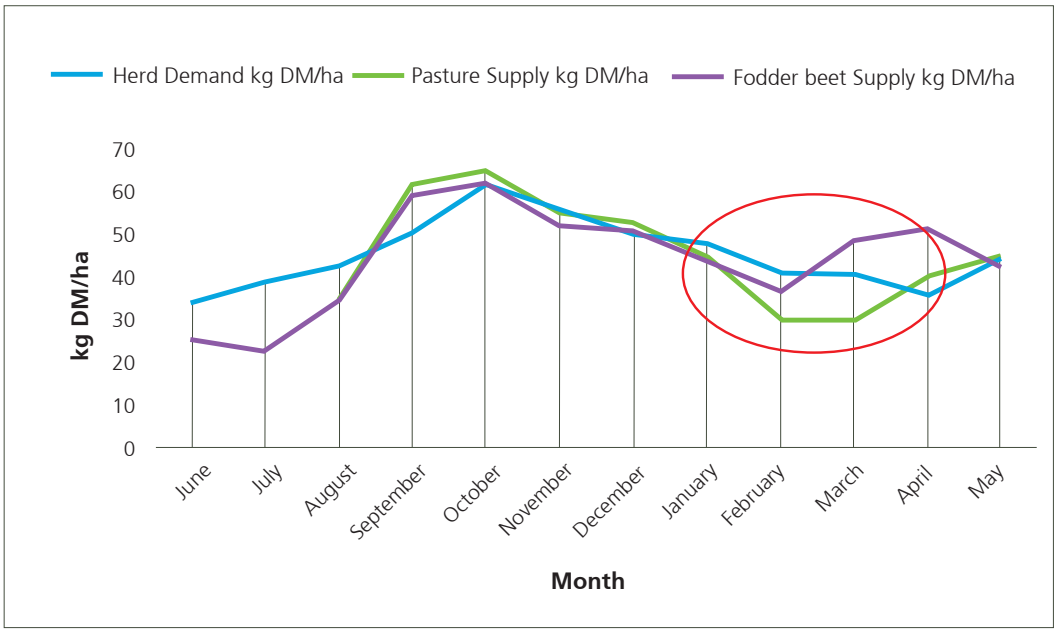


Table 4. *Attributes to consider when feeding fodder beet.*

***Average yield**	15 - 18 t DM/ha (50 – 60% of potential yield)
Feed supply	Sown in September Grazing from Feb to May
Feeding considerations	Break feed using long breaks to allow all cows access Fodder beet should not exceed 1/3 of the diet (~5 kg DM) Cows should only be fed fodder beet as part of a lactating diet after they have grazed fodder beet during the dry period Feed after cows have grazed pasture to prevent gorging Transition slowly (using allowance or time) **Allowance:** 2 kg DM/cow for first 2 days Increase over the next 7 days (1 kg DM/2 days) up to 5 kg DM/cow/day **Time:** 15 mins/day for first 2 days Increase in 10 min intervals until cows are grazing beet for 1 hour (approximately 5 kg DM/cow/day)
Health risks	**Risk:** rumen acidosis **Prevention:** Transition slowly and monitor cows Do not feed more than 1/3 diet Ensure all cows are eating fodder beet before increasing allowance Ensure cows have grazed pasture before feeding fodder beet
****Milk response**	35 – 45g MS/kg DM during summer

*Actual yield will depend on climate, region and management practices.

**Actual responses will depend on feed and animal factors such as feed quality, wastage, total DMI intakes, cow BCS and current milk production.

For more details see TechNote 10: Response to supplements.

24.5 Understand implications of feeding alternative crops/herbs

Plantain

Plantain is a high energy, high protein herb with good tolerance to heat (Table 5). It can provide valuable feed in regions where dry summers limit ryegrass growth and quality. Plantain does require moisture to grow well and under severe drought conditions plants will wilt; however, they will recover quickly following rain, irrigation.

Table 5. Attributes to consider when feeding plantain.

***Average yield**	11 t DM/ha
Feed supply	Sown in spring More persistent than chicory, with yields continuing for 2 – 3 years Can be grown as a mix or special purpose crop As a special purpose crop - graze approximately 60 days after sowing • don't graze before plants have 6 fully grown leaves • don't graze when wet as treading damage reduces plant survival
Feeding considerations	As a mix, can be managed as normal pasture As a special purpose crop, aim to feed 20 % of the cow's diet (3 – 4 kg DM/d) or approximately 2 – 3 hrs grazing over a sustained period. Back fence to ensure good regrowth. Recommendations are 5 – 6 ha plantain per 100 cows or 0.3 ha per 100 cows on a 21-day rotation. Transition cows onto plantain over a few days. Target heights are measured by leaf height (ignore the stems)\ • pre-grazing 25 cm (generally 4 – 6 weeks' growth) • post-grazing residual 5 cm
Health risks	**Risk:** Nitrate poisoning if period of rapid growth or during cold or overcast weather| **Prevention:** Test for nitrate levels if conditions favour increased nitrates
****Milk response**	+ 170 g MS/d pure plantain + 100 g MS/d mixed ryegrass/plantain

*Actual yield will depend on climate, region and management practices

**Response is based on Box et al. (2016) with 10 days of grazing ryegrass pastures compared with pure plantain or a plantain/ryegrass mix. Actual responses will depend on base diet, feed quality, wastage, total DMI intakes, period of feeding, cow BCS and current milk production.

Other crops

Most summer crops are sown in September/October. Green Feed maize, sudan and sorghum are exceptions in that they can be sown in November and December, providing an alternative when chicory, turnips, or plantain are no longer an option.

For more information on incorporating Sorghum, sudan or green feed maize into a pasture based system, visit the DairyNZ website. https://www.dairynz.co.nz/feed/seasonal-management/summer-management/setting-up-for-summer/

24.6 Understand implications of deferred grazing

Deferred grazing can be used to fill a summer feed deficit (Table 6). It is a low cost option of transferring feed from spring to summer. Although quality can vary, deferred pastures average approximately 10 MJ ME.

Table 6. Attributes to consider when using deferred grazing.

Feed supply	Paddocks are locked up in October/November and not grazed until January to March When grazing is sufficiently delayed, reseeding occurs
Feeding considerations	Paddocks are stripped grazed as part of the diet Utilisation with lactating cows is 40 -60% Remaining grass will rot away or can be used by dry cows
Health risks	**Risk:** facial eczema **Prevention:** supplement with zinc (drenching, dosatron, rumen bolus)

24.7 Use supplementary feeds profitably

Decisions on purchasing and feed supplements in mid lactation should consider the milksolids response and the total cost of feeding the supplement. These decisions should also consider options to reduce herd demand (e.g. removing culls, empties and non-productive cows).

24.7.1 Determine the milksolids response

The total milksolids response from the supplement in Figure 5 is 62 g/kg DM. This is the sum of the immediate milksolids response (52.5g; extra milksolids produced while the cows are receiving the supplement), plus the deferred milksolids response (9.5 g; extra milksolids produced due to energy from BCS).

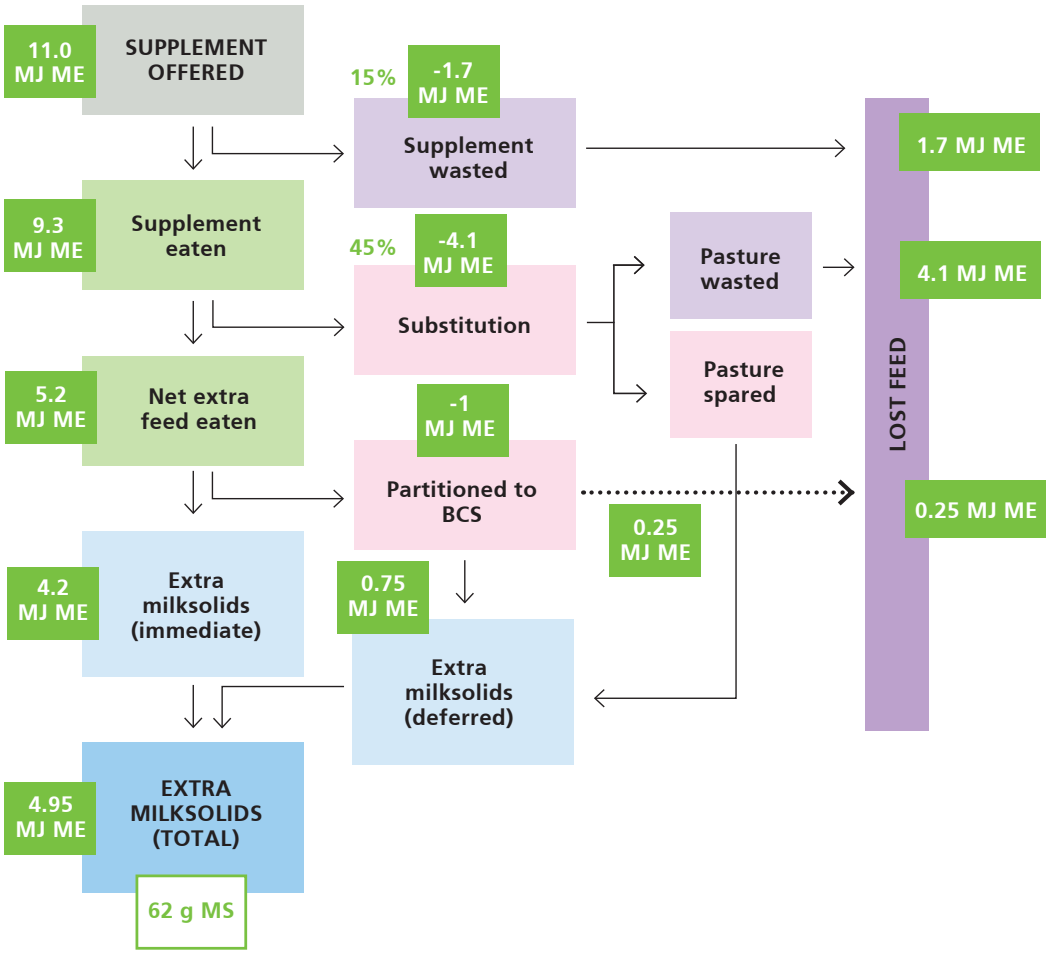
There are several factors that impact on the final milksolids response to supplements including wastage, substitution, and energy partitioning (Figure 5). These are described in detail in TechNote 10: Response to supplements.

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

Energy partitioning

In mid lactation, cows can partition energy to maintaining and/or gaining body condition; however, at this stage the cow's main priority is still to produce milk. Thus, most of the extra energy eaten when supplements are fed, is partitioned to milk production, and if energy is restricted, some body condition will be mobilised to support milk production.

Figure 1: Estimated total milksolids response during mid lactation, where 2 kg DM of PKE is offered in trailers in paddock to a 450 kg cow eating 15 kg DM ryegrass, and producing 1.5 kg milksolids.



Commonly used supplements

The most commonly used supplements during the mid-lactation period tend to be silages (pasture and maize), PKE and barley.

For more details see TechNote 28: Use crops and supplements profitably

24.7.2 Determine the economics of feeding supplements

Decisions on purchasing and feeding supplements in mid lactation should consider the milksolids response and the total cost of feeding the supplement. Rarely will supplementation be profitable unless there is an energy deficit.

There are resources available to help calculate the cost/benefit of adding supplements to the system.

The DNZ Supplement Price Calculator http://www.dairynz.co.nz/feed/feed-management-tools/supplement-price-calculator/

Summer Feeding Check http://www.dairynz.co.nz/publications/feed/

However, in some circumstances, specifically during summer, protein may be limiting production, therefore the cost of and response to protein supplementation needs to be considered. This is covered in the following section.

For more details see TechNotes 9: Pasture management and 10: Response to supplements

24.8 Determine the response to protein

Non-irrigated summer pastures can be low in crude protein (CP) content (Table 7) and some of the commonly used feeds are also low in protein (i.e. maize silage and barley are 8% CP).

For more details see TechNote 4: Feed composition and characteristics.

If protein is limiting production during the summer months in a pasture-based system, supplements high in undegradable dietary protein (UDP) are required to generate a milksolids response.

For more details see TechNote 6: Protein metabolism.

Table 7. Typical protein content of pasture during summer months.

	Northland - Kikuyu		North Island/dryland Southland		Irrigated South Island	Wetlands
	Leafy	Stemmy	Leafy	Dry stalky	Leafy	Leafy
CP (% DM)	16 - 20	6 - 10	15 – 22	13 - 18	18 - 28	18 - 30

24.8.1 Determine the response to undegradable dietary protein (UDP)

Foods that contain high levels of UDP include soybean meal, fishmeal and canola meal. These tend to be expensive supplements and often the milksolids response will not return sufficient value to justify their use during summer in pasture-based systems.

To determine if protein supplementation is economic, both the cost and response to the additional protein must be considered.

An example of the cost/benefit (at different milk prices) of feeding soyabean meal to cows with reduced CP in their diets is outlined in Table 8. Diets differed in protein content but contained the same energy.

1. Dietary CP = 11% (50% summer pasture and 50% maize silage)
2. Dietary CP = 16% (50% summer pasture, 40% maize silage and 10% soyabean meal)

Table 8. Costs and benefits of replacing maize silage with soyabean meal when cows are limited by dietary crude protein.

Milk price	$5.00	$6.50	$8.00
Revenue from milksolids 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 @ 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**

24.8.2 Determine the response to non protein nitrogen (NPN)

Supplements that contain NPN (e.g. urea) are less expensive, but can only contribute to the microbial protein pool.

For more details see TechNote 6: Protein metabolism.

In a grazing situation during summer, there will be no benefit of supplementing cows that are deficient in protein with urea. This is because the cows are already consuming a diet high in RDP and there is a threshold for microbial protein production. Also the rate of release of energy from feeds such as summer pasture, pasture silage, maize silage, or PKE is too slow to make use of the nitrogen that is rapidly released from non protein nitrogen feeds such as urea.

If feeding a mixed ration that includes feeds high in rapidly fermentable carbohydrates, urea may help overcome a protein deficiency; however, care needs to be taken when incorporating urea into a ration. It must be introduced to the diet slowly, and restricted to no more than 150 g/cow/day.

Models such as 'Rumen8' or Cornell Net Carbohydrate and Protein system (CNCPS) can be used to determine if the cow's dietary protein requirements are being met.

For more details see TechNotes 6: Protein metabolism, and 18: Allocate required nutrients.

24.8.3 Understand what milk urea means

As at other times of lactation, milk urea can be used to indicate the dietary protein content; however, a laboratory analyses of feed ingredients, and/or an assessment of the diet for protein content should be undertaken before any nutritional/ dietary changes are made.

For more details see TechNotes 6: Protein metabolism, and 18: Allocate required nutrients.

24.9 Further reading

Box, L. A., G. R. Edwards, and R. H. Bryant. 2016. Milk production and urinary nitrogen excretion of dairy cows grazing perennial ryegrass-white clover ad pure plantain pastures. Proceedings of the NZ Society of Animal Production. 76: 18 – 21.

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