

TechNote 17

Allocate spring pastures correctly

IN THIS TECHNOTE

- 17.1 Allocate the appropriate amount of pasture
- 17.2 Understand factors affecting pasture intake
 - "Is protein:fat ratio (P:F) a measure of feeding adequacy?"*
 - "Will intake increase if I offer multiple breaks?"*
- 17.3 Determine if cows are being allocated enough feed
- 17.4 Further reading

Good pasture management in spring is critical as it impacts pasture quality and yield throughout the season, and therefore impacts whole season performance. Key indicators of feeding level during the spring are post-grazing residuals and cow performance.



For more details see TechNote 9: Pasture management, and online eLearning activity: Pasture management; dairynz.co.nz/feedright-module-8.

17.1 Allocate the appropriate amount of pasture

In pasture-based systems, an optimum balance exists between daily pasture allocation and intake, and whole season performance. To achieve target post-grazing residuals in spring (7 – 8 clicks or 3.5 - 4 cm compressed height on a rising plate meter; RPM), and promote maximum pasture growth and quality for the remainder of the season, a compromise is made between pasture growth and utilisation, and individual cow dry matter intake (DMI).

Key resources such as the spring rotation planner provide guidance on feed allocation and rotation length during late winter/early spring and ensure target average pastures covers at balance date (when feed supply equals demand) are achieved. The aim is to have a farms average pasture cover at the lowest at balance date, with the target cover dependent on stocking rate and per cow pasture demand (influenced by breed and use of supplements).



For more details on spring rotation planner see DNZ FarmFact 1-12: Principles of the spring rotation planner or www.dairynz.co.nz/feed/seasonal-management/spring-management/

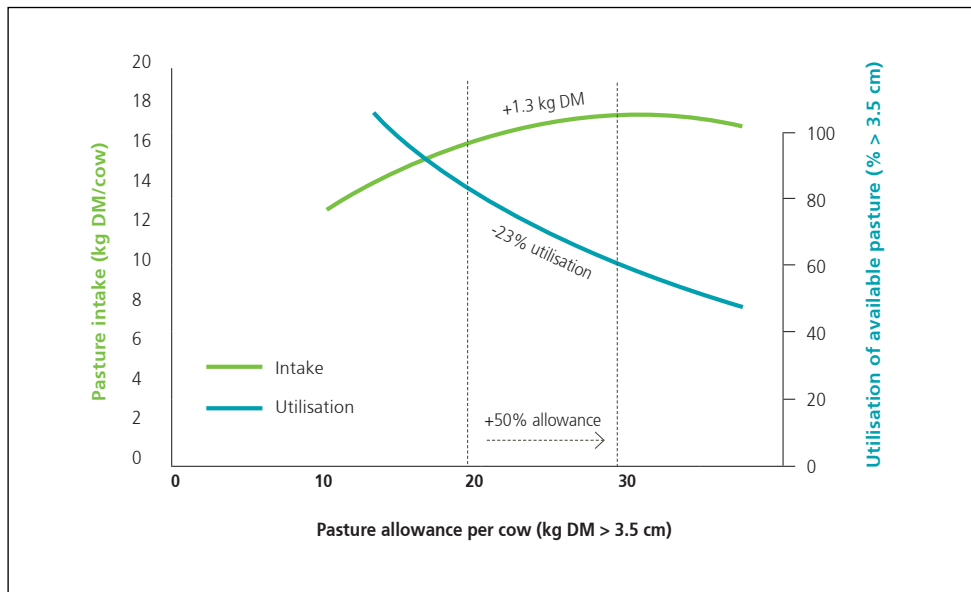
17.1.1 Avoid over-allocating pasture

To achieve target post-grazing residuals, cows are generally not eating at their maximum intake. If pasture allowance is increased to try and maximise daily intake in spring, then pasture utilisation decreases, post-grazing residuals rise above target, high quality pasture is wasted and pasture quality is lower in the next rotation.

The compromise that exists between pasture utilisation and individual cow intake is highlighted in Figure 1. This graph outlines the relationship between pasture allowance (available pasture above 3.5 cm or 1500 kg DM/ha), individual cow intake (kg DM/cow/day), and pasture utilisation (% of pasture allowance that is eaten).

As pasture allowance increases from 20 to 30 kg DM per cow (50% increase in available pasture), there is a small (1.3 kg DM; 8%) increase in pasture intake (green line), but a much larger (23%) decrease in pasture utilisation (black line).

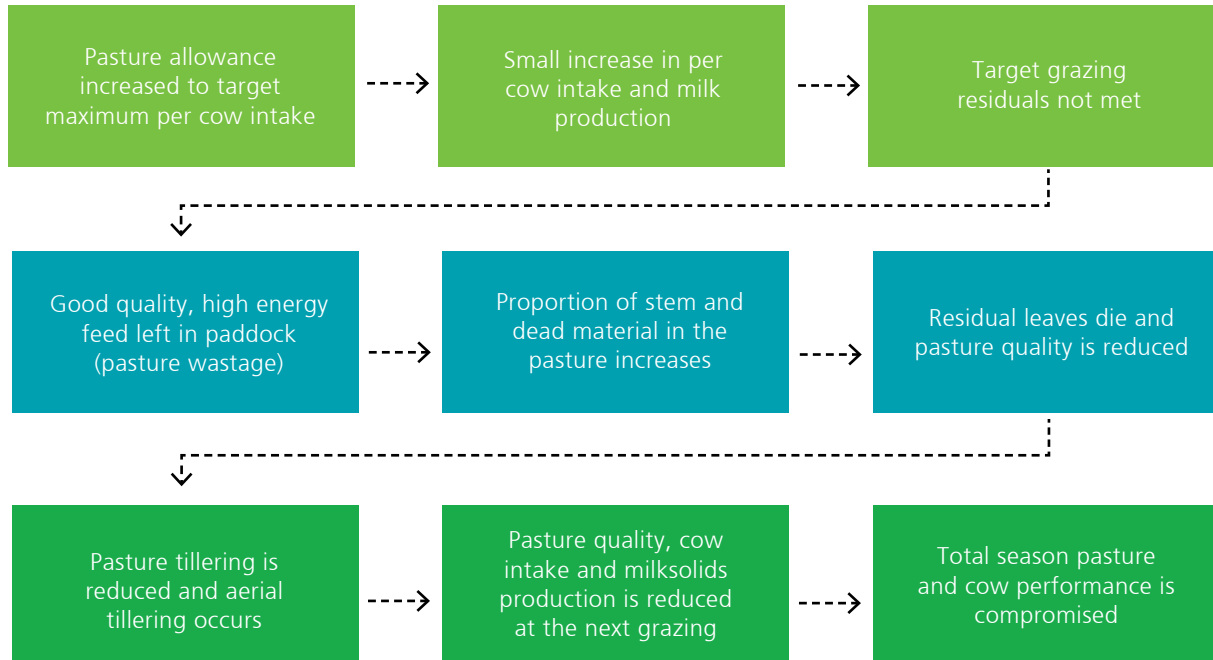
Figure 1. Relationship between pasture allowance, utilisation and intake (Adapted from McCarthy et al., 2014).



The flow chart below outlines the sequence of steps that occur when pasture allowance is increased above optimum and pasture utilisation decreases.

The immediate effect is a small increase in daily cow DMI and milksolids production, and a rise in pasture residuals. In the short term, feed (pasture) is wasted and pasture quality drops in subsequent grazings. Long-term effects are reduced pasture quality, lower cow DMI, and reduced cow performance for the remainder of the season (Figure 2).

Figure 2. Sequence of events from over allocation of pasture.



Mowing before grazing (pre-graze mowing)

Pre-graze mowing can be a useful management strategy if used occasionally when pasture management targets (post-grazing residuals, pre-grazing yields) are not met. However, continuous use of pre-graze mowing during spring/summer does not increase pasture eaten nor improve animal performance (milksolids production or body condition score), at either recommended (2800 kg DM/ha) or high (3400 kg DM/ha) pre-grazing covers. A research trial conducted in Canterbury from Oct to Feb indicated that continuous pre-graze mowing did not improve cow performance, but reduced pasture grown and increased the requirement for supplementary feed.

17.1.2 Avoid under-allocating pasture

Post-grazing residuals are lower than target, this may indicate pasture allowance is insufficient and cows are being underfed. Restricting pasture allowance to less than cow requirements in early lactation will cause an immediate drop in milk production, but the impact on whole season production depends on the timing, severity, and the duration of the restriction (Table 2).

From a pasture perspective, there are no lasting negative impacts of grazing to lower than the target residual (3.5 - 4 cm) once in early spring, provided the pastures are given time to recover (i.e. not grazed before the 2.5 - 3-leaf stage) before subsequent grazings.

Table 1 is a summary of data from several research trials. These data indicate that cows can recover from a short-term moderate feed restriction (e.g. eating 75% of requirements, or grazing to residuals of approximately 3 cm, for 2 weeks) in early lactation with no negative effect on whole season production. However, if the restriction is more severe than this (e.g. cows eating 65% or less of their requirements or grazing to less than 2.5cm) then the immediate negative effect on milksolids production is greater, and whole season production is compromised. Additionally, if a moderate feed restriction (e.g. grazing to 3 cm) is imposed for a longer period (e.g. 5 to 6 weeks), there are both short and long-term negative effects on milksolids production.

Table 1. Impact of under allocating pasture in early lactation on milksolids production.

Experiment	RESTRICTION				MILKSOLIDS LOSS		
	Started	Duration	Intake		Residuals	during restriction	whole season
	week post-calving	weeks	kg DM/d	% of control*	cm compressed height		
Kay et al., 2013	5	3	8.3	55%	2.0	-26%	-9%
Burke et al., 2010	11	3	8.0	55%	2.5	-33%	-7%
Roche et al., 2007	Calving	5	8.6	65%	3.0	-24%	-5%
Kennedy et al., 2015	3	2	10.5	75%	2.7	-9%	0%
Kennedy et al., 2015	3	2	11.5	85%	3.2	-5%	0%
Kennedy et al., 2015	3	6	10.7	75%	2.7	-14%	-9%
Kennedy et al., 2015	3	6	12.3	85%	3.2	-9%	-4%

*Control cows in these experiments were consuming approximately 14 -16 kg DM/cow/day.

Decisions on pasture allocation in spring should focus on maximising whole season pasture growth and quality, and thus optimising whole season cow performance. Decisions to use supplementary feed during this period should consider the severity and duration of the feed deficit and the predicted response to the supplement.



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

17.2 Understand factors affecting pasture intake

Although there are some good rules of thumb for individual cow intake (Table 2), the best indicators to use collectively to determine if feed allocation and intake are adequate in a pasture-based system are

- post-grazing pasture residuals,
- changes in milk production and composition,
- cow behaviour.

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

A: Yes and No. Yes, the P:F can indicate the energy status of the cow, but it can also be influenced by the dietary composition so should only be used in combination with other indicators such as post-grazing residuals, milksolids yield, protein % and cow behaviour.

Table 2. Rule of thumb for average cow intake post-calving.

Weeks	Intake change	Average cow intake
1		12 kg DM/day
2 - 5	Increase by 1 kg DM per week	13 - 16 kg DM/day
6 - 9	Increase by 0.5 kg DM per week	16.5 – 18 kg DM/day



For more details see TechNote 16: Determine energy requirements.

Control of DMI in the early lactating cow involves many complex processes. There are several key animal and farm system factors that affect a cow's intake or drive to eat. These are detailed below.

17.2.1 Cow size and breed

Estimated maximum pasture intakes for grazing cows of different liveweights (LWT) are presented in Table 3. It must be noted that these numbers will vary with individual cow, production, diet composition and quality, and amount of feed offered.

Table 3. Estimated maximum pasture intake for grazing cows.

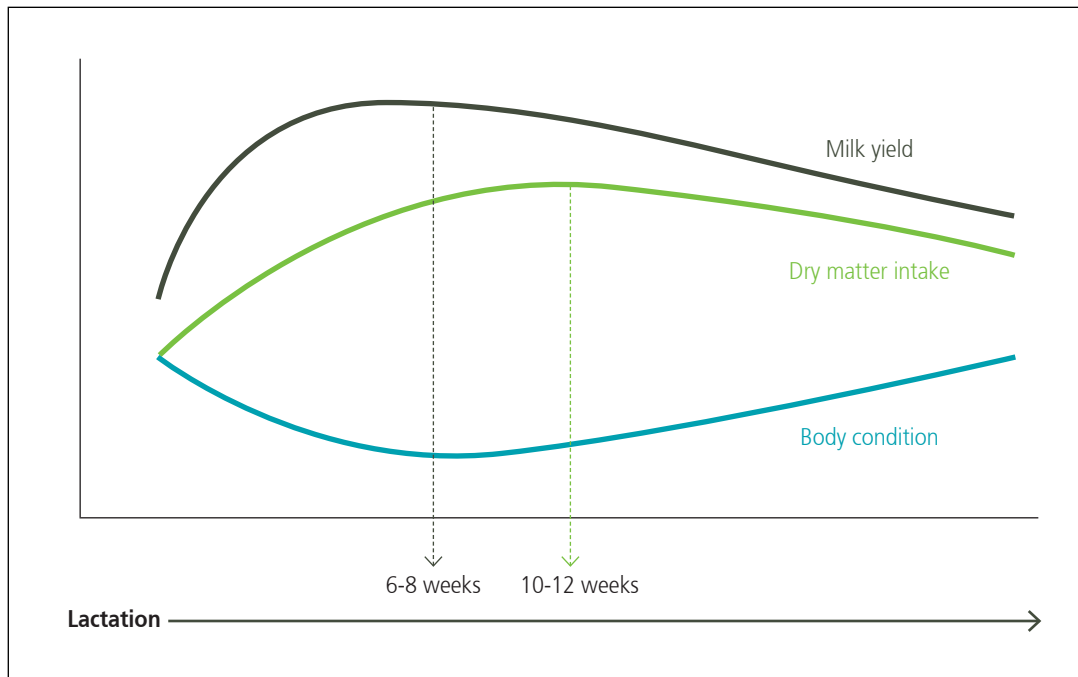
Cow liveweight	Maximum intake of pasture*	
	% of LWT	kg DM/cow/day
400	4.0	15
500	3.6	18
600	3.3	20

* to achieve post-grazing residuals of 3.5 - 4 cm (7 – 8 clicks on the RPM).

17.2.2 Stage of lactation

During the season, DMI increases as lactation progresses, with peak individual cow intake not occurring until approximately 10 - 12 weeks after calving. From this time, DMI will begin to decrease as milk production and energy requirements starts to decline (Figure 3).

Figure 3. Relationship between milk yield, dry matter intake and body condition loss during early lactation.



17.2.3 Grazing time and behaviour

Intake by a grazing cow is generally limited by the number of hours in the day available for grazing. Time prioritised to ruminating, and lying, walking and time spent milking, will determine how much time the cow has available to graze.

Cows typically graze for 8 to 10 hours a day, consuming approximately 2 kg DM/hour; however, there are periods where they will graze more intensively than others. This is typically immediately after milking and in the evening before sunset. Cows can adapt their grazing behaviour relatively quickly and increase the efficiency with which they graze. When offered two 4-hour bouts on pasture (after the AM and PM milkings), cows consumed 90% of what they ate when they had access to pasture for 22 h. Farm system factors such as milk frequency and feed allocation (timing and amount) will impact on grazing behaviour.

17.2.4 Physiological feedback

Chemical feedback mechanisms, such as hunger or satiety hormones, are produced in response to products of digestion. These signals tell the brain whether the cow should continue grazing or stop. This is why, when grazing cows are fed supplementary feeds, substitution occurs. This results in cows spending less time grazing (approximately 12 mins per kg DM supplement) and reduces intake from pasture.

Cows also receive feedback from post-rumen processing (e.g. passage rate) and physical rumen fill. There are distension/stretch receptors in the rumen; however, when cows are fed high quality forages, these have little impact on intake regulation. If the quality of the feed drops and fibre (NDF) increases (greater than 50 – 60%) then physical factors, fibre content and rumen fill play a bigger role in regulating intake.



For more details see TechNotes 8: Fibre metabolism, and 10: Response to supplements.

17.2.5 Feeding system

Cows fed a total mixed ration (TMR) in a confinement system have a greater maximum DMI compared with cows grazing pasture. This difference is primarily due to increased feed availability, higher DM% of the feed and ease of eating (time and energy).

Typical intakes during early lactation for a 600 kg cow fed a TMR are approximately 24 kg DM (4% body weight). In contrast, the same cow grazing good quality pasture will consume approximately 20 kg DM (~3.3% body weight).

17.2.6 Pasture quality

In a grazing system, pasture intake is also affected by pasture quality (digestibility and ME), pasture allocation (pre-grazing yields and area) and grazing behaviour. Cows harvest pasture in successive layers from the top to the bottom of the sward, starting with the available leaf material. Hard stem and dead material act as barriers to grazing, reducing bite size, bite rate, eating time and consequently daily intake.

Q: Will intake increase if I offer multiple breaks?

A: No, not if pasture allowance stays the same. Cows adapt behaviour quickly and there is no benefit to DMI or milk production of offering multiple breaks in a day. Decisions about breaks should be farm specific and take into account factors such as paddock size, shape of farm, terrain, soil types, weather, and distances walked.

17.3 Determine if cows are being allocated enough feed

Indicators of appropriate feed allocation include both plant and animal factors:

Pasture residuals

In a pasture-based system, post-grazing residuals are a good indicator if cows are being fed appropriately.

If cows are grazing good quality pasture to residuals of 3.5 to 4 cm compressed height (7 to 8 clicks on the RPM) they are being fed adequately.

The exceptions are when pasture quality is very poor, during prolonged periods of bad weather. In very wet weather, pasture utilisation can decrease as cows reduce grazing time, pastures can be pugged or even underwater, and soil contamination can reduce cow intake. In such conditions, cows can be underfed but leave behind residuals that are higher than target.

Milk protein:fat ratio

The ratio of protein to fat (P:F) in milk can indicate the energy status of the cow. When the cow enters into a period of negative energy balance, the P:F ratio generally decreases.

This is caused by an increase in milk fat content and/or a decrease in milk protein content.

- An increase in milk fat is primarily due to increased body tissue mobilisation (loss of BCS), resulting in an increase in circulating free fatty acids, which are taken up by the mammary gland and incorporated into milk.
- A decrease in milk protein is primarily due to reduced amino acid availability and glucose production due to lower energy available to the cow.

However, the P:F in milk ratio can also be influenced by the composition of the diet, in particular, the type of carbohydrates.

For example: a cow that is fed more pasture silage or PKE (high levels of structural carbohydrates) will have greater milk fat production and consequently a lower P:F ratio, compared with a cow that is fed a more maize grain or barley (high levels of starch that favour milk protein production, independent of the energy balance of the cow).



For more details see TechNote 5: Carbohydrate metabolism.

In addition, milk fat percent can be manipulated relatively easily by changing the diet, milkfat can change by 0.1 to 1.5 percentage units in a relatively short period. In contrast milk protein percent is more tightly regulated and seldom changes more than 0.1 to 0.4 percentage units.

Therefore, the P:F ratio is not a sensitive measure of energy balance and should not be used in isolation. It is more accurate to look at the ratio in combination with other measurements.

For example, if:

- P:F ratio drops below 70%, and
- milk protein percent drops by more than 0.4%; and
- milksolids production drops by more than 10%, and
- pasture residuals drop below 7 – 8 clicks,

then these together indicate the cow's energy balance has decreased and they are potentially being underfed.

Back calculations from current requirements

Calculating the energy requirements of the herd by using resources such as DairyNZ's Facts and Figures or FeedChecker (Figure 4) can determine if the energy offered to the cow matches the cow's requirements.

For example, the DairyNZ FeedChecker (Figure 4) calculates energy required, for maintenance, milksolids production, BCS gain or loss, and activity based on cow, size, production, distance walked, and terrain. It compares this with the energy supplied from feed (taking into account type, amount offered and feeding method used). The FeedChecker then determines if the proposed diet matches the current nutrient requirements.

The DairyNZ FeedChecker is designed to help with feed management decisions. However, although it allows you to compare the cost of different feeds, it does not take into account the revenue generated from these feeds, nor does it determine if the proposed feeding system is profitable. Other tools such as the DairyNZ Supplement Price Calculator are available for this.

In the scenario provided in Figure 4, a 450 kg cross-bred cow producing 1.7 kg MS, walking 2 km daily on flat terrain and losing 0.1 BCS unit/month, requires 190 MJ ME or 16.6 kg DM of an 11.5 MJ ME diet.

In option 1, energy requirements are than energy supply. The cells with DM and MJ ME are highlighted red to indicate there is an energy deficit.

In option 2, 3 kg DM of PKE has been added to the diet. This diet now meets energy requirements and there is no longer a deficit.

The DairyNZ FeedChecker compares cow requirements and feed supply for energy, protein, fibre, carbohydrates and fats. It also considers macro minerals and takes into account stage of lactation and pregnancy.



For more details see *TechNotes 2: Energy, mineral and vitamin requirements, and 18: Allocate required nutrients.*

17.4 Further reading

DairyNZ Facts and Figures. <https://www.dairynz.co.nz/media/5787669/dairynz-facts-and-figures.pdf>

DairyNZ FeedChecker. <https://www.dairynz.co.nz/feedright-feedchecker>

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Sheahan, A. J., J. K. Kay, and J. R. Roche. 2013. Carbohydrate supplements and their effects on pasture dry matter intake, feeding behaviour, and blood factors associated with intake regulation. *Journal of Dairy Science*. 96: 1 - 12.

The Ruminant Animal: Digestive Physiology and Nutrition. D.C. Church, ed. Illinois, United States of America: Waveland Press, Inc.

Figure 3. DairyNZ FeedChecker example.

NAME Warrick Jones
Calves from Today 24/10/2017

Calves from a different date? 10/09/2017

1. HERD/MOB INPUTS

Breed	cross-bred	350
Stage of lactation	Early	1.7
Average liveweight (kg)	450	flat
Estimated BCS loss/gain next month	-0.1	2.0
Date of next calving (PSC)	7/07/2018	42.9

2. PASTURE QUALITY & ALLOCATION

PASTURE QUALITY			
Pasture quality	Spring	2700	kg DM/ha
MJME	12.0	1500	kg DM/ha
		3.5	ha/day
		12.0	kg DM/cow

OR

Directly input pasture? **kg DM/cow**

ENERGY REQUIREMENTS

maintenance	54
total MS production	136
daily BCS gain/loss	-4
pregnancy	0
total activity	4
Sum of ME requirements at default ME = 11.0	190
Multiplier for feed quality (+/- 5% per MJ ME)	1.00
Total ME requirements at diet ME = 11.5	190

All MOB inputs complete? YES

3. ENERGY SUPPLY

FEED TYPE	FEED	FEEDING METHOD	Util.	OPTION 1		OPTION 2	
				OFFERED	EATEN	OFFERED	EATEN
				kg DM /cow	kg DM /cow	kg DM /cow	kg DM /cow
PASTURE	Spring	grazing - average conditions	85%	12.0	10.2	12.0	10.2
Hay_Silage	Silage -pasture - good	feed pad	90%	4.0	3.6	4.0	3.6
By_products	PKE	feed pad	90%	0.0		3.0	2.7

FEEDCHECKER

RECOMMENDED	OPT1 ON 1	diff	OPT2 ON 2	diff
Eaten				
DM	16.6		16.5	-0.2
MJME	130		11.4	-2
PROTEIN	18.0		22.7	
NDF	>35		46	
SSS	<38		18	
STARCH	<30		0.4	
FAT	<6		3.7	

Option 1 does not meet energy requirements

Option 2 meets energy requirements

Total energy requirements are calculated from herd/mob inputs