TechNote 9

Pasture management

IN THIS TECHNOTE

Financial success in a pasture-based system relies on maximising the growth, quality, and utilisation of pasture. Achieving this requires an understanding of how the ryegrass plant grows and the fundamentals of good pasture management.

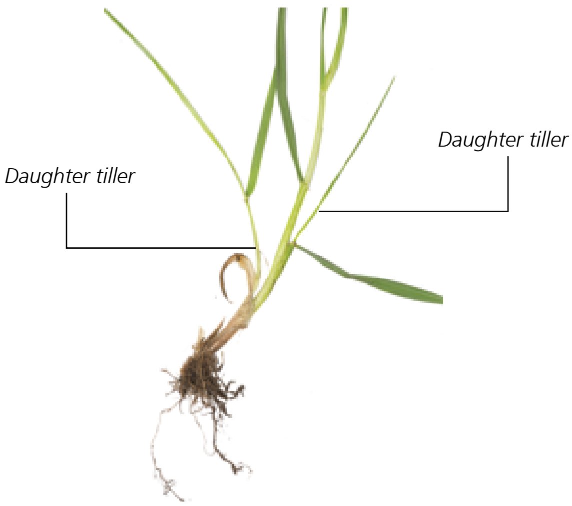
Much of the information presented in this TechNote, and Figures 1-8, are from McCarthy et al. (2014) and McCarthy et al. (2015).

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

9.1 Growth of the ryegrass plant

The ryegrass plant comprises several tillers, connected to each other at the base of the plant. Each tiller has its own roots, maintains three live leaves at any one point and lives for about one year. The key periods for growth and production of new tillers are spring and autumn, with spring the more important. The new tillers produced are known as "daughter tillers" (Figure 1).

Figure 1*. A mature perennial ryegrass tiller with 2 daughter tillers.*

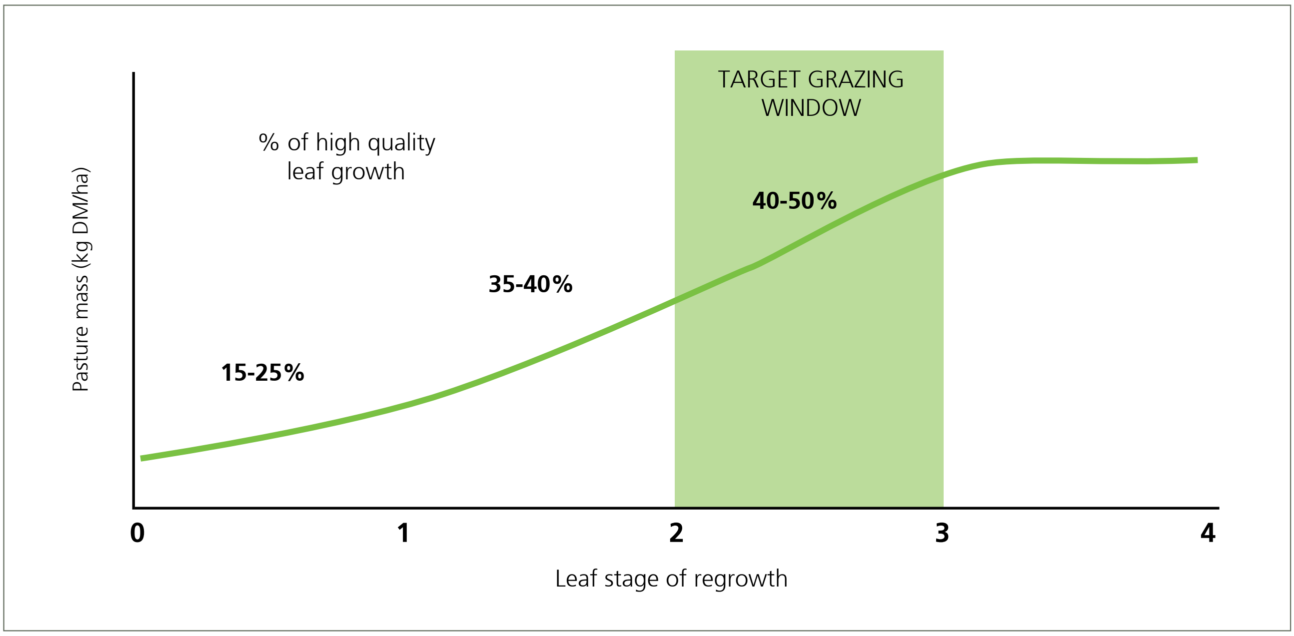


To maximise pasture yield, quality and utilisation, target post-grazing residuals of 7 - 8 clicks on the rising plate meter (RPM), or 3.5 - 4 cm compressed height should be consistently reached. This is the optimum post-grazing height from the plant's perspective as it maximises the proportion of green leaf harvested, creates a good environment for new daughter tillers to establish (i.e. good light penetration/little shading), while still providing the grazed tillers with enough energy to regrow.

After grazing or harvesting, the carbohydrates, that are more concentrated at the base of the ryegrass plants, provide the tiller with the energy needed to grow its first new leaf. At this stage, the freshly grazed plant is deprived of its primary energy source (photosynthesis), so the first leaf grown after grazing is the smallest, usually accounting for 15 – 25% of the total pasture mass (Figure 2). Once this first leaf has grown, it captures light providing the tiller with more energy via photosynthesis. This results in the second leaf being bigger than the first (35 – 40% of the total pasture mass). As the second leaf can then provide the plant with even more energy from photosynthesis, the third leaf that is grown is bigger still, contributing about 40 – 50% of the total pasture mass. Once the fourth new leaf starts to emerge, the first new leaf begins to die. This is often referred to as ceiling yield, where there is no increase in the total mass of the plant, as the rate of loss through the old leaves dying is equal to the growth of new leaves. Therefore, to maximise pasture yield, recommendations are to graze close to the 3-leaf stage (Figure 2).

> Repetitive grazing before the 2-leaf stage reduces pasture yield and growth.

Figure 2. *Relationship between leaf stage and pasture mass.*

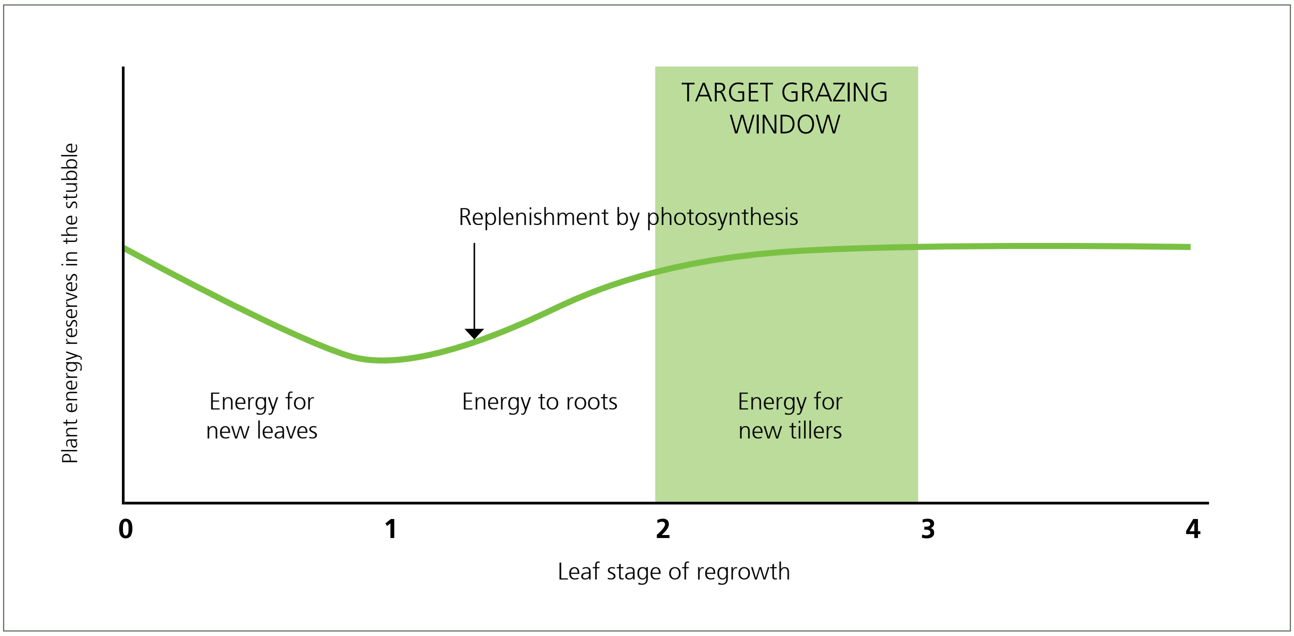


Grazing close to the 3-leaf stage also enables good pasture persistence. This is due to how the tiller partitions energy as it regrows. Prior to the first leaf emerging, the tiller directs its stored energy towards the growth of the first leaf (Figure 3). When the second leaf is starting to emerge, the energy supply from photosynthesis increases so the tiller partitions some energy towards its roots. It is not until after the second leaf has fully emerged that energy is directed towards growing new tillers. Therefore, repetitive grazing before the tiller has two leaves can negatively affect pasture persistence and tillering.

> Repetitive grazing before the 2-leaf stage does not allow plant reserves to be fully restored.

If the tiller is under stress, is unhealthy (deprived of nutrients or energy) or is not allowed to grow past the second leaf stage, then the daughter tillers will not develop and pasture density will decline.

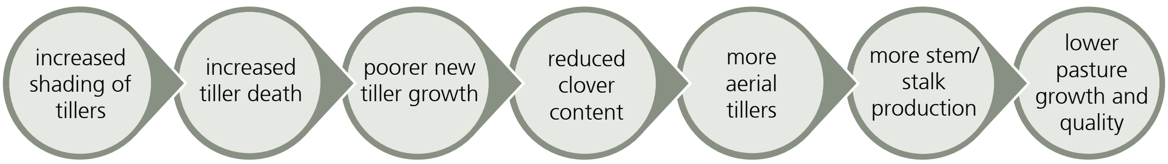
Figure 3. *Relationship between leaf stage and plant energy reserves.*



Although recommendations are to graze close to the 3-leaf stage, this should not be used as a rigid target. Grazing management needs to consider pasture cover targets, feed demand requirements and pasture quality. For example, it is advisable to graze closer to the 2-leaf stage when there is canopy closure, when demand is low, or when moving into a pasture surplus.

Canopy closure occurs when leaves begin to fall over and light cannot penetrate into the bottom of the pasture. The consequences of canopy closure are presented in Figure 4.

Figure 4. *Consequences of canopy closure on future pasture growth and quality.*



9.2 Leaf stage

The different leaf stages of a ryegrass tiller are highlighted in Figure 5.

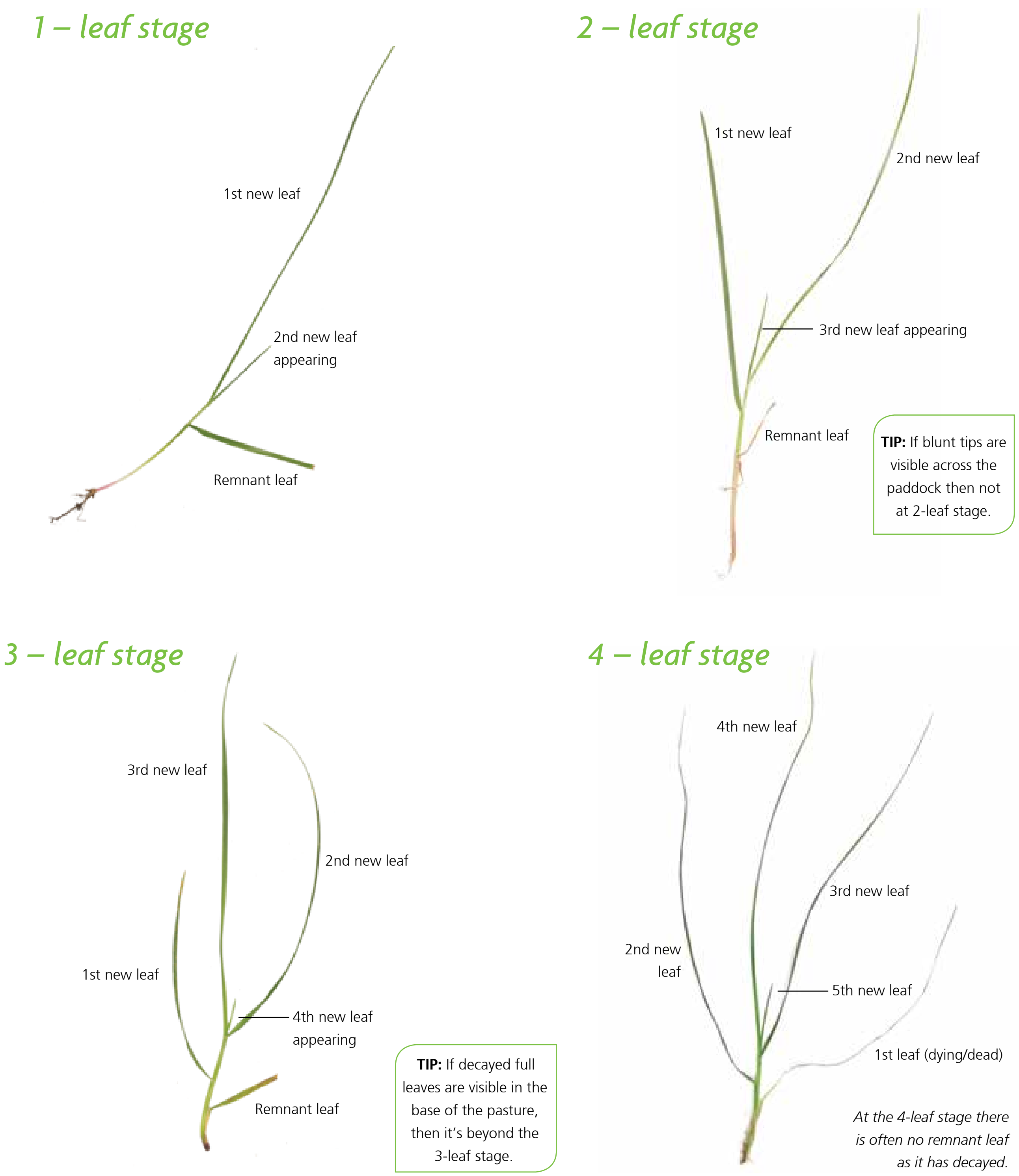
Leaf emergence rate depends on soil temperature and availability of moisture and nutrients, with leaves taking longer to appear when it is cooler or soil moisture is limited. The fastest a new leaf can emerge is approximately every 8 days, in ideal conditions, i.e. temperatures between 15 – 20°C and soil water availability of at least 40%. In contrast, it can take up to 72 days for a new leaf to emerge during a very cold winter.

Recommended rotation length with a 10-day leaf emergence rate
2 x 10 days = 20 days minimum
3 x 10 days = 30 days maximum

The leaf emergence rate can be used to determine the optimum rotation length. To graze at the recommended minimum recommended rotation length (2-leaf stage), multiply the leaf emergence rate by 2. To graze at the maximum recommended rotation length (3-leaf stage), multiply the leaf emergence rate by 3.

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

Figure 5. Leaf regrowth stages of a ryegrass tiller.



9.3 Pasture allocation

Accurate pasture allocation will ensure optimal utilisation of pasture and good animal performance. The target pre-grazing yield can be calculated by the following equation:

Stocking rate (cows/ha) x pasture requirement (kg DM/cow/day) x rotation length (days) + residual (kg DM/ha).

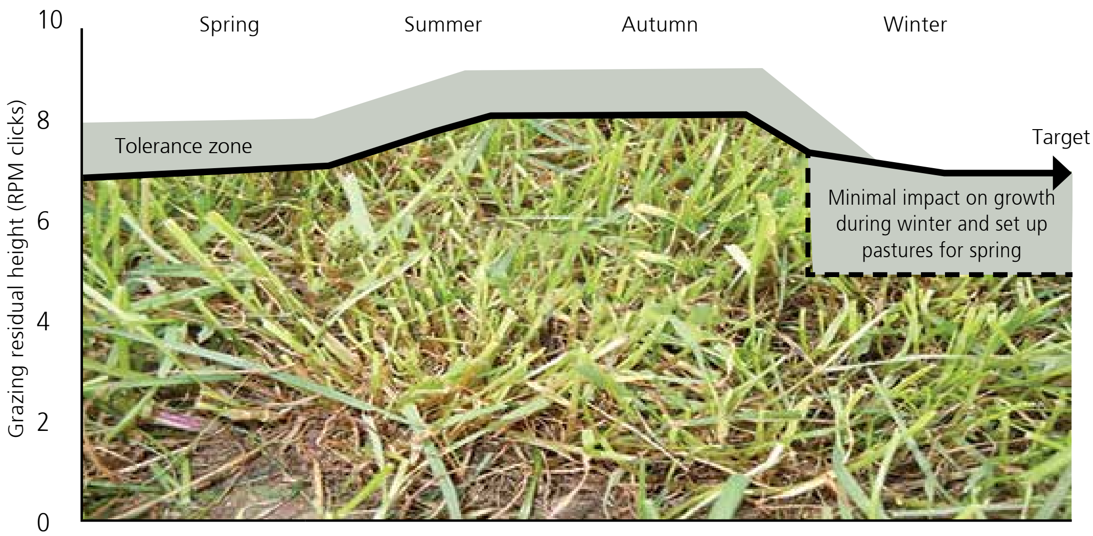
> To calculate target pre-grazing yield
>
> 3 cows/ha x 18 kg DM/cow/day x 25 days + 1500 kg DM/ha =2850 kg DM/ha

General recommendations are to target pre-grazing yields of 2800 – 3200 kg DM/ha in spring/summer with as much high energy green leaf as possible available in the grazing horizon.

9.4 Post-grazing residuals

Target post-grazing residuals are set to optimise pasture utilisation and subsequent pasture growth and quality. It is important to focus on pasture residuals throughout the season; however, the critical period is in spring when it is important to achieve a target residual of 3.5 to 4.0 cm (compressed height) or 7 – 8 clicks on the RPM (Figure 6).

Figure 6. *Schematic representation of target post-grazing residual (compressed height) throughout the season.*



1cm = 2 clicks   clicks x 140 + 500 = kg DM/ha

RPM = rising plate meter

cm	clicks	kg DM/ha
3	6	1340
4	8	1620
5	10	1900

This is because the reproductive period during spring leads to stem elongation and increased proportions of stem in the grazing horizon, which may lead to a slight increase in post-grazing residual heights during summer. Achieving target grazing residuals in spring will reduce the ratio of reproductive to vegetative tillers, thereby maintaining pasture quality and minimising the increase in residuals in summer. Achieving residuals in spring will also minimise the occurrence of aerial tillers (Figure 7) during a key tillering period.

> In spring it is critical to achieve post-grazing residual targets of 3.5 - 4 cm compressed height.

Aerial tillering occurs when the tiller buds are produced on elongated stems and not at the base of the plant. This can be caused by high residuals or shading of the plant. Aerial tillers develop further up the stem, and therefore struggle to develop a viable root system. This results in tiller death and reduced pasture growth and persistence.

Figure 7. *Example of an aerial tiller.*

Winter offers an opportunity to reset the pasture residual levels for the forthcoming season and ensure tiller growth is promoted in the base of the sward. There is no lasting negative effect on pasture performance of grazing below target residuals once during winter/early spring as long as the pastures are given time to grow to the 2.5 - 3-leaf stage before the subsequent grazing.

If residuals are above target, corrective actions should be used to reduce the negative impact on subsequent pasture growth and quality. These include post-graze topping, shutting the paddock for silage, shortening the round until the next grazing or further grazing with another stock class.

For more details see TechNotes 17: Allocate spring pastures correctly, 22: Manage summer pastures correctly, 26: Manage winter pastures appropriately, and 31: Manage crops and pasture appropriately.

9.5 Further reading

Chapman, D., S. McCarthy, and C. Wims. 2014. Maximising leaf availability using pasture growth principles. DairyNZ Technical Series August 2014. 23: 1 - 4.

Lee, J., P. Hedley, and J. Roche. 2011. Grazing management guidelines for optimal pasture growth and quality. DairyNZ Technical Series September 2011 5: 6 - 10.

McCarthy, S., C. Wims, J. Lee, and D. Donaghy. 2015. Perennial ryegrass grazing management in spring -paddock guide. https://www.dairynz.co.nz/publications/feed/

McCarthy, S., C. Wims, J. Kay, D. Chapman, and K. Macdonald. Grazing management - striking the right balance. DairyNZ Technical Series August 2014. 23: 13 - 16.

Parsons, A. J., I. R. Johnson, and A. Harvey. 1988. Use of a model to optimize the interaction between frequency and severity of intermittent defoliation and to provide a fundamental comparison of the continuous and intermittent defoliation of grass. Grass and Forage Science. 43: 49 - 59.

Stakelum, G., and P. Dillon. 2007. The effect of herbage mass and allowance on herbage intake, diet composition and ingestive behaviour of dairy cows: Irish Journal of Agricultural and Food Research. 43: 17 - 30.