Perennial ryegrass management
II. Practical application of grazing principles

Key targets

The 3030 Project identified three pasture management strategies as the keys to successful management of perennial ryegrass pasture. The 'ABC targets' are:

A. Graze between the 2nd and 3rd leaf stage.

B. Leave a post-grazing residual of 4–6 cm between pasture clumps [equivalent to 1,500–1,600 kg dry matter (DM) per ha].

C. Maintain a constant cover of green leaf area all year.

The 'Grazing management to maximize growth and nutritive value' Information Sheet Information Sheet of this series explained the research background and principles behind these ABC targets. This Information Sheet focuses on how to achieve the ABC targets in practice. It discusses some of the particular issues and lessons that have arisen from the 3030 Project experiences in southern Australia.

THE UNIVERSITY OF MELBOURNE

State Government Victoria Department of Primary Industries

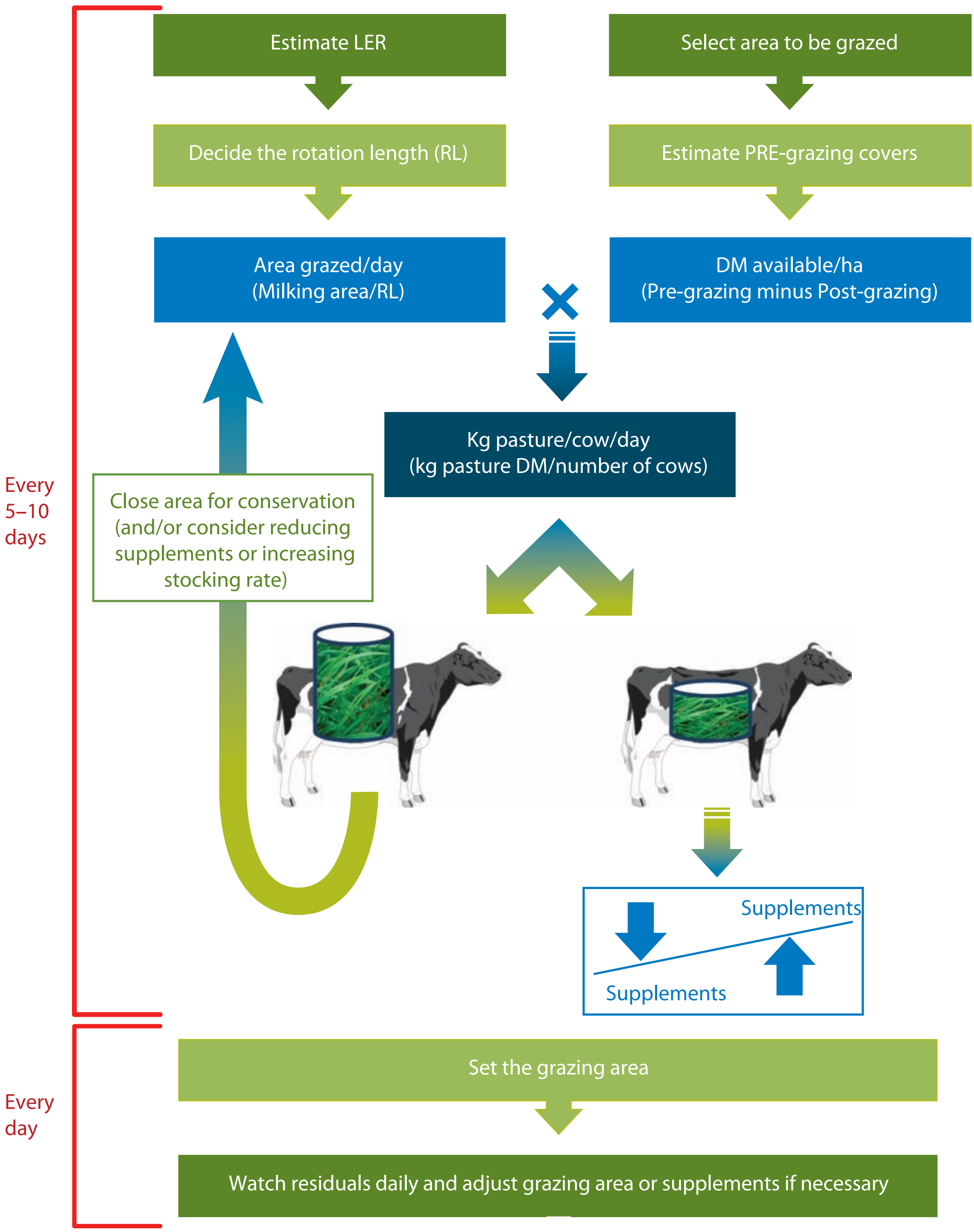
Dairy Australia Your Levy at Work

How to achieve the ABC targets in practice

There are four main areas of perennial ryegrass management that should be covered in order to achieve the ABC targets:

1. Set rotation length in relation to Leaf Emergence Rate (LER) and monitor it.
2. Choose the paddocks to be grazed and assess their pre-grazing cover.
3. Adjust supplementation and/or close for conservation to achieve the target rotation length and post-grazing residuals.
4. Make daily adjustments to the allocated grazing area in order to achieve the target pasture intake and post-grazing residuals.

The decision-making process described in this Information Sheet is summarised in the following diagram:



1. Set rotation length in relation to Leaf Emergence Rate (LER)

The LER of a pasture sward is the time needed for a leaf to fully emerge. It is determined mainly by the temperature at the base of the ryegrass plant and by the availability of soil moisture. LER is slower in cooler conditions and increases as temperatures rise.

The effect of soil moisture is only decisive when it limits plant growth. A recent glasshouse study by Rawnsley et al. (2010) showed that LER increases linearly with temperature until soil moisture begins to limit plant growth. From that point, as the soil dries off, LER starts to slow down.

On the 3030 Project farmlets at Terang in south west Victoria, LER was typically slowest in July–August (18–20 days/leaf) and fastest in October–November (8–9 days/leaf).

The average LER since the last grazing of a particular paddock can be estimated by dividing the number of new leaves on a parent tiller by the number of days since the paddock was last grazed.

Counting leaves does not require any tool and can be done under any weather and paddock conditions. Simply count the number of fully emerged leaves since the last grazing. A leaf has fully emerged when the tip of the next leaf is just visible. The last grazing is determined by identifying the remnant leaf that was cut during that previous grazing (see Figure 1 for an example of a tiller with 2.5 leaves). Several tillers with a small remnant leaf (as shown in Figure 1) should be chosen from across the paddock.

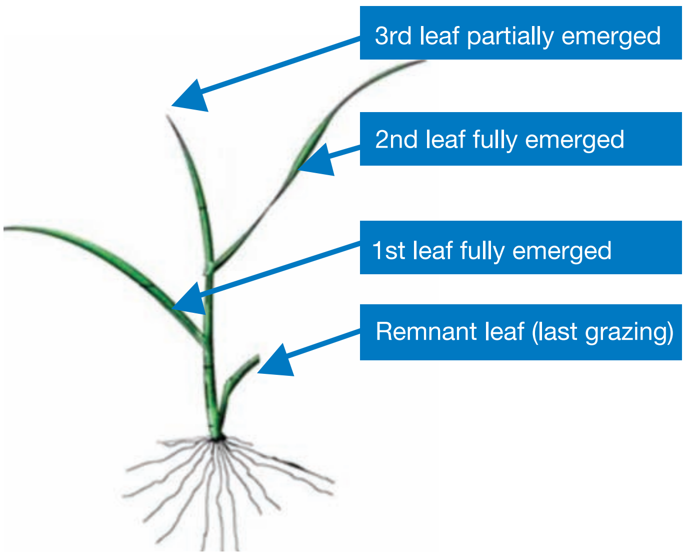


Figure 1. Ryegrass tiller at a 2.5 leaf stage.

To estimate the average LER within the last rotation, divide the days since the last grazing by the number of leaves on each tiller, as follows:

LER (days/leaf) = Days since the last grazing ÷ Number of fully expanded leaves

For example, if it has been two weeks since the last grazing and there are 1.5 leaves on each ryegrass tiller, the LER is calculated as:

LER (days/leaf) = 14 days ÷ 1.5 leaves/tiller = 9.3 days/leaf

Repeat the process in different paddocks or sections within a paddock to gain a reliable estimate of LER.

Note 1: This method calculates the average LER since last grazing (in the example: the last 14 days). To estimate the current LER, choose a paddock where only the 1st leaf has fully emerged and count the number of days since it was grazed.

Note 2: Do not choose tillers from pasture clumps when estimating LER because it is likely that they will not have been grazed completely so a suitable remnant leaf may not be found.

If LER is monitored consistently, a 'body of knowledge' will be developed over time. It is useful to consider the historical LERs for each time of the year as well as expected weather conditions during the following weeks to adjust the observed LERs. For example, if the temperature is getting cooler the LER will slow (more days/leaf), and if the temperature is warming then LER will speed up (less days/leaf).

Tool to estimate LER

A simple calculator has been developed by the team led by Richard Rawnsley at the Tasmanian Institute of Agricultural Research (TIAR) to predict LER throughout the year. Because LER is largely determined by air temperature and soil moisture, using the Bureau of Meteorology temperature data (and forecasts if available) and an estimation of soil moisture, it is possible to reliably predict LER. With this information, rotation length can be adjusted to this parameter and future changes in LER can be predicted with confidence. This tool is being tested for southern Victorian conditions.

The calculator can be downloaded from http://tasdairyprojects.com.au/Tools

When the LER has been calculated and the leaf stage target for grazing has been determined (see the 'Grazing management to maximize growth and nutritive value' Information Sheet), it is possible to determine the rotation length for the whole grazing area:

Rotation length (days) = Target leaf stage (number of leaves) x LER (days/leaf)

For example, if the target is to graze at leaf stage 2.5 then:

Rotation length = 2.5 leaves x 9.3 days/leaf = 23.3 days

Having determined the target rotation, the maximum area that should be grazed each day can be calculated:

Daily area allocation (ha/day) = Total pasture area (100 ha) ÷ Rotation length (23 days) = 4.3 ha/day

This 4.3 ha per day then needs to be divided into an area per feed (AM and PM grazing).

Note: This calculation assumes that an appropriate rotation length has been implemented on the farm. If this is not the case, a 'transition' rotation length should be implemented. Using the above example, if the previous rotation length was too short the pasture will not have achieved its target leaf stage if the rotation length is changed to 23 days. A longer rotation length will be needed until paddocks consistently reach the 2–3 leaf stage at grazing. Conversely, if the rotation length was too long, a rotation length shorter than 23 days will need to be imposed.

2. Choose paddocks and assess pre-grazing covers

Once the rotation length has been determined, it is time to identify the paddocks to graze. The order of paddocks to be grazed should be determined primarily by leaf stage and to a lesser extent by pasture cover.

The general target is to graze between the 2nd and 3rd leaf stage. There are benefits from grazing closer to the 2nd or 3rd leaf stage, depending on the time of the year. Moving within this range can balance quantity and quality of consumed pasture. This is discussed in detail in the 'Grazing management to maximize growth and nutritive value' Information Sheet.

Once the order of paddocks to be grazed is decided, the amount of feed available for the cows on each paddock needs to be assessed. The key for this assessment is to have a good estimation of pre-grazing cover.

The post-grazing residual target should remain constant at 4–6 cm (1,500–1,600 kg DM/ha).

Pre-grazing cover can vary between paddocks and even within a paddock. Visual estimations can give a reliable assessment as long as they are periodically 'calibrated' (compared and adjusted) to a proven tool (see the following options).

Tools to measure pasture:

Four examples of tools or methods to measure pasture cover objectively that have been tested for Australian pastures are outlined (see Figure 2):

a. **Cutting pasture to ground level (0 cm) within a quadrant of 0.1 or 0.25 m^2.** The fresh material is weighed and a representative sample is dried to obtain the DM percentage. This method is the 'gold standard' to calibrate any tool or sensor, but is extremely time-consuming and, therefore, impractical.

b. **Rising Plate Meter:** This tool is highly reliable and can be acceptably representative of the paddock since it normally gives one reading for every step the user takes as they walk across the paddock.

c. **Ellinbank Automatic Pasture Reader (Department of Primary Industries (DPI) Victoria, Ellinbank, Australia):** this is a sound-based technology sensor that can be attached to the front, side or back of a quad-bike or utility vehicle to estimate pasture biomass while driving through a paddock. This tool can be highly representative, as it can obtain about 15 observations per meter, depending on the travelling speed.

d. **Rapid Pasture Meter (C-*Dax* Systems Ltd, Palmerston North, New Zealand):** This is a light beam-based technology sensor that can be attached to the back of a quad-bike to estimate pasture biomass while driving through a paddock. This tool is widely used in New Zealand and can also be highly representative, as it takes about 37 readings per metre.

Figure 2. Methods to estimate pasture cover (a) cut pasture, (b) rising plate meter, (c) Ellinbank automatic pasture reader, and (d) rapid pasture meter (C-Dax).

With an estimate of the pre-grazing cover of paddocks to be grazed, and maintaining the target post-grazing residual of 1,500 kg DM/ha, the amount of DM the cows are expected to be harvesting each day can be calculated.

For example, if the pre-grazing cover is 2,500 kg DM/ha and the target post-grazing residual is 1,500 kg DM/ha, the cows should be consuming 1,000 kg DM/ha. Using the daily area allocation from the example (above) of 4.3 ha per day, 4,300 kg DM needs to be consumed by the herd each day to maintain the target rotation length.

3. Adjust supplementation and/or close for conservation

The amount of DM that needs to be harvested each day in order to maintain the target rotation length has been calculated, but another calculation is required to determine if this amount of pasture (4,300 kg DM/day in the example) will be enough to feed the herd or if there are enough cows to harvest the DM.

There are three possible scenarios:

1. **Less pasture than required by the herd ➔ increase supplements.**

   If there were 400 cows in the milking herd, they each would be consuming 10.8 kg DM/ day (4,300 kg DM divided by 400 cows) to maintain the rotation length. The rest of the diet needs to be made up with supplements (concentrates and/or other forages) according to the cows' nutritional requirements, feed availability and price.

2. **More pasture than required by the herd ➔ decrease supplements and/or close area for conservation.**

   If there were 150 cows in the milking herd, then each cow needs to consume 28.7 kg DM/day (4,300 kg DM divided by 150 cows) to maintain the target rotation length. This level of pasture intake is not possible. It is a generally accepted rule that modern dairy cows can consume about 3% of their liveweight as quality pasture, although this will vary according to stage of lactation and other factors. In addition, the farm manager will have a minimum level of concentrate feed that he/she wants to keep in the cows' diet. These factors set a maximum level of pasture intake.

   In this example, not all the pasture that has to be harvested each day to maintain the target rotation length can be consumed by the herd. The daily allocation of grazing area should be reduced to suit that pasture intake limit (e.g. 15 kg DM/cow/day instead of 28.7).

   Continuing with this example, pasture consumption by the herd is 150 cows x 15 kg DM/cow = 2,250 kg DM/day. If there is 1,000 kg DM/ha available, then 2.0–2.5 ha/day will meet the pasture intake requirements of the herd.

   To achieve the desired reduction in pasture allocation per cow, the area allocated per day should be reduced. If the area is not reduced the rotation length will end up longer than desired. A portion of the milking area should be temporarily taken out of the grazing rotation of the milking herd. This can be achieved either by locking up some paddocks to make silage or hay, or grazing them with other stock (eg. dry cows) if weather conditions allow. The 'Closing paddocks for conservation' Information Sheet gives more details on these options.

3. **No changes required: the number of cows grazing is enough to harvest the necessary DM/ha to maintain the target rotation length.**

An easy-to-follow spreadsheet has been developed by Phil Shannon from DPI Victoria to allocate number of grazings per paddock, in relation to the paddock area, feed available and target rotation length. This spreadsheet, the 'Rotation Right Tool', can help farm managers stay within the right rotation more often and allocate a consistent amount of pasture per cow per day. The Rotation Right Tool can also detect when there is a surplus in the system that needs to be conserved.

4. Daily adjustments of allocation

Adjustments in the allocation of pasture (size of the grazing strip) will need to be made every 12 or 24 hours if there are large changes in the following variables:

i. **Post-grazing residual:** when it is either substantially lower or higher than the target (1,500–1,600 kg DM/ha, 4–6 cm between clumps).

ii. **Milk production:** clear drops in daily milk yield across the herd that are not explained by other factors such as weather conditions, abrupt changes in supplement levels or other forages in the diet.

iii. **Wastage of other supplements:** once it is confirmed that the allocation of supplements is right and is not the source of the wastage, the pasture allocation might need to be reduced.

It is important to make sure that these adjustments do not change the overall targets for grazing management. If substantial adjustments are consistently being made, then the initial process described in Sections 1, 2 and 3 needs to be re-assessed.

Maintaining a post-grazing residual of 1,500–1,600 kg DM/ha is one of the key targets for grazing management. This range is typically equivalent to 4–6 cm of pasture height between clumps, although there is some variation between species, seasons and sward density (tillers/m^2). A practical indication of this target height is the '2nd knuckle' observation (see Figure 3).

Figure 3. Assessing post-grazing residual height (5 cm or '2nd knuckle height').

One of the challenges is to maintain the target post-grazing residual level regardless of variations in the pre-grazing pasture cover during the year. Pre-grazing covers tend to be higher in spring and lower in late autumn/winter. When not closely monitored, post-grazing residuals tend to follow the same pattern as pre-grazing covers throughout the year.

A clear example of seasonal variations in pre-grazing cover and their effect on post-grazing residuals is the performance of the RyegrassMax farmlet study of the 3030 Project at Terang.

As shown in Figure 4, pre-grazing covers during the spring of the first year (2005/06) were too high for grazing cows (reaching values above 5,000 kg DM/ha). This led to post-grazing levels from 2,000 to 3,000 kg DM/ha which are well above the desired target of 1500–1600 kg DM/ha.

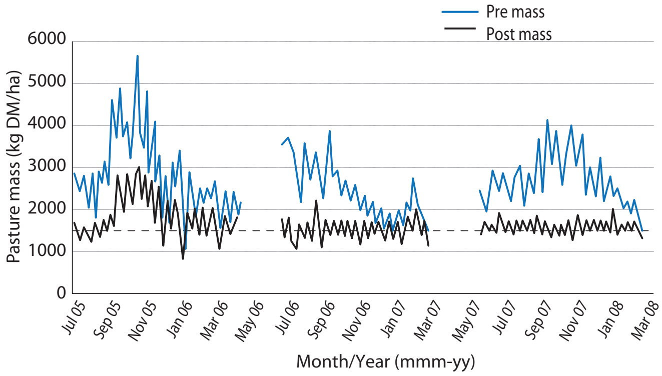


Figure 4. Pre-grazing covers (blue) and post-grazing residuals (black) measured at the RyegrassMax farmlet in 2005/06, 2006/07 and 2007/08 at the 3030 Project farmlet study at Terang.

In the following years (2006/07 and 2007/08), post-grazing residuals were better controlled, based on close monitoring of pasture cover, LER and accurate allocation of pasture and supplements. This tight control showed that it was possible to maintain a constant level of post-grazing residual (near 1,500 kg DM/ha), even when pre-grazing levels were as high as 3,500 kg DM/ha or as low as 1,700 kg DM/ha (Figure 4; years 2006/07 and 2007/08).

When the target post-grazing residual is not achieved other options to harvest that pasture can be implemented. These include using 'followers' (e.g. dry cows or young stock) to graze the pasture, and removal by mowing ('topping', see the 'Grazing management specific practices' Information Sheet for further details).

Grazing duration is another important factor in the daily adjustments of grazing allocation. As a general recommendation, cows should not have access to a paddock or section of a paddock for more than three days.

When strip-grazing a large paddock for more than three days, best management practice includes a back fence to stop the cows re-grazing the 3-day regrowth. Re-grazing tillers when only the 1st leaf has emerged will deplete sugar reserves and put plant persistency at risk (see the 'Grazing management to maximize growth and nutritive value' Information Sheet).

Summary

This Information Sheet has described the practical application of perennial ryegrass management principles for farm managers and advisors who are already familiar with the leaf-stage based grazing management theory.

As a refresher, or initial familiarisation with these principles and techniques, we recommend a training program named 'Feeding Pastures for Profit' run by DPI Victoria (see Shannon and Tyndall (2006) for more details). The program includes the use of the Rotation Right Tool and a practical decision-making guide named the Body of Evidence. The focus of the program is on the day-to-day practical observation of pasture with the aim of achieving high levels of energy intake and graze pastures on a leaf stage-based rotation with a residue of about 5 cm.

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About 3030

PROJECT 3030 aims to help farmers achieve a 30% improvement in farm profit by consuming 30% more home-grown forage (pasture plus crop). It is aimed at dryland farmers in southern Australia who have mastered the challenge of growing and using ryegrass pasture for dairy-cow feeding.

For further information

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