# Perennial ryegrass

*(Lolium perenne)*

by Bill Fulkerson

## FEED FOR DAIRY COWS

Perennial ryegrass is a temperate grass ($C_3$) originating from Europe where it is grown in climates ranging from cold temperate to Mediterranean. It is the most widely used dairy pasture species in the world, primarily due to its high nutritive value and long growing season under ideal conditions.

However, the growth and persistence of perennial ryegrass is limited in most Australian dairying areas. This is due to moisture stress and high summer temperatures which cause perennial ryegrass to go into varying degrees of physiological dormancy; and plant loss can be excessive.

Perennial ryegrass contains no mineral deficiency for dairy cows at typical levels of milk production. The exception may be magnesium in young shoots in early spring, which may cause hypomagnemia or grass staggers.

Well-managed perennial ryegrass has enough metabolisable energy (the first nutrient limiting milk production under a typical pasture-based dairy farm situation) to produce 21-22L milk/cow/day. Energy dense cereal grain based concentrates are needed to support higher production.

Grazing management is the key to achieving optimal growth, utilisation, persistence and quality. Grazing intervals need to be long enough for the plant to replenish carbohydrate reserves but short enough to avoid leaves beginning to decay, which results in a fall in quality and palatability.

The average production of perennial ryegrass on commercial dairy farms in Australia is about 8-10t DM/ha/year. It's possible to achieve about 20t DM/ha/year under ideal conditions with correct water and grazing management and the application of at least 400kg N/ha/year.

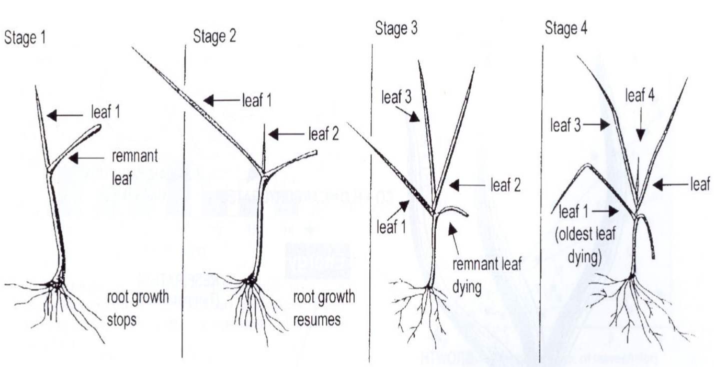



**Figure 1.** Regrowth of a ryegrass tiller following defoliation (Donaghy 1998).

## ESTABLISHMENT

Perennial ryegrass is usually sown in early autumn but may be sown in spring if the seed bed is clean and irrigation is available.

### Seeding rate

Perennial ryegrass can be sown into a prepared seed bed or direct drilled. Seeding rates depend on location:

- North of Sydney: 20kg plus 4kg white clover/ha
- South of Sydney: 15kg plus 5kg white clover/ha

### Fertiliser

Use soil test results to determine the application rate for phosphorous and potassium fertiliser at sowing. Olsen phosphorus value should be above 25g/kg and Coldwell phosphorus above 100g/kg. If direct drilling, apply phosphorus with seed, preferably as diammonium phosphate which also provides nitrogen.

Apply additional nitrogen at 40-50kg/ha, three weeks after sowing if sowing follows a knockdown herbicide. This nitrogen is needed because soil nitrogen is used to breakdown decaying organic matter. If sowing into a prepared seed bed, apply nitrogen at the same rate after the first grazing

### Soils

For best results add lime if soil pH (in calcium chloride) is less than 5.3 or aluminium saturation is more than 10% of cation exchange capacity.

### Grazing

To let in light and promote tiller initiation, graze when seedlings have 3 leaves/tiller and when plants are well anchored (cannot be pulled out).

## GRAZING MANAGEMENT

### Vegetative stage (February to September)

The optimal grazing interval (days) is based on the time taken to grow three leaves/tiller (see diagram left). More frequent grazing prevents replenishment of soluble carbohydrate reserves used for regrowth after grazing.

Grazing intervals longer than 3 leaves/tiller lead to lower forage quality and less palatable swards.

The time taken to grow three leaves (leaf appearance interval) depends primarily on temperature. This can be estimated from the mean daily temperature using the following equation.

Grazing interval =

$$3\left[20-\left[\frac{0.55[\max Temp(^{\circ}C+\min Temp(^{\circ}C))]}{2}\right]\right]$$

For example, in Camden, NSW, July is the coldest month. The July maximum and minimum temperatures are 20ºC and 6ºC. Therefore grazing interval in the coldest month would be:

Grazing interval = $3\left[20-\left[\frac{0.55[20+6]}{2}\right]\right]$

Grazing interval = $3\left[20-\left[\frac{14.3}{2}\right]\right]$

Grazing interval = $3[20-7.15]$

Grazing interval = 38.5 days

However, it is probably only necessary to go to 2½ leaves in mid-winter giving a 32 day grazing interval.

The duration of grazing should not be more than two days. New regrowth shoots grow from stored carbohydrate reserves and if cows eat them, regrowth will be severely set back from stubble depleted of reserves.

Farm layout can be planned around the correct grazing interval and the fact that cows should not be left on an area for  more than two days. For example, the farm layout at Camden should aim to provide 16 by 2-day paddocks to give an effective grazing interval of 32 days, for winter grazing.

In mid-spring, particularly when high amounts of nitrogen fertiliser are applied, pastures may grow densely resulting in canopy closure by 2 leaves/tiller. If the canopy closes, growth slows as sunlight does not reach the young shoots at the base of the pasture. Therefore, spring grazing may need to be before 3 leaves/tiller (less than 18 days). Utilisation of pasture by stock tends to decline rapidly as pre-grazing pasture mass exceeds 2500kg DM/ha or when the canopy closes (grass falls over).

In late spring, the grazing interval may need to be reduced to manage leaf rust. Although this shorter grazing interval will reduce growth, it is better than losing plants or having grass that cows will not eat. Rust infestations increase when the grass canopy closes and/or when humidity is high. It is worse when the plant is stressed from lack of nitrogen or moisture.

## Reproductive stage (October to December)

Perennial ryegrass tillers can become reproductive from early September to late December, dependant on variety. The first sign that a tiller is becoming reproductive is the sequential development of up to five nodes along the true stem.

The upper-most node is the growing point. When the plant is in the vegetative state, this growing point is at ground level. It moves up as the tiller starts to set seed.

The tiller will die if it is cut or grazed below this upper-most node (growing point). However, the death of this tiller initiates new leafy tillers from the base due to sunlight reaching the base and from sugar reserves released from the reproductive tiller.  In practice, 'topping' (slashing or mulching to remove reproductive tillers) can maintain ryegrass pasture quality and will delay seed set for many weeks.

Even short season varieties can be induced to keep growing leaf by appropriate topping. However, maximum dry matter production in spring will be achieved by allowing stem growth and this is what happens when hay or silage is cut.

## Persistence

Persistence depends on the development of a good root system, which in turn relies on an appropriately long grazing interval to allow plant reserves to accumulate.

After grazing, root growth stops and many small roots die, as plant reserves are diverted to producing a new leaf. The roots do not start to regrow until ¾ of a new leaf/tiller has regrown and the plant's reserves start to be replenished. The more frequently a pasture is grazed, the longer root growth is suppressed, making it difficult for plants to survive stress periods such as hot, dry summers. This suppression of root growth is often reflected in an increase in 'sod pulling' by stock (plants not adequately anchored) particularly in Autumn and can reduce persistence,.

***The 2 ½-3 leaf grazing interval that optimises pasture growth and forage quality also maximises persistence.***

## ENDOPHYTES

Endophytes can improve persistence and plant production. Endophytes are fungi that live between the plant cells of many forage grasses. They live mostly near the base of the grass tiller, spreading upwards as the seed heads develop in reproductive tillers. Their presence within the plant is symptomless. Endophytes are symbiotic: plants benefit from the protection endophytes provide against invasion by various grubs.

For example, in NSW, endophytes improve establishment and persistence of ryegrass on the South Coast where African Black Beetle is a problem.

However, endophytes have been associated with livestock problems including ryegrass staggers, and 'ill thrift' which is characterised by production losses, reduction in appetite, liveweight gain and milk production.

Cultivars with the novel endophyte AR1® do not cause animal ill thrift. Where insect pressure is high, AR1® cultivars provide better persistence than nil endophyte lines of perennial ryegrass.

The AR5 endophyte is available in the perennial ryegrass variety, Extreme™. It is less likely to cause ill thrift in animals but improves plant persistence and production.

## FERTILISER MANAGEMENT

When pasture is actively growing, nitrogen should be applied at the equivalent of 40-50kg /ha after every second grazing, up to a maximum of six applications per year (ie max 300kg/ha/year).

This guideline is only relevant if grazing interval is based on grass growth/leaf number.

The nitrogen content of perennial ryegrass pasture depends on soil nitrogen availability and is adequate if plant nitrogen exceeds 3.5%. Pasture nitrogen content may be more than 5% if perennial ryegrass is heavily fertilised with nitrogen or in a mixture with white clover.

Perennial ryegrass can grow without nitrogen fertiliser if grown in a mixed sward with white clover. The yield contribution from clover needs to be above 40% for best ryegrass yields; and even then the yield will be lower than nitrogen-fertilised ryegrass.

Dairy cows need about 2.8% dietary nitrogen and excrete excess in urine. A high concentration of urea in cows' urine is toxic to plants (>800kg/nitrogen in a urine patch). Nitrogen-fertilised ryegrass can result in excessive protein intake and urine scorching of the pasture leaving bare patches where plants have died. In some cases this renders significant areas of paddocks unproductive. Urine scald patches and the smell of ammonia at milking indicate excessive nitrogen (protein) intake.

## NUTRIENT CONTENT

Table 1 shows the nutrient content and water use efficiency for perennial ryegrass. Potentially, ryegrass has enough metabolisable energy density for the production of about 27L milk/cow/day. In practice it is rare for more than 21L milk/cow/day to come directly from ryegrass consumed (ie without any extra milk coming from mobilising body reserves or supplements).

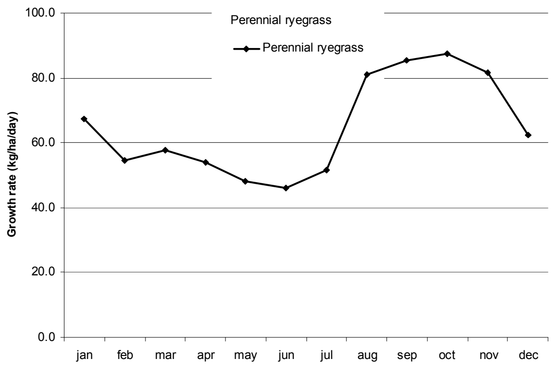
The protein content of ryegrass pasture, is often too high. In early regrowth potassium and nitrate can also be far too high. Magnesium content can be deficient and cause metabolic problems such as ryegrass staggers, particularly where potassium levels are also high.

**Table 1:** Nutrient content (%DM), metabolisable energy (MJ/kg DM) and water use efficiency (MJ metabolisable energy/mm water) of perennial ryegrass in its vegetative stage of growth in reference to cow requirements.

| Nutrient (%DM) | Perennial ryegrass (vegetative) | Cow requirements [b] |
|---|---|---|
| Metabolisable energy (MJ/kgDM) | 11.4 | 10.3 |
| Nitrogen | 3.9 | 2.4 |
| Non-protein N | 0.9 | |
| Nitrate N | 0.1 | 0.14[d] |
| Crude protein | 24.3 | 15 |
| Acid detergent fibre | 23 | 18[e] |
| Neutral detergent fibre | 49 | 45 |
| Water soluble carbohydrate | 7.8 | |
| Calcium | 0.53 | 0.51 |
| Phosphorus | 0.22 | 0.33 |
| Potassium | 2.2 | 0.9 |
| Magnesium | 0.28 | 0.2 |
| Sodium | | 0.18 |
| Chloride | 0.1 | |
| Sulphur | 0.43 | 0.2 |
| ERDP:FME (g/MJ)[a] | 17 | 10 |
| Water use efficiency [c] (MJ ME/mm water) | | |
| Winter | 360 | |
| Summer | 160 | |

*All figures in %DM except where otherwise stated*
*a – Rate of effective rumen degradable protein (ERDP) to fermentable metabolisable energy (FME)*
*b – Requirements for a 600kg Holstein-Friesian cow giving 20 litres milk/day*
*c – Includes all water – irrigation, rain and use of soil moisture*
*d – Maximum content*
*e – Minimum content*

**Figure 1:** Seasonal growth pattern of perennial ryegrass at Camden




## WATER USE EFFICIENCY

Data from Camden and elsewhere indicates that the water use efficiency of perennial ryegrass is similar to prairie grass, but better in winter and worse in summer than fescue (see Table 1).

## REFRENCES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## About FutureDairy

FutureDairy aims to help Australia's dairy farmers manage the challenges they are likely to face during the next 20 years. The challenges are expected to be related to the availability and cost of land, water and labour; and the associated lifestyle issues.

Our activities are structured around three priority areas – **Forages, Feeding and Innovations**. These are the areas where there are opportunities to address the challenges related to water, land and labour resources.

FutureDairy's approach is unique in that our work considers Science, Systems and People issues. In addition to conducting trials on research farms (**Science**), we explore how our findings work under commercial conditions on Partner Farms (**Systems**). We also use social research to help understand the social issues (eg labour, lifestyle and practical implications) involved in taking on new practices and technologies (**People**).

Our **Forages** work is all about producing more home grown feed from the same area of land. We are investigating the potential to concentrate resources (water, fertiliser and management). Our target is to produce more than 40t DM/ha/yr in a sustainable way. To achieve this we are trialling a 'complementary forage rotation' based on growing three crops a year:

- a bulk crop (eg maize);
- a legume for nitrogen fixation (eg clover); and
- a forage to provide a pest/disease break and to improve soil aeration (eg a brassica).

Our **Feeding** work is researching if it is more profitable to use extra bought-in feed to feed more cows (ie increase stock numbers) or to increase production per cow.

FutureDairy is investigating a number of **Innovations** that could improve farm efficiency, labour management and lifestyle. We have a major study on automatic milking systems (AMS), the obvious labour saving innovation. We are adapting automatic systems to be profitable and suitable for Australia's pasture-based, large herd situation.

We are also studying innovations that allow precision farming without increasing labour needs. Some examples include remote sensing of animal function and pasture status, and the use of video cameras to monitor paddock activities (eg calving) remotely via a computer.

### Contact us


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