



Strengths, Weaknesses, Opportunities and Threats for the use of perennial ryegrass on southern Australian dairy farms

Perennial ryegrass (*Lolium perenne*) pastures have been, and will continue to be, the mainstay of pasture-based dairy farming in southern Australia in the foreseeable future. The 3030 Project asked the question: “If the productive ceiling of perennial ryegrass has been reached what alternatives are available to lift home-grown forage consumption?”

The 3030 Project has explored forage alternatives but has also examined perennial ryegrass to gain a better understanding of why it is the cornerstone of pasture-based systems in southern Australia.

This information sheet analyses the key features of perennial ryegrass using a SWOT approach (Strengths, Weaknesses, Opportunities and Threats).



Strengths

- Perennial**—In most southern Australian dairy farming environments, perennial ryegrass pastures can remain productive for at least four years. This significantly lowers the cost of production and, in a dryland environment, permits growth with minimal intervention as soon as soil moisture allows. These factors were highlighted consistently in the financial performance of the RyegrassMax farmlet, a study that tested the optimisation of a 100% ryegrass dairy farm system in south west Victoria (see the Project 3030 Farmlet performance Phase 1 and Phase 2 Information Sheets for more details).
- Grows all year round**—If there is sufficient soil moisture, perennial ryegrass will grow at most times of the year in southern Australia. During the autumn break, for example, or when there are significant summer rains, an established perennial ryegrass sward can respond almost immediately.
- High nutritive value**—Well-managed perennial ryegrass provides high-quality feed of at least 11 megajoules (MJ) of estimated metabolisable energy (ME) per kg of dry matter (DM) for most of the year and rarely below 10 MJ / kg DM. Similarly, crude protein (CP) levels rarely drop below 18–20% DM, except under nutritional or water stress. Overall, perennial ryegrass has better nutritive value than most temperate pasture species.
- Minimal disease threat**—There are few diseases of perennial ryegrass that significantly affect its productivity or longevity. Ryegrass can be susceptible to fungal rust (*Puccinia coronata*, also known as crown rust). These types of diseases reduce ryegrass performance, but do not usually threaten plant survival.

- **Minimal pest threat**—There are only a few pests that can undermine perennial ryegrass performance in the Australian environment. The red headed cockchafer (*Adoryphorzs coufoni*) can affect the viability of ryegrass stands, particularly if pasture is not managed to develop and maintain a high volume of roots. In Tasmania, the corbies (*Oncopera intricata*) can have a major impact on perennial ryegrass performance. As with most plants, ryegrass seedlings are vulnerable to the likes of red legged earth mite (RLEM, *Halotydeus destructor*) and lucerne flea (*Sminthurus viridis*) during establishment. Although these pests can reduce ryegrass density or growth rates, they generally do not completely destroy the sward.
- **Ideal for grazing**—One of the standout features of perennial ryegrass is that it thrives under good grazing management. It is also more 'forgiving' of temporary changes in grazing practices (e.g. delayed grazing) than other perennial pasture species in terms of its impact on nutritive value.
- **Minimal animal health issues**—When sensible/recommended soil fertility and fertiliser programs are followed, there are few animal health issues associated with perennial ryegrass. Most can be managed with basic knowledge of ruminant nutrition.
- **Surpluses can be conserved**—As well as being ideally suited to grazing, perennial ryegrass can be conserved for high-quality silage.
- **Seedling vigour**—Compared with other perennial pastures ryegrass seedlings have excellent vigour and are relatively quick and easy to establish.
- **Broadleaf weed control**—Most broadleaf weeds are easily controlled using a selective broadleaf herbicide (e.g. MCPA, 2,4-D) with minimal impact on ryegrass growth rates.
- **Body of knowledge**—The farming community, researchers and service providers know a lot about perennial ryegrass management. A good example of how this body of knowledge was tested was the performance of the RyegrassMax Farmler at Terang in the 3030 project (see the Project 3030 Farmler performance Phase 1 and Phase 2 Information Sheets for more details). The project highlighted the potential of the perennial ryegrass system when sticking to the established best management practices (see the 'Perennial ryegrass management' Information Sheets in this series).

Weaknesses

- **Shallow roots**—Perennial ryegrass is relatively shallow rooted with almost 75% of the total root mass in the top 10 cm (see Figure 1). Perennial ryegrass is not able to access moisture at depth in the soil, for example where moisture has accumulated at depth over winter, where there are relatively shallow watertables or from irrigation. The shallow root system of perennial ryegrass has been linked to its poor persistence in summer-dry environments. The persistence of perennial ryegrass-based pasture and an alternate pasture based on deeper rooted perennial grasses (tall fescue, cocksfoot and phalaris) was compared in south west Victoria (Nie et al. 2004). After four years, the tiller density of perennial ryegrass declined by 55–62% from the establishment year while the deeper rooted alternate pasture mix was able to maintain its tiller density over this period.
- **Low temperature ceiling**—While perennial ryegrass performs well at low temperatures, it has a relatively low temperature ceiling compared to other perennial grasses. Beyond the ceiling, growth rates decrease significantly, causing plants to become dormant and possibly die. Slack et al. (2000) showed that a temperature increase from 18/13°C (day/night) to 24/19°C reduced regrowth in perennial ryegrass by 44%, compared with a 20% reduction in prairie grass.
- **Poor summer growth**—The combination of shallow roots and a relatively low temperature ceiling means that perennial ryegrass cannot consistently provide significant amounts of quality feed during the hot/dry summer months in southern Australia. Trials over three years in south-western Victoria on three sites with different soil types showed that the summer production of perennial ryegrass pastures was 1.3 tonnes DM/ha less than a summer active fescue-based pasture (Table 1).

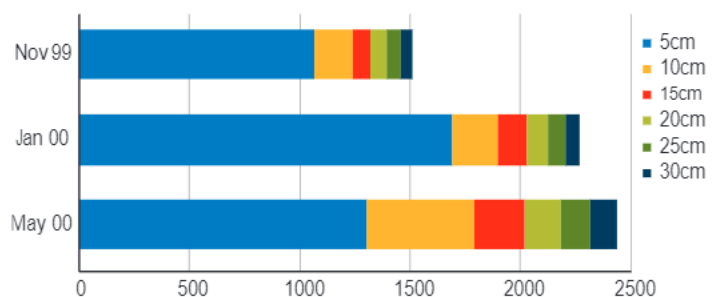


Figure 1. Perennial ryegrass root DM (mg/plant) with depth (5 cm sections to 30 cm) at Elliott Research Station in Tasmania in November 1999, January 2000 and May 2000 (D. Donaghy, pers comm).

Table 1. Seasonal production of different pasture species in south west Victoria (Tharmaraj et al., 2008).

	Autumn	Winter	Spring	Summer	Total
	(t DM/ha)				
Italian ryegrass-based pasture	2.5	3.7	4.1	2.1	12.5
Winter active fescue-based pasture	2.5	3.7	3.9	2.1	12.2
Summer active fescue-based pasture	2.7	2.8	4.4	3.9	13.8
Perennial ryegrass-based pasture (high N)	2.7	3.8	5.4	2.6	14.4
Perennial ryegrass-based pasture (low N)	2.5	3.6	4.5	2.6	13.2

- **Limited winter growth**—The winter production of perennial ryegrass has improved significantly in recent years with a better understanding of rotations, nitrogen use, post-grazing residuals plus more winter-active cultivars. However, growth rates are limited by temperature and sunlight hours. Short rotation ryegrass and winter cereals have a higher potential for winter growth than perennial ryegrass, yet the growth of perennial ryegrass through the winter period tends to be of excellent quality.
- **Limited ability to defer grazing or cutting**—Perennial ryegrass does not store well as a standing sward. There is limited ability to graze or cut a high-quality perennial ryegrass pasture once the ideal stage for grazing has passed.
- **Tolerance to waterlogging**—Although perennial ryegrass can tolerate short periods of waterlogging, if these conditions persist, the lack of oxygen in the root zone will reduce production, and, in extreme cases, cause plant death. A glasshouse study in Victoria by McFarlane et al. (2003) showed that after 14 days of waterlogging, the leaves and root growth of perennial ryegrass were affected. After 28 days, leaf and root mass had dropped 70% and photosynthesis had been reduced by up to 50%. Pugging can also severely reduce plant density.

Opportunities

Use of best management practices

Grow more

- **Rotation length**—Sticking to sound rotation management principles, predominantly grazing the pasture between the 2nd and 3rd leaf stage, can give outstanding perennial ryegrass growth (see the ‘Perennial ryegrass management 1. Grazing management to maximise growth and nutritive value’ Information Sheet).
- **Nitrogen**—The 3030 Project has tested and refined the best management practices to incorporate N into the farming system. These practices focused on applying urea immediately post-grazing or 2–4 days pre-grazing, at application rates of 20 to 50 kg N/ha. In the farmlet experiment at Terang, the aim was to apply about 1.0–1.5 kg N/ha/day during the growing season, totalling not more than 200 kg N/ha/year (see the ‘Use of N’ Information Sheets for details).
- **Autumn break management**—The 3030 Project’s on-farm studies showed the benefits of entering winter with sufficient pasture cover across the farm. This meant delaying the start of grazing until after the autumn break when the paddocks consistently reached at least 2,400 kg DM/ha. This supported the belief that “nothing grows grass like green grass”.
- **Maintenance of residuals over the dry summer months**—Preventing grazing residuals from falling below 1,400–1,500 kg DM/ha through summer and maintaining a higher average pasture cover will promote higher growth rates during the following autumn and winter.

Waste less

- **Residuals**—Post-grazing residuals of 1,400–1,500 kg DM/ha were targeted at every grazing in the 3030 Project work on the RyegrassMax farmlet.
This ensured that pastures were fully utilised at each grazing but, just as importantly, guaranteed pasture nutritive value and maximum regrowth for subsequent grazings.
- **Conserved surpluses**—Surpluses should be identified early and conserved mainly as high-quality silage as soon as weather conditions allow. The 3030 Project farmlet studies at Terang identified potential to improve pasture utilisation and silage nutritive value by focusing on refining the timing of the cut in relation to the last grazing and the time of canopy closure (see the ‘Closing paddocks for conservation’ Information sheet).

Maintain persistence

- Maintaining consistent residuals of 1,500 kg DM/ha and grazing between the 2nd and 3rd leaf stage encourages tillering and root development. This correlates with pasture persistency.

Threats

- **Persistence in dry conditions**—A combination of shallow-rootedness and a low temperature ceiling undermines the ability of perennial ryegrass to persist in hot, dry summer conditions (particularly on sandy and free-draining soils). This can be made worse by overgrazing during summer.
- **Pasture pests**—There are a few genuine perennial ryegrass pests that kill the plants or significantly reduce productivity. Of these, the red headed cockchafer has emerged as a significant threat to perennial and annual ryegrass pastures. There is no known chemical or biological control for red headed cockchafers once a pasture sward is established. Work is under way to determine how ryegrass pastures can better withstand cockchafers.
- **Grass weeds**—There are limited effective spray options for controlling grass weeds, such as barley grass (*Hordeum leporinum*) or winter grass (*Poa annua*), in a perennial ryegrass sward.

Perennial ryegrass SWOT Summary

Two key points can summarise the outcomes of the SWOT analysis undertaken:

1. **Perennial ryegrass Strengths and Opportunities are not completely exploited in most dairy systems of southern Australia.** Other forage alternatives should only be sought once the economic potential with perennial ryegrass has been reached, or where the Threats (mainly drought and pests) consistently limit its growth and persistency.
2. **Alternative species should provide:**
 - Additional grazeable feed when pasture is in limited supply.
 - A similar quality and at least the same total amount of feed as perennial ryegrass.
 - Fodder reserves that are cheaper or more reliable than perennial ryegrass.
 - Higher persistency than perennial ryegrass.

Use a paddock by paddock analysis to decide if ryegrass has reached the optimal economic yield for that situation. Use the SWOT approach to:

1. Define the Weakness to be addressed or the Threat to be avoided or minimised.
2. Choose the alternative to ryegrass that addresses the Weaknesses or Threats without giving away too many of the perennial ryegrass Strengths.

Two examples of this 'paddock by paddock' SWOT approach are given below:

Example 1

SITUATION: There is a section of the farm with subsoil moisture beyond the effective root zone of ryegrass (more than 1 m) during the summer months.

ALTERNATIVE: One alternative to overcome this weakness is tall fescue. While tall fescue needs to be managed appropriately, it offers the perennial grazing characteristics of ryegrass but has a deeper root system and a higher temperature ceiling. This allows it to grow moderate to high-quality feed during summer when pastures are generally in limited supply. However, the typically slow establishment of tall fescue means that the increased production will only be realised in the second year (see the 'Tall fescue' Information Sheet for details).

Example 2

SITUATION: The farm system demands more high-quality feed than perennial ryegrass can provide during winter, even when its growth rate been maximised.

ALTERNATIVE: Options such as annual ryegrass (see Figure 2), winter cereals or autumn-sown Brassicas would provide high-quality, grazeable feed during late autumn and winter. In this example, further consideration could be given to a double cropping system, incorporating a C₄ type grazeable crop (such as millet or forage sorghum, see the 'Millet and sorghum' Information Sheet for details) in case there was also a shortage of grazeable feed during summer. The C₄ grazeable crop could follow the annual ryegrass or winter cereal prior to an autumn sowing of perennial ryegrass.

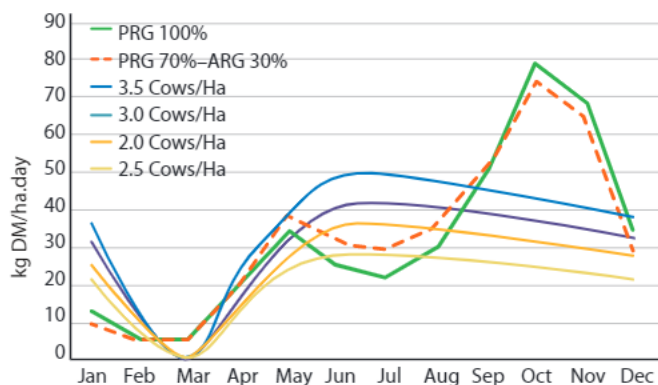


Figure 2. Supply of pasture with 100% of milking area on perennial ryegrass (PRG) or 70%–30% perennial ryegrass–annual ryegrass (ARG) for an autumn-calving (April) herd at different stocking rates.

References

McFarlane et al. (2003) The effects of waterlogging on growth, photosynthesis and biomass allocation in perennial ryegrass (*Lolium perenne* L.) genotypes with contrasting root development. *Journal of Agricultural Science* 141, 241–248.

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See also

Chapman et al. (2007) Milk-production potential of different sward types in a temperate southern Australian environment. *Grass and Forage Science* 63, 221–233.

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[3030 Project Milestone 8: Final Report \(2008\).](#)
[\[Relevant section: Complementary forage systems \(3030 farmlets performance\), pages 93–115\].](#)

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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