

Using short-rotation ryegrass to improve matching spring-pasture supply with cow feed demand

In the wetter and cooler summer districts of New Zealand, short-rotation ryegrasses can provide both production and environmental benefits to spring calving dairy farms.

A farm-scale trial was conducted to assess if including up to 30% of the milking platform in short-rotation ryegrass provided extra early-spring feed - a time of year when cow feed demand often exceeds pasture growth.

The trial also reported on key on-farm management challenges commonly faced when using short-rotation ryegrass.

Key findings

1. Showed the most potential when used as part of a pasture renewal programme to augment perennial rye grass in a spring calving farm system.
2. Provided greater spring and early summer pasture growth than perennial ryegrass (10kg DM/ha/d growth).
3. Showed that continuous grazing over spring for a two-week period can add another 0.1kg milk/cow/d for each extra full grazing day.
4. Had the greatest benefits when feed supply and demand are optimised (this may require moving calving date).
5. Reduced N leaching through increased plant Nitrogen uptake at a time of the year when there is a high risk of N leaching.
6. Required constant monitoring to achieve good pasture quality and plant longevity, due to the faster cool season growth, more erect growth habit and different flowering stage.

What is short-rotation rye grass and why use it?

Short-rotation ryegrasses are crosses between perennial and Italian ryegrass, producing hybrids with the leafiness, palatability, and winter growth of Italian ryegrasses, and the persistence inherited from perennial ryegrass. The New Zealand National Forage Variety Trials show short-rotation ryegrasses have greater cool season growth rates than perennial ryegrasses. This greater cool season activity means more Nitrogen is taken up by the plant over late-autumn, winter, and early-spring, reducing the risk of N leaching.

However, these hybrid ryegrasses do have some farm management drawbacks, including a short lifespan of 2-5 years and lack of persistency if overgrazed during a hot and dry summer and early-autumn.

Under dairy grazing systems do short-rotation ryegrass provide extra spring pasture growth?

The trial at Telford Dairy Farm in South Otago included short-rotation ryegrass as part of the farms pasture-renewal programme, and measured growth rates for three years. The short-rotation ryegrasses were planted in autumn following a summer forage-crop (whole-crop barley) using full tillage methods. Short-rotation ryegrass comprised up to 30% of the milking platform over three years.

Nitrogen fertiliser with total annual inputs ranging from 30-60kg N/ha was applied to paddocks both:

- Strategically - to boost new plant (tiller) development post-heading in late-spring and summer
- Tactically - during the early-spring and autumn to boost feed levels when needed

For three consecutive milking seasons, both the pasture and daily milk production from the short-rotation ryegrass and perennial ryegrass paddocks on the farm were measured and compared.

Results showed short-rotation ryegrasses provided more feed in spring, as was predicted (Table 1). The increase of 10kg DM/ha/d growth in spring translated into more grazing days/ha on the short-rotation ryegrass paddocks, but did not affect the milk production per cow (19.1 versus 19.2kg milk/d for short-rotation and perennial ryegrass pastures, respectively).

The lack of an effect on milk production was due to regularly inter-changing two pasture types, when

following the grazing plan. During spring there was, a slight upward trend in milk production when continuous grazing days of short-rotation ryegrass were achieved in any two-week period. This effect added another 0.1kg milk/cow/d for every extra full grazing day on short-rotation ryegrass.

Table 1: Pasture growth rates (kg DM/ha/d)

Season	Short-rotation ryegrass	Perennial pasture
Winter	6	7
Spring	47	37
Summer	37	39
Autumn	19	20

The use of short-rotation ryegrass in combination with carefully matching the spring pasture supply with calving date (24 Aug planned start of calving) resulted in no requirement for supplements for lactating cows in spring over the three consecutive milking seasons that were measured.

Why is matching spring-pasture supply and cow feed demand important?

On many dairy farms the pasture growth does not exceed cow requirements until late September (balance date) which, depending on stocking rates, would result in cows being underfed if fed only pasture during early lactation. Feeding supplements can be used to fill any shortfall in early-spring pasture supply. However, supplements can have a lower feeding-value than fresh spring-grown pasture (e.g. silage and baleage) and/or increase on farm costs.

Any prolonged underfeeding of dairy cows, particularly early in lactation, reduces milk production at the time of feed restriction and affects total season milk production. Poor nutrition in spring can also reduce the reproductive performance of the herd, adding additional costs from reproductive intervention, and even decreasing milk production for the following season as a result of later calving cows.

Does short-rotation ryegrass require any special management?

Short-rotation ryegrass requires more Nitrogen fertiliser

More N fertiliser was used on the short-rotation ryegrass

(about 60kg N/ha) than on the perennial pastures (about 30kg N/ha). The extra N was used in late spring to encourage the development of new tillers in the post-heading phase in an attempt to improve summer production and persistence.

This boosted summer production of the short-rotation ryegrass. Using the industry standard N response of 10kg DM/kg N, the extra N applied would equate to 3kg DM/ha/d grown by the short-rotation ryegrass in summer. The results in Table 1 show the strategic application of Nitrogen fertiliser was successful in maintaining summer production.

Timing of establishment affects short-rotation ryegrasses growth potential

The autumn and winter growth of newly established short-rotation ryegrass was affected by the establishment technique. Using full-tillage cultivation following the harvesting of a summer forage-crop led to relatively late autumn sowing and emergence dates of the short-rotation ryegrass paddocks (late-March and early-April).

This caused the pasture to be too immature for grazing before autumn rains saturated the soil, resulting in the pastures entering winter as recently germinated seedlings. In the final year of the trial, a change to under-sowing the whole-crop barley with the pasture-seed mix in spring created a pasture that was able to be grazed three times in autumn by the milking herd, which also reduced the grazing pressure placed on the rest of the milking platform.

Companion clovers are susceptible to shading by fast growing ryegrasses, particularly after autumn sowings when falling temperatures restrict clover growth more than grasses. Controlling pasture covers in autumn helped to allow the clovers to compete with the short-rotation ryegrass and improved their establishment success (Figure 1).



Figure 1: High quality short-rotation ryegrass pasture with good companion clover content and little dead matter in base of sward.

Ensure soil fertility does not limit short-rotation ryegrass growth potential

The low application rate of nitrogen fertiliser on the Telford dairy farm may have limited the high growth potential of the short-rotation ryegrass in autumn and winter. Especially as the summer forage-crop preceding the short rotation rye grass using up much of the plant-available Nitrogen in the soil and no additional fertiliser was applied in early-autumn.

Frequent pasture measurement is required over spring and early-summer

The higher potential growth rate of short-rotation ryegrasses in spring requires shorter grazing intervals to control pasture quality. If left to accumulate above 3000kg DM/ha (9cm compressed height), the feed quality declined and it was harder to get the cows to eat to the targeted post-grazing residuals of 1500kg DM/ha (4cm compressed height). This can lead to further pasture quality declines (Figure 2) or increased requirements for mechanical topping. More frequent defoliations over this period also ensure clovers receive adequate light, especially when sown with vigorous ryegrasses.



Larger break-fed paddocks also required back-fencing to ensure an even targeted post-grazing cover of 1500kg DM/ha was achieved across the entire paddock. This reduced the need for mechanical topping of the paddock.

Figure 2: High amount of dead matter and stem resulting from too infrequent or not hard enough grazing in spring.

Increase grazing interval and don't graze it as hard in dry summers and autumns

Having a more erect growth form than perennial ryegrass means short-rotation ryegrass usually has a higher proportion of plants (tillers) with growing points above grazing height and hard grazing (leaving <1500kg DM/ha or <4cm compressed height post-grazing covers). Dry summer and early-autumn conditions can severely reduce individual ryegrass plant (tiller) populations. Under these conditions infrequent (30 day spells) and laxer grazing (leaving 1800kg DM/ha or 5cm compressed height post-grazing covers) will prolong short-rotation ryegrass persistence (Figure 3).



Figure 3: Good post and pre grazing covers as measured with a rising-plate pasture meter.

Farmer management recommendations

- Carefully assess if the cool season growth advantages of short-rotation ryegrass outweigh the disadvantages of this ryegrass type - especially its typically short 2-5 year persistency.
- Short-rotation ryegrass performance is maximised in cooler summer-moist (or irrigated) regions under high soil fertility conditions.
- Selecting a cultivar with an appropriate endophyte for your region will help to increase its pasture persistence.
- Plant companion summer active clovers to compensate for any losses in summer production from the short-rotation ryegrass.
- Short-rotation ryegrass plants have a more erect growth habit with a less dense crown and fewer, larger tillers compared to perennial ryegrasses, making them more susceptible to over-grazing and excessive treading.
- To establish short-rotation ryegrass, consider either under-sowing it below a forage-crop, as part of a farm's cropping programme, or direct-drill it to minimise the time interval that a paddock is out of the grazing rotation. Under-sowing will also reduce establishment costs.
- Ensure short-rotation ryegrass is established early in autumn to get several grazings out of it before winter. This encourages the development of additional short-rotation ryegrass plants in the pasture sward through vegetative tillering, which ensures a dense pasture is formed going into winter and spring. It also prevents establishing clovers from being shaded out by the faster growing ryegrass.
- In regions where wet winter soils prevent early grazing of newly established pasture, spring sowing is a better alternative. This has the added advantage of clover establishing at a time of the year when it can more easily compete with companion grasses.

- Ensuring a dense short-rotation ryegrass pasture is formed by spring helps to prevent the pasture becoming less dense in other seasons, maximising its growth potential and stopping weeds proliferating.
- Graze from a maximum of 3000kg DM/ha down to 1500kg DM/ha in spring to maximise summer clover growth and reduce reproductive development, enabling the pasture's high feed value to be maintained. Owing to its high spring growth rate, the intervals between grazing for short-rotation ryegrass will be shorter than for perennial ryegrass.
- Apply low rates of Nitrogen fertiliser (approximately 20-40 kg N/ha) in late-spring/summer, after heading, to encourage plant tillering and maintain a dense pasture sward.
- Don't overgraze in summer and early-autumn to <1800kg DM/ha when soil moisture levels are low, as this places additional stress on individual short-rotation ryegrass plants, which can cause some to die. This reduces its growth potential and allows weeds to proliferate as the pasture becomes more open.

Table 2: Key target pasture covers for short-rotation ryegrass during the milking season.

Season	Max. grazing (kg DM/ha)	Min. post grazing (kg DM/ha)
Spring	3000	1500
Dry summer/ early autumn	3000	1800
Wet summer/ early autumn	3000	1600
Late autumn	2800	1400

Some additional short-rotation ryegrass paddock photos (reduced to 80% full size) that might be useful for illustrations.



At 2900kg DM/ha pasture cover this paddock needs to be grazed



Too long at 4000kg DM/ha pre-grazing pasture cover.



Good even post-grazing pasture cover achieved



Additional resources

Brougham, R.W. (1961). Some factors affecting the persistency of short-rotation ryegrass. *New Zealand Journal of Agricultural Research* 4: 5-6.

Peel, S., Ludemann, C. (2015). Forage Value Index: Handbook. DairyNZ Limited, Hamilton, New Zealand. <http://www.dairynz.co.nz/feed/pasture-renewal/select-pasture-species/about-fvi/>

NZPBRA (2016). New Zealand Plant Breeding and Research Association forage trial results. <http://www.nzpbra.org/forage-trials/results/>

Stewart, A., Kerr, G., Lissaman, W., Rowarth, J. (2014). Pasture and forage plants for New Zealand. Grassland Research and Practice Series No. 8. Forth edition. New Zealand Grassland Association, Dunedin, New Zealand.

DairyNZ Technical series 30 June 2016 Short rotation rye grasses

Acknowledgement

This research was funded by the Pastoral 21 programme, a collaborative venture between DairyNZ, Fonterra, Dairy Companies Association of New Zealand, Beef + Lamb NZ and the Ministry of Business, Innovation and Employment. The support of Telford Dairy Farm and AgResearch and DairyNZ research staff is also gratefully acknowledged.

