Farmlet research finds short-rotation ryegrasses can boost spring pasture production

David Stevens, Andrew Wall, and Ross Monaghan, AgResearch
Dawn Dalley, and Louise Gibson, DairyNZ

Key Findings

- Short-rotation ryegrasses have greater cool season growth potential than perennial ryegrass
- However, they have shorter lifespans and are less persistent
- Using short-rotation ryegrasses as part of a pasture renewal strategy can boost spring pasture production, decreasing reliance on supplements
- Researchers used shorter grazing intervals to maintain pasture quality

Short-rotation ryegrasses have potential to provide production to spring-calving dairy farm systems.

Italian ryegrass or short-rotation hybrid ryegrasses have a greater cool season growth potential\(^1,\,^2\) and have superior dry matter (DM) production over winter and early spring when compared with perennial ryegrass\(^3\). Some studies have also indicated that herbage may be of a higher feed value during winter and early spring\(^4,\,^5,\,^6\).

Short-rotation ryegrasses could help address low pasture growth rates in early spring, having been found to produce more DM and have a higher nutritive value than perennial ryegrass when grown in cooler temperatures under experimental conditions. The higher DM production observed could translate into increased pasture DM intake, with potential flow on benefits for total milk production. The greater cool season activity of short-rotation ryegrasses also allows these species to take up more plant-available nitrogen (N) in the soil over late-autumn, winter, and early-spring, when the risk of N leaching is greatest\(^7,\,^8\).
However, there has been little research done to test short-rotation ryegrass performance at farm-scale, where environmental and managerial conditions can prevent pasture species growing to their full potential\(^9, 10, 11\). Also, short-rotation ryegrasses do have some drawbacks including typically having a short lifespan (1-3 years) and persistency issues in dry summer conditions, especially if over grazed in summer. From the limited number of paddock/whole-farm system evaluations using short-rotation ryegrasses on seasonal dairy farms, the results have varied considerably\(^2, 12, 13\).

Based on this, the greatest benefit from short-rotation ryegrasses would likely be achieved as part of a pasture renewal programme, augmenting perennial ryegrass-based pastures to meet feed supply requirements of seasonal spring-calving dairy farm systems.

**Using short-rotation grasses as part of a pasture renewal programme**

We evaluated early-spring pasture supply and milk production of a seasonal calving dairy farmlet, where 20-30% of the milking platform was planted in short-rotation ryegrass as part of an annual pasture renewal programme.

For short-rotation ryegrasses to be complementary to the existing perennial ryegrass feed base, they need to consistently increase milk production or reduce costs to outweigh any risks associated with their use. This study evaluated the complementarity and integration of short-rotation ryegrass in pasture-based temperate dairy systems at the whole-farm level and highlighted management challenges.

The trial was conducted at the Telford Farm Training Institute, Balclutha, New Zealand (latitude 46.30oS, longitude 169.73oE, altitude 17 m a.s.l) from 2011 to 2015. The soils on the dairy farm were almost equally divided into two major soil groups: Tokomairiro deep silt loams (Fragic Perch-gley Pallic soil, NZ soil classification) on flat-to-rolling topography, and Puerua silt loams (Typic Orthic Gley soil) on flat topography, both soil types being artificially drained due to poor soil-water drainage. The soils received annual maintenance dressings of phosphatic-based fertiliser and lime, according to soil fertility tests and OVERSEER® nutrient budget modelling results. Soil pH, Olsen P, Quick test K and SO4-S values averaged 6.0, 36, 6, and 17, respectively. Existing pastures were predominantly perennial ryegrass cultivars Trojan and Bealey (NEA2 endophyte) and white clover cultivars Kotare and Weka. Annual rainfall, averaged over the last 10 years (2006-2015), was 678 mm and its distribution was relatively even throughout the year, with August being the driest month (36 mm) and October the wettest month (76 mm). The mean annual air temperature was 9.9°C, ranging from 14.1°C in January to 4.8°C in July.

A 39 hectare demonstration farmlet was established carrying 110 Kiwi-cross/Holstein Friesian cows (PW 136 and BW 90) over the milking season, peaking at 2.8 cows/ha during November. Planned start of calving was 24th August, with an aim to have all cows calving at BCS 5.0 or greater. Cows were dried off in April/May at a time that allowed for effective grazing area of the perennial ryegrass feed base, they need to fill any feed supply deficit. Integrating this crop into the farm system reduced the effective grazing area of the farm in spring, enabling greater control of spring pasture growth and thereby reducing the need for mechanical control (e.g. topping) or conserving pasture silage or baleage. The short-rotation ryegrass was used as a two-to-three year pasture option following the whole crop cereal silage. It was sown shortly after the whole crop cereal silage was harvested, using full tillage methods suitable for pasture establishment. First grazing occurred once the pasture sward had reached the third full leaf stage, could withstand attempts at being pulled out of the ground, and soil conditions were not excessively wet to prevent excessive pugging and poaching damage. Nitrogen fertiliser was applied to the farmlet paddocks both strategically, to boost tiller development in the late spring, and tactically, during the early spring and autumn to boost feed levels. Low rates were used with total annual inputs ranging from 30-60 kg N/ha.
The pasture and milk production from the short-rotation ryegrass were calculated and compared to results from the perennial pastures in the same farmlet (short rotation ryegrass effects isolated within the farmlet). Milk production (kg/d) was measured for each cow each day. This data was used to test differences between pasture types grazed in the previous grazing. Spline fitting and the use of covariate analysis enabled a test for the effects of recent grazing history to see if an increase in number of short rotation ryegrass grazing events increased milk production, once all other effects were accounted for, such as year, week of lactation and amount of pasture available.

**More grass grown**

Short-rotation ryegrasses provided more feed in spring, as was predicted (Table 1). This increase of 10 kg DM/ha/d translated into more grazing days/ha, as reflected in the grazing record and the lack of supplement fed, but not significantly different milk production per cow (19.1 compared with 19.2 kg milk/d for short rotation and perennial ryegrass pastures respectively). This may have been due to the pasture allocation/grazing management processes, with frequent switching of grazing between the two pasture types. This suppression of trait expression has also been found by other researchers, as fitting the cultivar into the grazing system overrides the cultivar potential.

Some additional analyses have, however, indicated an upward trend in milk production when more continuous grazing days of short-rotation ryegrass were able to be achieved in any two week period. This effect added another 0.103 kg milk/d for every extra full grazing days (P=0.001). This indicates that a greater proportion of the farm should be sown in short-rotation grasses in order for their traits to be more fully expressed on-farm and to allow the cows to adjust to the different feed type. A balance between perennial and short rotation ryegrasses will be best. Often farmers use very small amounts of short rotation ryegrass and so management of those pastures to capture their benefits is much harder. Issues such as nitrate poisoning were never seen, potentially due to the low N use and the regularity of the short rotation ryegrass in the diet.

### Table 1. Net pasture growth rates (kg DM/ha/d)

<table>
<thead>
<tr>
<th>Season</th>
<th>Short-rotation ryegrass</th>
<th>Perennial pasture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Spring</td>
<td>47</td>
<td>37</td>
</tr>
<tr>
<td>Summer</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>Autumn</td>
<td>19</td>
<td>20</td>
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Managing short-rotation ryegrasses

The pasture growth of the short rotation ryegrasses was significantly greater in spring. However, more N fertiliser was used on the short-rotation ryegrass (approximately 60 kg N/ha) than on the perennial pastures (approximately 30 kg 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 then would have boosted summer production of the short rotation ryegrass. Using the industry standard N response of 10kg DM/kg N then the extra N applied would equate to 3 kg DM/ha/d grown by the short rotation ryegrass in summer which may explain why there was no difference between the perennial and the short rotation ryegrass in summer, when lower production would be expected.

Winter growth of the short-rotation ryegrass appeared to be affected by the establishment technique. The planned approach of sowing after harvesting the whole cereal crop led to relatively late sowing and emergence dates (late March and early April). This meant pasture was still 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 study, a change to under-sowing the whole crop cereal with the pasture mix in spring created a pasture that provided two grazings in autumn, increasing total DM production of the short-rotation ryegrass. This tactic is also likely to improve pasture production in the first winter.

Due to the higher potential growth rate of short-rotation ryegrasses in spring, shorter grazing intervals were needed to prevent the rapid development of seedhead as pasture cover increased above approximately 2600 in spring. We found that, if left to accumulate above 3000 kg DM/ha, the feed quality declined and the targeted post-grazing residuals of 1500 kg DM/ha were harder to achieve. This can lead to further pasture quality declines, or increased requirements for topping.

**Conclusion: Short-rotation ryegrasses a potential tool to improve spring pasture production**

The principle of implementing technologies which better align a high quality pasture-based feed supply with the demand of the cow was demonstrated using short rotation ryegrasses at a farmlet scale.

At commercial scale, with good on-farm management to ensure that potential growth is maximised in the cooler seasons, short-rotation ryegrasses offer a pasture renewal opportunity to kick-start the milking season through better matching of pasture growth with feed demand.
References


3. www.nzpbra.org (accessed 18th March 2016)


