Establishment Techniques to Increase the Production of Italian Ryegrass (*Lolium multiflorum*) Over-Sown into an Irrigated Kikuyu (*Pennisetum clandestinum*) Pasture

Joseph C. FitzGerald
The University of Queensland, Australia

Mark N. Callow
The University of Queensland, Australia

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Establishment techniques to increase the production of Italian ryegrass (*Lolium multiflorum*) over-sown into an irrigated kikuyu (*Pennisetum clandestinum*) pasture

Joseph C FitzGerald and Mark N Callow

Agri-Science Queensland, DAFFQ, University of Queensland Gatton Campus, LAWES QLD 4343 Australia
Contact email: mark.callow@dpi.qld.gov.au

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Introduction

Irrigated mixed pastures of kikuyu (*Pennisetum clandestinum*) over-sown with Italian ryegrass (*Lolium multiflorum)* in the cool-season (May-October) can produce large amounts of biomass in a sub-tropical environment (Botha *et al*. 2008). However, appropriate pasture management practices are required to suppress the aggressive growth of kikuyu prior to autumn, in order to facilitate establishment of ryegrass seedlings.

The present study evaluated ryegrass establishment techniques on the dry matter (DM) production, botanical composition and forage quality of a mixed sward containing kikuyu.

Methods

A replicated plot experiment was conducted at Gatton in south-east Queensland, Australia (152.35°E, 27.55°S, 94 m a.s.l.) on an established kikuyu pasture historically grazed by dairy cattle. Twelve treatments were laid out in a complete factorial design with 3 replicates. Treatments included 2 ryegrasses of different maturity (medium and late), 3 ryegrass plant densities (0, 500 and 1200 plants/m^2) and 2 pre-planting herbicide strategies (nil and glyphosate (36 % a.i) at.0.7 L/ha). The first experiment, sown in 2011, was repeated in 2012.

One month prior to planting all plots were mown to approximately 2 cm above ground level and again at planting on 14 April 2011 and 13 April 2012. Immediately afterwards, seed was broadcast by hand and irrigated with above-ground sprinklers to initiate germination. To simulate grazing, plots were mechanically harvested to a residual height of 5 cm each time ryegrass tillers had 2.5-3 leaves. In total, plots were harvested 7 times within each year. Prior to defoliation, botanical composition was determined by sorting a biomass subsample into ryegrass and kikuyu components. Cumulative ryegrass yields were calculated for both years, commencing from the first defoliation in June through to plant senescence in December 2011, and similarly from May to November in 2012. Harvested material in 2011 was analysed to determine the forage quality parameters, neutral detergent fibre (NDF) content and dry matter digestibility (DMD). All results were analysed by performing ANOVAs (GenStat 11th Edition).

Results

Dry matter yield

In 2011, ryegrass yield was significantly higher (P<0.05) in swards planted at 1200 plants/m^2, yielding 6.3 t DM/ha, compared to swards planted at 500 plants/m^2 (4.6 t DM/ha) (Fig. 1a). There was no significant difference (P>0.05) in total sward yield between treatments, due to compensatory growth of kikuyu. In 2011 glyphosate application showed no difference between treatments. However, in 2012 total sward and ryegrass cumulative yields were affected by the interaction of planting density and glyphosate application (Fig. 1b). Here, swards planted at 1200 plants/m^2 with no glyphosate yielded significantly higher (P<0.05) total sward yields (14.3 t DM/ha) than the remaining treatments, although swards sprayed with glyphosate recorded the highest ryegrass yield (12.9 t DM/ha) (P<0.05). Ryegrass maturity in both years had no significant effect on DM yield or sward composition, therefore, data is not shown.

When individual harvests were measured in October 2011, total sward yields of treatments over-sown with ryegrass were significantly higher than treatments not over-sown (Fig. 1a). Ryegrass yields at this time were significantly (P<0.05) greater at the highest plant density (2.7 t DM/ha). In October 2012, total sward yields were also greatest in treatments over-sown with ryegrass. However, unsprayed plots with 500 plants/m^2 had significantly (P<0.05) lower total sward yields (Fig. 1b).

Botanical composition

Botanical composition was greatly influenced by season in both years, with kikuyu dominating in the warm season and ryegrass in the cool season. The proportion of ryegrass herbage was highest in October in both years. In 2011 ryegrass comprised 55% and 75% of the harvested herbage at planting densities of 500 and 1200 plants/m^2, respectively, regardless of glyphosate application. In October 2012 swards sprayed with glyphosate and planted at 1200 plants/m^2 had the highest proportion of ryegrass (98%), compared to 87% for unsprayed swards planted at 500 plants/m^2.

Forage quality

All ryegrass treatments had higher quality over kikuyu

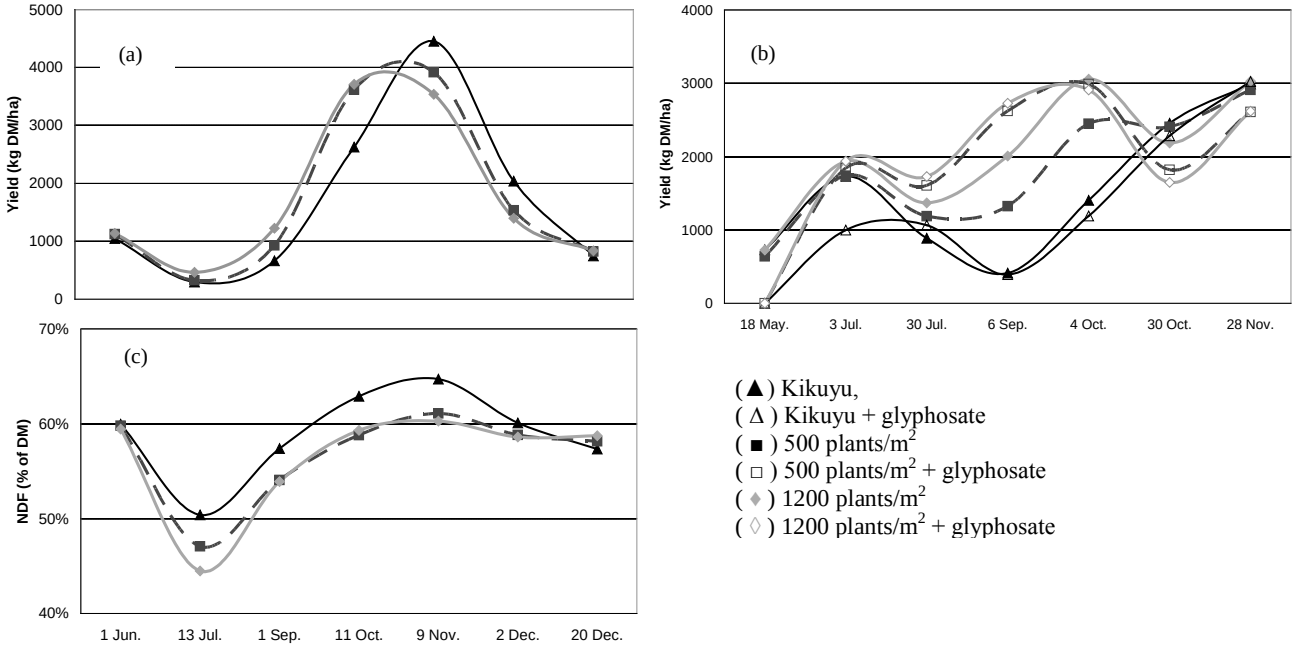

Figure 1. Total sward yields in: (a) 2011 and (b) 2012; and (c) neutral detergent fibre levels in 2011.

alone during the cool season. Ryegrass decreased NDF content and increased DMD. Minimum NDF content was 45 % in July (Fig. 1c), which coincided with the highest DMD of 89%.

Discussion

This study showed that the proportions of kikuyu and ryegrass significantly affect pasture quality and yield. Botha *et al.* (2008) reported similar results in South Africa, although pasture quality reached an upper level in their study where no further improvements were measured, even though ryegrass proportion increased. As the cool season progressed, the increased maturity of kikuyu and ryegrass plants had a greater influence on pasture quality than the proportion of ryegrass. Further quality data collected from the 2012 experiment is being analysed to further test this finding.

The effect of over-sowing on total sward yield varied between years, with DM production in 2012 being 15% more than 2011. This is most likely attributable to periodic moisture stress in 2011. Over-sowing annual ryegrass in 2011 increased pasture quality throughout the cool-season, without substantially affecting total sward yield, while in 2012, over-sowing increased total sward yield, due to the greater ryegrass yield in the cool season. Such increased ryegrass yields would increase DM intake and, thereby improve milk production.

The most effective over-sowing strategy to increase ryegrass proportion was a high planting rate. Increasing the plant density increased the proportion and yield of ryegrass by 13 % and 1.7 t DM/ha, respectively, in 2011 and by 19 % and 1.3 t DM/ha, respectively, in 2012. Increased DM intake and milk production would potentially offset the increased seeding costs incurred. Spraying with glyphosate was effective in 2012 only, suggesting that the rate of plant growth prior to spraying affected efficacy of the herbicide.

Conclusion

Over-sowing ryegrass into an established kikuyu sward with a target plant population of more than double the current industry standard increased ryegrass DM yield and the proportion of ryegrass in the sward. A pre-planting application of glyphosate can potentially increase the proportion of ryegrass grown. However, further investigation is required to understand the factors that affect its efficacy on kikuyu.

References

Botha PR, Meeske R, Snyman HA (2008) Kikuyu over-sown with ryegrass and clover: dry matter production, botanical composition and nutritional value. *African Journal of Range and Forage Science* **25**, 93-101.