Investigating the impact of cover cropping on a native pasture system in southern Queensland

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Abstract: *Initial data showed that cover cropping with barley increased (P <0.05) peak standing dry matter in a summer-active native perennial grass-based pasture, which had high ground cover, despite little rain and low soil moisture. Ground cover (%) increased (P <0.05) under cover cropping with the addition of nitrogen, particularly where initial ground cover values were low. Further measurements of stored soil water, total herbage mass and ground cover over the 2011 season will enhance our understanding of the potential for cover cropping in south-east Queensland cropping belt.*

Key words: pasture cropping, ground cover, dry matter

Introduction

Growing cereals in northern New South Wales and south-east Queensland generally involves annual winter cropping preceded by a period of fallow (Hayman and Alston 1999; Marley and Littler 1989). The soils cropped in these areas are clays with a relatively high water-holding capacity and are often associated with brigalow (*Acacia harpophylla*) vegetation (Freebairn *et al.* 2009). Soil fertility in the region has decreased due to a reduction in the levels of soil organic carbon and total nitrogen (N) as a direct result of soil erosion and continuous cropping (Marcellos and Felton 1992). Cover cropping (i.e. direct drilling a winter annual cereal crop into a living native perennial grass-based pasture exploiting the differential growth patterns of the crop and the pasture while minimising damage to the pasture itself), which has been gaining popularity and interest among farmers throughout eastern Australia (Waters *et al.* 2008), may be a way of confronting the shortfalls for annual cropping and fallows by producing more biomass and providing year-round ground cover, intercepting more light for photosynthesis and providing less opportunity for weed germination and soil erosion (Bruce and Seis 2005). To explore the potential of cover cropping in south-east Queensland we investigated the impact of cover cropping on total plant dry matter of a native pasture system.

Methods

An experimental site was established on a summer-active native perennial grass-based pasture (dominated by *Bothriochloa macra* and *Dicanthium sericeum*) at "Biribindibil" (28° 24'42" S, 140° 50'1"E), Toobeah, about 50 km west of Goondiwindi, Queensland in 2009. The site consisted of two side-by-side paddocks, one with low ground cover (<40%) and the other with high ground cover (>70%). Four replicates of four treatments were randomly allocated to plots (4 x 20 m) in each paddock. Treatments (native pasture, tilled native pasture, native pasture cover cropped with barley (*Hordeum vulgare* cv. Grout) and native pasture cover cropped with barley plus N), commenced on 24 June 2009. Nitrogen (50 kg N/ha) was applied as urea by surface spreading at the time of planting, targeting both crop and pasture in the native pasture cover cropped with barley+N treatment. A custom-built tilco tyne planter with press wheels was used for sowing the barley using four tynes on a 25 cm row-spacing. The tilled native pasture treatment was applied by using two passes of the planter without press wheels. Peak standing dry matter (kg DM/ha) was assessed by harvesting total (native pasture+barley) plant dry matter from a single quadrat [1 x 1 m] per plot on 30 March 2010. Treatments were not grazed by livestock, but native animals were not excluded.

Results and discussion

In the first season of the study, rainfall was below average and stored soil moisture was low

(<200 mm) resulting in a poor stand of barley. However, total plant dry matter was significantly greater (P <0.05) for treatments in the high ground cover paddock compared with low ground cover paddock (Table 1). For treatments in the high cover paddock, sowing barley or sowing plus added N significantly increased (P <0.05) total plant dry matter by 56% compared with native pasture alone (Table 1). While the tilled native pasture had indications of more dry matter compared with the native pasture for both low and high ground cover situations, the differences were not statistically significant.

Cover cropping with barley plus the addition of N almost doubled ground cover (from 50 to 80%) when compared with the other treatments (Table 1). With low rainfall, soil moisture was limited and so the barley crops did not progress through to the harvestable grain stage. Where ground cover was already high (>70%), the benefit of additional herbage mass generated by cover cropping was minimal, particularly considering the expense associated with generating the higher herbage mass.

In winter, the summer-active native perennial grasses were frosted or dormant, reducing the amount of ground cover in both the high and low ground cover paddocks. Summer-active species respond to seasonal rains in spring and summer, increasing ground cover. The addition of N not only improved growth of the sown barley, but appeared to bolster growth of the native species. To determine the exact role of barley in the ground cover response would require the inclusion of another treatment of native pasture with N applied.

Measurements of stored soil water, total herbage mass (using a higher sample number within each plot) and ground cover over the 2011 season will further our understanding of the potential for cover cropping in the south-east Queensland cropping belt.

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Table 1. Total plant dry matter (kg DM/ha) on 30 March 2010 and ground cover (%) on 7 October 2010 at "Biribindibil". Values followed by the same letter in each column are not significantly different (*P* >0.05).

Treatment	Pasture	Dry matter (kg DM/ha)	Ground cover (%)
Native pasture	Lower cover	1820c	50bc
Tilled native pasture		1890c	40c
Native pasture cover cropped with barley		1910c	40c
Native pasture cover cropped with barley+50 kg N/ha		2160c	80a
Native pasture	Higher cover	2340bc	60b
Tilled native pasture		3020ab	50bc
Native pasture cover cropped with barley		3550a	40bc
Native pasture cover cropped with barley+50 kg N/ha		3290a	80a