GRAIN AND GRAZE: PASTURE CROPPING SUB PROGRAMME

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Key Messages

- **Pasture cropping is a relatively new system combining livestock and crop production on the one area of land**
- **Production of crop and pasture individually can be lower when grown together in a pasture cropping system compared with when either is grown alone, however the overall annual production can be higher.**
- **Pasture cropping systems can be managed so that annual winter crops have no direct competition from pastures while the crop is growing**
- **Pasture cropping can improve year-round resource use increasing overall annual productivity compared with conventional annual cropping or pasture systems**
- **Pasture cropping will be most effective in soil types that do not store soil moisture well and have some summer rain.**

Project Background

Traditional mixed farming systems consist of crop - pasture rotations that are often inflexible due to a set sequence of crops and the annual need to establish pastures, which risk failure. Increasingly there has been a spatial segregation of livestock and cropping due to perceived negative impacts of grazing on the soil structure of cropping paddocks. However, perennial pastures can sustain profitable grazing and have many environmental benefits including, greater resource use efficiency (reduced Nitrogen (N) leaching or deep drainage). Increasing the proportion of perennial pasture across the landscape can improve environmental outcomes while maintaining or improving profitability given the appropriate management systems. Pasture cropping is a relatively new system combining livestock and crop production on the one area of land, which to-date has had little scientific research.

Pasture cropping is an innovative farming system where cereal crops are sown directly into perennial pastures. Generally, the crops are sown into summer growing native perennial pastures, such as red grass (*Bothriochloa macra*), after the first frost in autumn when these species become dormant. This is done to utilise the discrete growth phases between the annual crop and the perennial grasses (Figure 1). Delaying sowing or a selective herbicide like paraquate/diaquate can reduce competition at the beginning of the cropping phase when these species are grown together. Also, shading from the crop delays the growth of the summer growing perennial grasses until the crop senesces and the canopy opens. Therefore the system can be managed to have no direct competition while the crop is growing. However, perennial grasses growing through summer will prevent the accumulation of nutrients and waters, which can reduce crop performance.

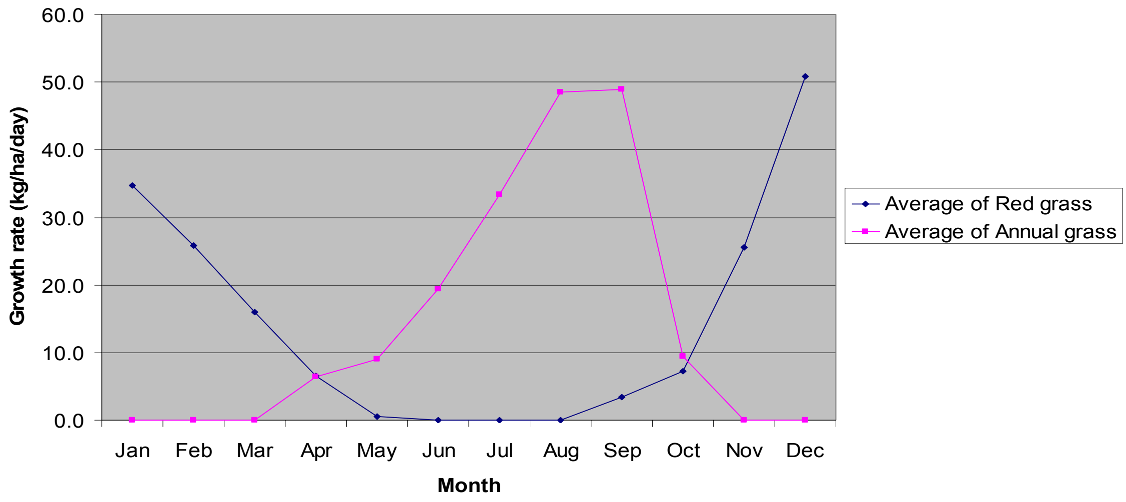

Figure 1. Average growth rates for Wellington from 1998 to 2004 (SGS Pasture Model)
Pasture cropping can improve year-round resource use increasing overall annual productivity compared with conventional annual cropping or pasture alone (Howden *et al. 2005)*. Improved profitability is determined by efficiently utilising additional forage to compensate for reduced crop yield that can occur. In addition, costs are limited as fallowing is not required and fertiliser input can be matched to available soil moisture at sowing. However, removing fallowing is expected to increase variation in crop performance due to less stored moisture (Howden *et al*. 2005), but this may not necessarily increase the riskiness of the system due to potential to use low performing crops for high quality grazing during dry periods. Pasture cropping will be most effective in soil types that do not store soil moisture well and have some summer rain.

Experiments

This research project has two major experiments based at the NSW Department Natural Resources (DNR) Wellington Research Station. The aim of the two experiments is to:

1. Determine the success of Pasture Cropping for different starting pasture compositions and crop sequences (i.e. the difference between cropping year-after-year compared to doing it once) in comparison to No Till cropping and pasture treatments. Success will be assessed by the profitability of the crop, the grazing value of the pasture, perennial grass recruitment and resource condition.

2. Determine the effect of fertiliser level and in-crop weed control on the production, profitability and resource use of a pasture cropping system. Pasture cropping is perceived as a low input system and this experiment will help determine what effect the level of input has on crop and pasture components.

In conjunction with the main research site there are demonstration sites at Trangie and Condobolin that are examining the system in lower rainfall environments. In 2007 a new site will be monitored at Lake Cowal to further test the system in a more winter dominant rainfall area.

Preliminary Results

At Wellington there was very little difference in crop yields between pasture cropping and no till treatments in 2005 in a degraded lucerne (DL) paddock, but in a high perennial native (HP) paddock there was a higher yield in the no till treatment (Table 1). The variation in crop yield in the HP paddock was determined by available N (pasture cropped treatments only received 50 kg/ha of DAP in that year), with a strong relationship between N in the top 10 cm of the soil plus N added in fertiliser and crop yields (R2 = 0.95). There was no summer fallowing in the no till treatment as the experiment only began in April, and this could have influenced results.

Crop production was very low in 2006 due to extremely low rainfall and crops were not harvested. Only 260 mm of rain was recorded for the year of which only 78mm fell in the crop growing season. Crop biomass was recorded from cuts as a surrogate measure to grain yield (Table 1). There was substantially more biomass produced in the no till crops due to a more stored moisture from summer fallowing.

Table 1. Grain yields (2005) and crop biomass (2006) measured in no till and pasture cropping treatments in both a high density native perennial (HP) and a degraded lucerne (DL) pasture at Wellington.

Paddock	Treatment	2005 – Grain t/ha (SE)[1]	2006 – Crop biomass t/ha (SE)[2]
HP	No till	1.7 ± 0.07	1.6 ± 0.13
	Pasture crop	1.2 ± 0.06	0.7 ± 0.03
DL	No till	2.3 ± 0.06	0.8 ± 0.08
	Pasture crop	2.1 ± 0.09	0.3 ± 0.04

[1] Pasture cropped treatments were sown with 50 kg/ha of DAP and No till with 100 kg/ha

[2] Both treatments were sown with 100 kg/ha of DAP

The production of C4 native perennial grasses, the dominant perennial grasses in a HP paddock, was reduced by 19% in November 2005 (596 kg/ha), 9% in February 2006 (1030 kg/ha) and 19% in May 2006 (728 kg/ha) in the pasture cropping treatment compared to pasture alone. Therefore producing a crop through winter only marginally decreased perennial grass production the following summer and autumn. In a degraded lucerne paddock, pasture cropping stimulated additional lucerne growth from 147 kg/ha to 452 kg/ha in November 2005, but returned to a similar production level as pasture alone after grazing.

Conclusions

Production of crop and pasture individually can be lower when grown together in a pasture cropping system compared with when either is grown alone, although this depends on pasture composition, season and paddock history. There was a synergistic affect of pasture cropping on lucerne production and the overall annual production can be higher.

References

Howden SM, Seis C, Bruce SE, Gaydon D (2005) Can pasture cropping help the management of climate risk? In 'The Fourth National Native Grasses Conference'. Burra, South Australia.

Funding

The trial is funded by the Central West/Lachlan Grain & Graze program. Grain & Graze is a national program investigating 'mixed farming systems' and is a collaborative partnership between the Grains Research and Development Corporation (GRDC), Meat and Livestock Australia (MLA), Australian Wool Innovation Limited (AWI) and Land & Water Australia. The Central West/Lachlan is one of nine regions across the traditional sheep/wheat zones of southern Australia. For more visit the website at www.grainandgraze.com.au

This research is being conducted by NSW Department of Primary Industries.

CWFS is a regional partner of the Central West/Lachlan Grain & Graze program.

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