Native Pasture Cropping

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Take home messages

- **native pastures can provide valuable forage for stock**
- **barley can be sown into native pasture and taken through to harvest**
- **native pasture cropping can be managed as a viable mixed farming system in the Wimmera and Mallee**

Background

Native grass pastures have a range of production, economic and environmental benefits. Native pastures can improve soil health because they maintain 100% ground cover throughout the year, provide high levels of soil organic carbon and improve soil structure and nutrient availability.

Pasture cropping is a zero-till technique involving the sowing of winter cereal crops into summer-growing perennial pastures. As a farming system, native pasture cropping can improve farm economic performance through reduced input costs for cropping, increased fodder after harvest for summer grazing and reduced annual weed problems. Crop stubble and the regenerating native pasture can be rotation grazed. In addition, the establishment of native grasses on farms in the Wimmera and Mallee will provide clear biodiversity benefits and has the potential to increase the resilience of farming across the region.

Aim

The Native Pastures Project aims to develop a regionally viable farming system which incorporates the establishment of native perennial pastures, cropping into native pasture and rotational grazing of the pasture and stubble. The project demonstrates the potential for native pasture farming systems in the Wimmera/Mallee region to provide clear pastoral, cropping and environmental benefits.

The 2011 trial aimed to test the performance of barley sown into established native pasture in two different soil types in the Wimmera and Mallee regions.

In 2010, BCG demonstrated the potential of native pasture cropping in the Wimmera and Mallee by sowing wheat into native pasture in a replicated plot trial. The trial results found no significant differences in crop yield or quality between the native pasture plots and the control (no pasture) plots on a Wimmera clay soil. On a Mallee sandy soil, the results showed significantly lower yields but no significant difference in grain quality (*BCG 2010 Season Research Results*). However, these results were offset by the performance of the native pasture as summer fodder which, over summer 200/2010, yielded dry matter returns of up to 1.4 tonnes per hectare.

Method

The trial tested sowing a barlely crop into summer-active native pasture at two sites in the Wimmera/Mallee. The two treatments tested were pasture cropping (sowing Gairdner Barley into summer-active native pasture) and conventional cropping (sowing Gairdner Barley into bare soil.) The latter treatment acted as a control.

Trial plots at each site were six metres wide and 28 metres long. Native pasture was established at each site in October 2009. Dry matter cuts of the native pasture were taken at Hopetoun on 3 February 2011 and Kewell on 10 February 2011 to measure pasture forage potential. The native pasture plots were slashed prior to sowing of the cereal crop.

Cereal dry matter cuts at GS32 were taken at Hopetoun on 7 September 2011 and at Kewell on 24 August 2011 to measure crop growth performance. Grain yield and quality were measured at harvest. Gross margin figures were calculated using input costs at time of use and grain prices at time of harvest. Pasture value was calculated as pasture energy equivalent of oats ($/ha) based on an average of 55% digestability of native grass species.

Site 1, on a sandy soil type in the southern Mallee, is situated 12km east of Hopetoun. Mean annual rainfall is 311mm, of which 192mm (62%) falls during the growing season.

Location:	Hopetoun
Replicates:	4
Sowing date:	1 June 2011
Seeding density:	423g/plot
Crop type/s:	Gairdner Barley
Native pasture:	Red Grass *Bothriochloa macra*, Spider Grass *Chloris truncata*, Cotton Panic *Digitaria brownii.* Sowing rate: 9kg/ha, each species. Sowing date: 16 October 2009.
Inputs/Fertiliser:	MAP, 50kg/ha, at crop sowing
Seeding equipment:	Avon seeder, knife point, press wheel, 30 cm row spacing.

Table 1. Native pasture cropping inputs and applications at the Hopetoun trial site in 2011.

Application	Description/product	Method/timing	Rate
Herbicide	Buctril MA	Bulk Boom 3, February 2011	1.4L/ha
Sowing of crop	Gairdner Barley	Avon seeder, 1 June 2011	72.0kg/ha
Pre-emergent herbicide	TriflurX, Roundup P/Max	Bike boom 1, June 2011	1.5L/ha 1.5L/ha
Fertiliser	MAP	At sowing, 1 June 2011	50kg/ha
Fertiliser	Sulphate of Ammonia	Hand spreader, 15 August 2011	160kg/ha
Herbicide	Tilt	Bulk boom, 21 September 2011	500ml/ha

Site 2, on a grey clay to red clay loam soil in the Wimmera, is situated at Kewell, 11km north of Longerenong, Vic. Mean annual rainfall is 414mm, of which 285 (69%) falls during the growing season.

Location:	Kewell
Replicates:	3
Sowing date:	10 June 2011
Seeding density:	423g/plot
Crop type/s:	Gairdner Barley
Native pasture:	Red Grass *Bothriochloa macra*, Tall Windmill Grass *Enterapogon acicularis*, Silky Blue Grass *Dichanthium sericeum* Sowing rate: 9kg/ha, each species. Sowing date: 15 October 2009.
Inputs/Fertiliser:	MAP, 50kg/ha, at crop sowing
Seeding equipment:	Avon seeder, knife point, press wheel, 30 cm row spacing.

Table 2. Native pasture cropping inputs and applications at the Kewell trial site in 2011.

Application	Description/product	Method/timing	Rate
Herbicide	Goal Ester 680 Roundup P/Max Buctril MA (pasture only)	Bulk boom 25 February 2011	350ml/ha 2L/ha 14.L/ha 75ml/ha
Sowing of crop	Gairdner Barley	Avon seeder, 10 June 2011	72.0Kg/ha
Pre-emergent herbicide	Roundup P/Max TriflurX Goal	Traymate 10 June 2011	2L/ha 2L/ha 75ml/ha
Fertiliser	MAP	At sowing, 10 June 2011	50kg/ha
Mouse baiting	Mouseoff	garden spreader, 30 June 2011	
Herbicide	MCPA LVE Brodal Kamba 500	Boom spray, All plots 15 August 2011	500ml/ha 45ml/ha 125ml/ha
Fertiliser	Sulphate of Ammonia (4 plots) Urea (2 plots)	Garden spreader 18 August 2011	90kg/ha 60kg/ha
Herbicide	Gladiator Goal	Contraption boom, non-pasture plots only, 2 September 2011	2L/ha 75ml/ha

Results

Pasture dry matter cuts were taken from both trial sites in February 2011 to measure native pasture forage potential. The results of the native pasture dry matter cuts are shown in Table 3.

Table 3. Native pasture dry matter weights (kg/ha) from the two trial sites.

Trial site	Mean weight (kg/ha)	Range (kg/ha)	Sample size (number of cuts)
Hopetoun	2923	2179 — 3410	12
Kewell	4534	2978 — 5706	9

The results in Table 3 show that, over the 2010/2011 summer growing period, native pastures produced over 2.9 t/ha of potential forage on a Mallee sandy soil (Hopetoun site), and over 4.5 t/ha on a Wimmera clay soil (Kewell site).

Gairdner Barley was sown into the native pasture plots and bare soil (control) plots in June 2011. Dry matter cuts at GS32 were taken to measure crop emergence. The results are shown in Table 4.

Table 4. Dry matter weights (g/m^2) at GS32 for barley sown into native pasture plots and bare soil (control) plots at the Hopetoun and Kewell trial sites.

Treatment	Hopetoun	Kewell
Crop in native pasture plot	163	161
Crop in bare plot (control)	655	547
Sig. diff. **LSD (0.05)** **CV%**	**P<0.01** **340.6** **37.0%**	**P<0.05** **604.5** **48.6%**

The results in Table 4 show significantly lower dry matter weights for barley growing in the native pasture plots compared with the control plots.

Both trial sites were harvested in December 2011 and the grain yield, protein levels and screenings calculated. Yield figures werecorrected to 11.5% moisture to standardise grain yield results. Table 5 shows the crop performance results for the Hopetoun trial site. Table 6 shows the crop performance results for the Kewell trial site.

Table 5. Crop performance results for Hopetoun trial site in 2011.

Treatment	Yield (t/ha)	Protein (%)	Screenings (%)
Crop in native pasture plot	1.06[a]	13.48[c]	3.02
Crop in bare plot (control)	3.23[a]	12.18[d]	1.95
Sig. diff. **LSD (0.05)** **CV%**	**P<0.001** **0.92** **19.1%**	**NS**	**NS**

Table 6. Crop performance results for Kewell trial site in 2011.

Treatment	Yield (t/ha)	Protein (%)	Screenings (%)
Crop in native pasture plot	1.69[a]	9.13[c]	3.63
Crop in bare (control) plot	4.81[a]	10.97[d]	14.04
Sig. diff. **LSD (0.05)** **CV%**	**P<0.001** **1.25** **11.0%**	**NS**	**P<0.05** **13.39** **43.1%**

The results in tables 5 and 6 show that, for both trial sites, the yield return of Gairdner Barley sown into native pasture was significantly lower than barley sown into bare soil. Grain quality was similar across the two plot treatments, although the bare soil plots at Kewell produced significantly more screenings.

Gross margin figures for the two trial sites were calculated, based on annual grain prices, fertiliser and herbicide costs and pasture forage value. The results are shown in Table 7. The pasture establishment costs were not included because the plots were sown in 2009 at a rate required for the trial, not at a broad-scale application rate, which would be lower.

Table 7. Annual gross margins ($/ha) for the two treatments at Hopetoun and Kewell.

Treatment		Hopetoun	Kewell
Crop in native pasture plot	Cropping	-$46.65	$90.13
	Pasture	$224.69	$309.53
	Total	$178.04	$399.66
Crop in bare (control) plot	Total	$408.72	$601.40

Barley at Hopetoun went H2, (delivered Hopetoun, 2 December). Barley at Kewell went ASW, (delivered Murtoa, 2 December.

Interpretation

The 2011 trial demonstrated that barley can be successfully sown into native pasture and harvested, but that it came with a significant yield penalty. There was no financial return from the cropping phase at Hopetoun, and minimal return from cropping phase at Kewell. With the pasture values included, grass margins for both sites were still below those from the conventionally cropped plots.

The 2011 trial also demonstrated that native grasses have great potential for producing grazing fodder over summer, though 2010/2011 was a wet summer. The results compare favourably with other perennial pasture trials. The native pastures at Hopetoun, at 16 months old, exceeded dry matter weights of five sub-tropical grasses, also grown at Hopetoun, which produced approximately 850 to 1400 kg/ha after 16 months (Craig 2010). The native pasture dry matter weights also exceeded those from a pasture cropping trial in the WA wheat belt where perennial pasture yields ranged from 130 to 2520kg/ha (Nicholls 2010).

Although the native pastures were slashed prior to crop sowing, slashing did not remove pasture biomass nor open up the ground through mechanical activity in the way stock would have done when grazing. It is possible that the mechanical action and biomass reduction of native pasture through grazing would promote conditions more favourable to crop growth, and consequently, crop yield. This is supported by the results of the 2010 native pastures trial, which sowed cereal into native pasture with less biomass (younger pasture) with little to no grain yield penalty (Starks 2011).

Commercial Practice: what this means for the farmer

Pasture cropping is a mixed farming system. Cropping into perennial pastures is likely to produce some yield penalty (see Nicholls 2010), but in a mixed farming system, the benefits of summer grazing, and the less tangible benefits of soil health improvements and reduced annual weed problems, can offset this and bring long-term improvements in farm sustainability (Seis 2008).

Cereals sown into native pasture do not have to be taken through to harvest, but can be grazed to provide valuable winter forage for stock. In combination with the summer-active native grasses, this practice could sustain high quality grazing potential all year round.

Native grasses could also be established on degraded, unproductive areas of a farm. When established, the native pastures would provide valuable grazing opportunities and improve farm profitability.

The 2011 native pasture cropping trial demonstrated the potential for farmers in the Wimmera and Mallee of combining pasture establishment, grazing and cereal production into a single farming system through adaptive management . The trial also highlighted the need for greater emphasis on the management of native pastures to promote more favourable conditions for a cropping phase of a pasture cropping farming system.

Acknowledgments

This project was funded through Grain & Graze II.

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