PROFITABLE FUTURE: NEW ROTATIONS FOR LOW RAINFALL ENIRONMENTS

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Summary

This study compared various crops and crop mixtures as alternatives to fallow in the first year of a 2 year cropping rotation.

When compared to fallow, the 2005 grain yields from the field pea more than compensated for the subsequent 2006 wheat grain yield reduction.

Introduction

The Mallee is a difficult environment in which to consistently produce viable non-cereal crops, with low and variable rainfall leading to a risk of crop failures in dry years. One of the challenges is to find alternative crops or systems to integrate into cereal rotations that won't result in complete failure in a dry year, and won't significantly reduce the yield of a cereal in the following year. Long fallows are often used in years in preparation for cereals for weed control or disease issues. Increasingly there is pressure to move away from long-fallow systems as there is a lack of growing plant matter to utilise rainfall, allowing water recharge and consequent salinity, and erosion from lack of effective ground cover. Well-managed medic pastures have some benefits such as self-regeneration and the ability to withstand heavy grazing, but are normally limited to farming systems retaining stock.

The New Rotations for Low Rainfall Environments project has attempted to tackle this problem of identifying viable non-cereal break crops for the Mallee. The project has included dry matter production of non-cereal crops as an important indicator to potential feed value for either grazing or hay production for years when profit from grain yield is unlikely. This production, reduction in water recharge, and nitrogen (N) input from fixation if a legume is grown, may compensate for any yield reduction of the subsequent cereal crop, compared to a long fallow.

Method

In 2005, trials were sown at the Cowangie and Walpeup Landcare Delivery sites (Table 1). Treatments for these trials were chosen as the better potential options and comparisons from previous years New Rotations trials. The Cowangie trial was sown on 25 June. At the Walpeup site, an additional time of sowing was included to evaluate the effects of dry sowing compared to sowing on the break. Plots were either sown dry on 3 May with no prior herbicide application (Walpeup Early) or sown on 22 June after

the break and a knockdown herbicide application (Walpeup Late). All sown plots received 10 units of phosphorous (P) at sowing in 2005. The mustard treatment also had 35 units of pre-drilled N applied.

Table 1. Varieties and sowing rates, sown at Cowangie and Walpeup (2 times of sowing – dry and on the break) in 2005.

Crop	Variety	Seeding Rate
Fallow	Chemical	
Field Pea	Morgan	110 kg/ha
Mustard + N	JR049	4 kg/ha + 35 Units Pre-drilled Nitrogen
Field Pea/Mustard	Morgan & JR049	70 kg/ha (Field Pea), 1.6 kg/ha (Mustard)
Medic Pasture	Regenerated	
Vetch/Triticale	Morava & Tahara	31 kg/ha (Vetch), 30 kg/ha (Triticale)

In 2006 Yitpi wheat was sown at 60 kg/ha during May at both sites. All plots received 10 units of P at sowing. The plots were split with 20 units of pre-drilled N on one half of the plots.

Results

Growing season (GSR) and annual rainfall in 2005 and 2006 (Table 2) for Cowangie was obtained from farmer records, Walpeup rainfall data was obtained from the Bureau of Meteorology Station at DPI Walpeup. In 2005, Cowangie GSR and annual rainfall were below average (deciles 4 and 3 respectively), while Walpeup GSR was average (decile 6) and annual slightly below average (decile 4). October was the wettest month during the growing season in 2005 at both sites. In 2006 the GSR and annual rainfall were deciles 1 and 2 at Walpeup and the Cowangie site data was not available. There were only 2 major GSR events, April/May and July.

Table 2. GSR (mm), annual rainfall (mm), average rainfall (mm), and GSR and annual rainfall deciles at Cowangie and Walpeup in 2005 and 2006

	Cowangie			Walpeup		
	2005	2006	Average	2005	2006	Average
GSR	181	na	234	221	90	220
GSR Decile	4			6	1	
Annual	249	na	342	295	174	331
Annual Decile	3			4	2	

Mustard + N produced the highest biomass of all treatments when sown post break (Table 3) in 2005, but produced the lowest grain yield at both sites. Field pea produced high grain yields except when in competition with weeds. The Walpeup Early trial had weed problems resulting from dry sowing, with the biomass and grain yields generally lower. The triticale dominated the vetch/triticale mixture and produced similar biomass and grain yields to the field pea/mustard mixture. Field pea grain yield was reduced when grown in a field pea/mustard mixture.

Table 3. Biomass (tDM/ha) and grain yield (t/ha) for Cowangie, Walpeup Early and Walpeup Late sites in 2005

	Cowangie		Walpeup Early		Walpeup Late	
2005 Crop	DM t/ha	Yield t/ha	DM t/ha	Yield t/ha	DM t/ha	Yield t/ha
Field Pea	3.8	3.1	2.1	0.4	2.8	1.8
Field Pea/Mustard	5.7(40:60)	2.0(80:20)	0.6(80:20)	0.1(70:30)	2.3(70:30)	0.8(80:20)
Mustard +N	7.5	0.5	0.6	0.0	3.9	0.1
Medic	2		0.4		0.3	
Vetch/Triticale	4.8(30:70)	3.6(0:100)	0.7(40:60)	1.0(10:90)	2.4(30:70)	0.7(10:90)

(:) Ratio of legume to non-legume in mixture

The 2006 wheat yields are presented in Table 4. The 2005 fallow treatment yielded similarly to higher grain yields in 2006 than the 2005 alternative crops. Pre-drilling N in 2006 generally increased both grain yields and grain protein contents. The inclusion of a cereal (triticale) in 2005 resulted in reduced wheat yields in 2006 with or without pre-drilled N compared to all other 2005 treatments.

Table 4. Wheat grain yield (t/ha) and protein (%) for Cowangie, Walpeup Early and Walpeup Late sites in 2006

	Cowangie		Walpeup Early		Walpeup Late	
2005 Crop	Yield t/ha	Protein %	Yield t/ha	Protein %	Yield t/ha	Protein %
Field Pea	1.1	13.5	0.3	14	0.4	14
+N 2006	1.2	14	0.4	15	0.4	15.1
Fallow	1.2	13.4	0.6	14.1	0.5	14.2
+N 2006	1.3	13.6	0.7	14.4	0.8	14.5
Field Pea/Mustard	0.9	12.9	0.3	14.3	0.3	14
+N 2006	1.1	13.3	0.4	15.3	0.4	14.9
Must +N	0.9	12.6	0.3	14.5	0.4	13.8
+N 2006	0.9	12.8	0.4	15.7	0.4	14.9
Medic Pasture	1	13	0.3	14	0.4	13.7
+N 2006	1.2	13.6	0.4	15.5	0.4	15
Vetch/Triticale	0.6	12.7	0.2	14.1	0.2	13.7
+N 2006	0.8	12.7	0.3	14.9	0.3	13.9

Discussion

The 2005 sown alternative “break” crops produced excellent biomass and grain yields, most especially the Morgan field pea. Dry sowing was less successful due to weed control difficulties. The regenerated, no-cost annual medic produced the lowest biomass production. Medic pasture has the advantage of self-regeneration and being able to tolerate heavy grazing but the alternative crops produced a much larger amount of biomass. This could be either grazed or cut for hay, and have the potential for grain yield thus giving many more options for the grower. However they do increase the economic risk factor due to cost of establishment. The water use efficiency (WUE) of the alternative crops varied from 3 to 16kg of grain/mm of GSR.

The 2006 sown wheat showed some yield benefits both from the previous fallow treatment and also from the pre-drilling of Urea. There were also indications of rotational benefits resulting from the broad-leaf alternative crops as opposed to the

cereal triticale. The maximum WUE at Walpeup reached 14kg of wheat/mm of GSR, 60% of the 20 kg of cereal grain/mm of GSR benchmark.

Acknowledgements

Funding support from National Action Plan through the Mallee CMA and DPI Victoria.

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