Demonstrating the benefits of break crops in Northern Mallee no-till cropping systems

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Why was the project was done?

Agronomic constraints threaten the sustainability of intensive cereal no-till cropping systems. Local research has shown these constraints can be managed by diversifying rotations with break crops, however as this research was conducted at only one site, farmers wanted to know whether the same results would be observed on a commercial scale at a whole of paddock level. In 2014, the Mallee Catchment Management Authority (Mallee CMA) funded a project to compare the impact and profitability of the inclusion of broadleaved break crops in paddock rotations in the Northern Victorian Mallee.

How was the project was done?

Five paired paddocks where farmers are comparing rotations that include broadleaved break crop options to cereal intensive cropping systems were first implemented in 2014. The paired demonstration paddocks are of a commercial scale and are managed by the participating farmers using commercial equipment. Monitoring is focusing on two soil types (light and heavy) within each paddock to collect data on weed dynamics, soil fertility and nitrogen (N), disease, soil water and productivity. The economics of each rotation is being compared using gross margins developed in consultation with the collaborating farmers.

Key Messages

- Broadleaved break crops increased pre sowing soil nitrogen by up to 40 kg/ha in 2014 while Rhizoctonia inoculum was also significantly reduced following these crops.
- Growing a legume break crop in 2014 increased the grain yield of the subsequent wheat crop by 0.6 – 0.7 t/ha.
- Wheat crops following legumes were twice as profitable than following another cereal crop in 2015.
- The profitability of paddock rotations that included legume break crops in 2014 were similar to or exceeded the profitability of the cereal intensive rotation in the same paddock.

Background

Farmers in the Northern Mallee (Millewa and Carwarp regions) are increasingly incorporating broadleaved break crops into their paddock rotations. This is in response to agronomic constraints such as brome grass, rhizoctonia and declining soil nitrogen levels threatening the sustainability of the continuous cereal cropping systems that had dominated the region for more than a decade. This change has been supported by local research that showed that managing agronomic constraints can increase the productivity of the subsequent cereal cropping phase by 1-2 t/ha and increase profitability by up to $90/ha/year over a four-year period (Moodie et al., 2015). However, as this research was conducted at only one site, farmers wanted to know whether the same results would be observed on a commercial scale at a whole of paddock level. In 2014, Mallee CMA funded a project to compare the impact and profitability of the inclusion of broadleaved break crops in paddock rotations in the Northern Mallee. This article reports the results from the first two years of this project.

Method

Five paired paddocks comparing rotations including broadleaved break crop options to cereal intensive cropping systems were established in 2014. The paired demonstration paddocks are of a commercial scale and are implemented and managed by collaborating farmers using commercial equipment. Participating farmers select the appropriate crop for each paired paddock on an annual basis taking into account seasonal condition, paddock history, within paddock agronomic constraints and profitability outlooks. The same paddocks were used in 2014 and 2015 and the project will continue until the 2017 season.

Mallee Sustainable Farming is monitoring two soil types (light and heavy) within each paddock to collect data on weed dynamics, soil fertility and nitrogen (N), disease, and productivity. Prior to sowing, soil samples are collected along permanent transects on each soil type in each paired paddock (Figure 1). Soils are collected to assess grass weed seed banks, mineral N, top soil fertility and Predicta B soil borne disease inoculum levels.

In crop grass weed numbers are monitored at five permanent locations on long each monitoring transect in early winter and then again in spring. Following harvest, yield maps are collected from the participating farmers and are processed in PA source (http://www.pasource.com/). Gross margins (GM) are then calculated for each paired paddock using the actual inputs and costs supplied by the collaborating farmers. Where costs are unable to be supplied, the input costs stated in the Rural Solutions Farm Gross Margin and Enterprise Planning Guide were used (Rural Solutions 2015).

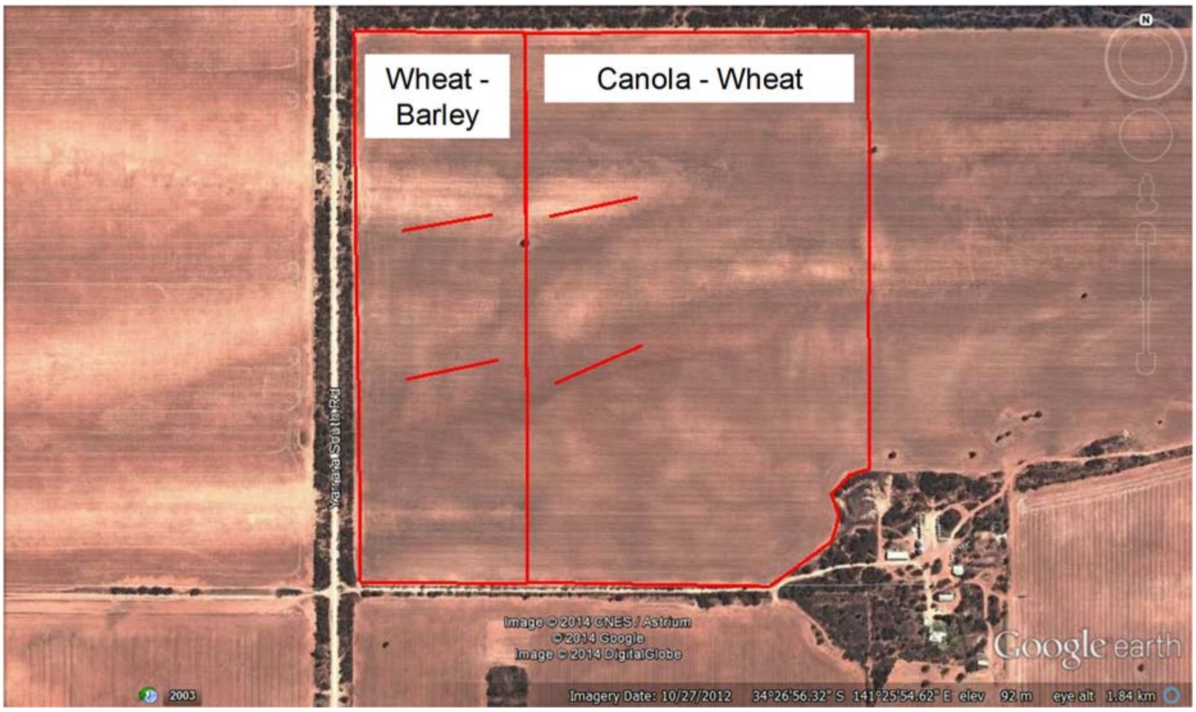

Figure 1. An example of a paired paddock with two permeant monitoring transects established on a light and heavy soil. White text boxes provide the details of the rotation implemented in each paired paddock in 2014 and 2015.

Results

Agronomic impacts

Differences in pre-sowing soil N between rotations where most prevalent on the light soils than on the heavy soils in 2015 (Figure 2). Field pea (farm 3), vetch (farm 4) and canola (farm 5) in 2014 increased pre sowing soil N the next year by 15-40 kg/ha relative to cereal based rotation in those paddocks. Smaller differences were observed on heavy soil types with 10 kg /ha or less difference in pre sowing N between rotations.

All rotations have successfully managed to control grass weed populations over the two seasons despite initial weed seed banks of up to 200 plants m^2 at the commencement of the projects. Control of grass weeds in the cereal intensive rotations relied on Clearfield herbicides (farm 1,2 and 5) or oaten hay (farm 3 and 4) in 2014. Less than one grass weed plant per square meter was measured in all paddocks in spring 2015.

Break crops had a significant impact on the level of rhizoctonia inoculum in the soil prior to sowing in 2015. Growing broadleaved break crops resulted in a low to medium risk level for rhizoctonia in 2015, while corresponding intensive cereal treatment resulted in a medium to high rhizocotnia risk in all paddocks. On average, 2015 rhizoctonia inoculum levels were seven times greater on the heavy soils and 14 times greater on the light soils following a cereal crop than after a broad leaved break crop.

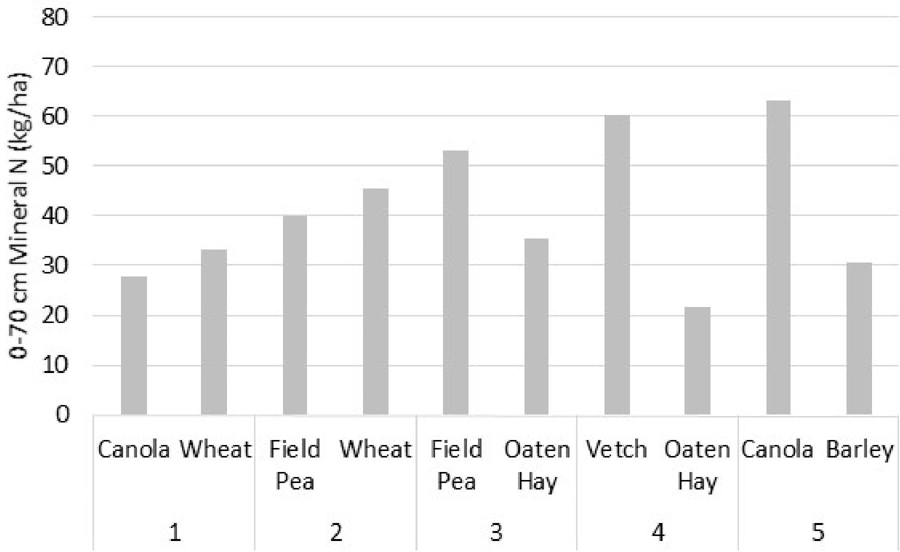

Figure 2. Soil mineral nitrogen (0-70 cm – kg/ha) measured for a light soil (top – grey bars) or heavy soil (bottom – black bars) prior to sowing in 2015 following different crops grown in 2014 in five paired focus paddocks in the Northern Mallee

Crop yield and profitability

Crop yields were similar in 2014 and 2015 with the exception of canola which yielded poorly in 2014 (0.4 t/ha) (Table 1). Legume crops grown in 2014 boosted wheat yield in 2015. On farm 3, wheat following field pea yielded 0.6 t/ha more than wheat following oaten hay (Figure 3). Similarly, wheat following vetch hay yielded 0.7 t/ha more than following oaten hay on farm 4. However, canola grown in 2014 did not improve the grain yield of the subsequent cereal crop in 2015 (farm 1 and 5).

The profitability of rotations that included a legume break crop option were similar to maintaining an intensive cereal crop rotation in those paddocks, despite above average yields and high gross margins of the cereal crop options in 2014 (Table 1). This is because wheat following either field pea or vetch hay had approximately twice the gross margin of wheat following oaten hay in 2015. These excellent gross margins were not only a result of increased income from higher grain yields but were also a cheaper crop to produce. Conversely, growing canola in 2014 resulted in significantly lower cumulative gross margin than maintaining a continuous cereal rotation in those paddocks. However, canola grown on farm 3 in 2015 yielded 1.1 t/ha resulting in a high gross marginof $410/ha. In this paddock the profitability of a two-year break crop sequence (field pea – canola) has been approximately equal to maintaining continuous wheat in that paddock.

Table 1. Yield (grain or hay), gross margin (GM) and cumulative GM following different crop options in paired paddocks in the northern Mallee in 2014 and 2015.

Farm	2014			2015			Cumulative GM ($/ha)
	Crop	**Yield (t/ha)**	**GM ($/ha)**	**Crop**	**Yield (t/ha)**	**GM ($/ha)**	
1	Canola	0.4	-7	Wheat	1.2	141	134
	Wheat	1.4	219	Barley	1.3	115	334
2	Field Pea	1.0	131	Canola	1.1	410	541
	Wheat	2.1	366	Wheat	1.5	205	571
3	Field Pea	1.0	138	Wheat	2.4	454	592
	Oaten Hay	2.2	389	Wheat	1.8	262	651
4	Vetch Hay	1.9	178	Wheat	1.8	354	532
	Oaten Hay	2.4	194	Wheat	1.1	189	383
5	Canola	0.4	-27	Field Pea	0.7	163	136
	Canola	0.4	-27	Wheat	1.3	177	150
	Barley	1.9	293	Wheat	1.3	177	470

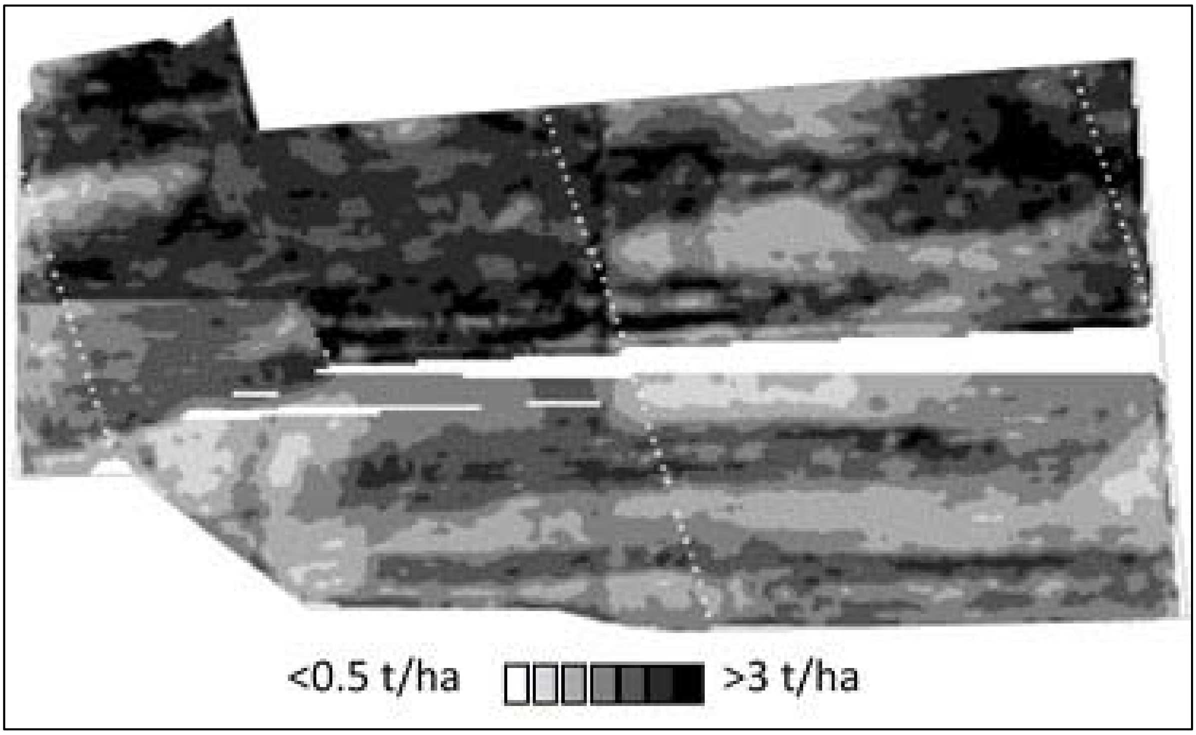

Figure 3. Grain yield of wheat in 2015 on farm 3 following field pea (top paddock) or oaten hay (bottom paddock) in 2014.

Implications for commercial practice

This project is demonstrating that including broadleaved break crops in commercial paddocks in the northern Mallee is having a significant impact on agronomic factors and the yield and profitability of subsequent cereal crops. To date, using a legume as a break crop has improved productivity and profitably more significantly than using canola in the rotation. Grass weed control has been effective in both the break crop and intensive cereal rotations although Clearfield herbicides or hay crops have been extensively used in the cereal rotations. These same paddocks will continue to be monitored in 2016 and 2017 seasons.

References and links

Moodie, M., Wilhelm, N and McDonald, T (2015). Productive and profitable pulse crops in the Northern Victorian Mallee. Mallee Sustainable Farming Results Compendium 2013. http://msfp.org.au/wp-content/uploads/2015/02/Moodie_Pulse-Crops-in-Vic-Mallee.pdf

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Further information

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