Break crops can provide over 1 t/ha of extra wheat over the three subsequent seasons

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Why was the trial done?

Although cereal-intensive cropping has been demonstrated to be productive in the Mallee, thereare situations where grass weeds, disease and high fertiliser costs may necessitate a break crop option. This trial was designed to evaluate the effect of a range of break crops and pasture over a range of mallee soils over 3 years of subsequent wheat.

How was the trial done?

In replicated field trials at the Karoonda (Lowaldie) site, break crops including legume, rye, brassica and pasture were grown in 2009 and 2010 and followed by consecutive wheat crops until 2013. Wheat yield following these breaks were compared with a continuous wheat treatment. All treatmentswere applied at four positions in the landscape: hill (deep sand), mid-top, mid-slope and swale (heavyflat).

Key Messages

- Average wheat yield gains were approximately 0.6 t/ha in the first year after a break and the size of this yield gain was similar in high and low yielding seasons.
- Second year break effects were generally in the order of 0.3 t/ha and third year break effects 0.1 t/ha, resulting in a total of approximately 1 t/ha more wheat being produced following a break compared to continuous wheat.
- The effect of breaks on subsequent wheat yields is usually more consistent across soils, seasons and break type than the yield of break crops.
- Cumulative gross margins from wheat following legume, brassica and legume-based pasture breaks were generally much higher than continuous wheat, but the overall profitability of including breaks is strongly determined by the high variability in the relative profit from the different break options on different soils in the year that they are grown.

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About the trial

In replicated field trials in 2009 and 2010, five break crops were established which were followed by wheat crops until 2013 to test yield response compared with a continuous wheat control (Table 1). Planting rates and fertiliser applications were the same across all soil types but differed according to crop type (Table 2). All treatments were replicated four times and laid out as a randomised complete block designed experiment at four positions (hill, mid-top, mid-bottom and swale). The mid-top position is located on a north facing dune and while the depth of sand in this profile is not as deep as the hill position, it is more erosion prone with poorer crop establishment and fertility than the hill. In 2013, the break crop main trials were sown to wheat in early June after approximately 40 mm of rainfall in May and 33 mm received over December to March. Rainfall for the remainder of the growing season was similar to the long term average with 228 mm.

Table 1. Break crop treatments imposed in 2009-13.

Treatment	15 May 2009	27 May 2010	24 May 2011	30 May 2012	3 June 2013
1	Legume (peas)	Wheat	Wheat	Wheat	Wheat
2	Brassica (mustard)	Wheat	Wheat	Wheat	Wheat
3	Cereal Rye – grain	Wheat	Wheat	Wheat	Wheat
4	Cereal Rye– grazed	Wheat	Wheat	Wheat	Wheat
5	Volunteer pasture	Wheat	Wheat	Wheat	Wheat
6	Wheat (control)	Wheat	Wheat	Wheat	Wheat
7	Wheat	Brassica (canola)	Wheat	Wheat	Wheat
8	Wheat	Cereal Rye – grain	Wheat	Wheat	Wheat
9	Wheat	Cereal Rye– grazed	Wheat	Wheat	Wheat
10	Wheat	Volunteer pasture	Wheat	Wheat	Wheat
11	Wheat	Legume (lupins)	Wheat	Wheat	Wheat

(Experiment – 1.6 m wide plots x 40 m length)

Table 2. Inputs applied to each crop type in 2009-2013

Treatments	Crop/Variety	kg/ha	Fertiliser
Legume	Peas cv. Kaspa (2009) Lupins cv Mandelup (2010)	100 90	DAP @ 50 kg/ha DAP @ 50 kg/ha
Brassica	Mustard cv. Sahara (2009) Canola cv. Hyola 50 (2010)	5 5	DAP @ 50 kg/ha plus Urea 35 kg/ha DAP @ 50 kg/ha plus Urea 35 kg/ha
Rye for Grain	Cereal rye cv. Bevy	80	DAP @ 50 kg/ha plus Urea 35 kg/ha
Dual Purpose Rye	Cereal rye cv. Bevy	80	DAP @ 50 kg/ha plus Urea 35 kg/ha
Volunteer pasture	Volunteer Pasture	nil	Nil
Wheat 2009/10	Wheat cv. Correll	70	DAP @ 50 kg/ha plus Urea 35 kg/ha
Wheat 2011	Wheat cv. Mace	70	DAP @ 50 kg/ha plus Urea 35 kg/ha
Wheat 2012/13	Wheat cv. Kord Cl Plus™	70	DAP @ 50 kg/ha plus Urea 35 kg/ha

Results

Break Effects on Wheat Grain Yield

Using the yield data from three years of wheat crops following breaks in either 2009 or 2010 we were able to analyse the gain from including the break crop (Figure 1). The relationship between continuous wheat yield and wheat after break yield shows a wheat yield benefit (across soil types and seasons and break type) of approximately 0.6 t/ha in the first year after the break (wheat after break yield= 0.99 continuous wheat yield +0.65 t/ha), 0.3 t/ha in the second year after the break (wheat after break yield =0.99 continuous wheat yield + 0.27 t/ha) and 0.1 t/ha in the third year after the break (wheat after break yield= 0.99 continuous wheat yield +0.14 t/ha).

Attempts to analyse the break effects by individual soil types or seasons did not give a more meaningful result, so while there was variability in the soil by season response to break crops these were not consistent enough to provide additional recommendations.

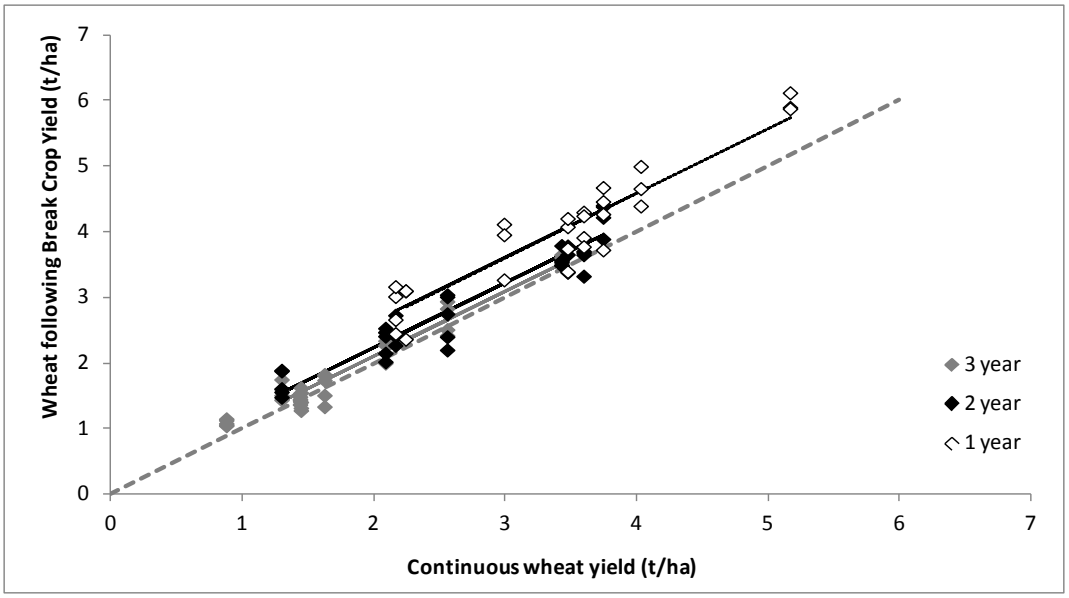

Figure 1. *Wheat yields following a break (1 year after break; 2 years after break and 3 years after break) plotted against wheat following wheat. Data is from 4 soil types over 3 seasons (2010-13) and legume, brassica and pasture breaks.*

Cumulative Gross Margins

The cumulative gross margins for three years of wheat grown following a break in either 2009 or 2010 were calculated for each soil type × crop sequence combination and are presented relative to the gross margin for continuous wheat (Table 3). The gross margins over the run of seasons that have fallen during the trial suggest that there are variable returns on having breaks in the rotation depending on the season and soil type in which the break crop are grown. In the swale, most break options produced more profitable outcomes in the subsequent three wheat crops except dual purpose rye. In the mid-bottom part of the landscape rye break options in 2010 produced a loss of income in subsequent wheat crops while canola in 2010 and rye in 2009 produced only small benefits to wheat income. In the mid-top part of the landscape, all break options increased subsequent wheat income while in the hill there was again variability around the effect of rye in the sequence and pasture in 2010 caused a loss in wheat revenue compared with continuous wheat.

Table 3. Difference in cumulative gross margin of three years of wheat grown following a break crop compared with continuous wheat.

Rotation					Swale	Mid-Bottom	Mid-Top	Hill
2009	**2010**	**2011**	**2012**	**2013**	**$/ha**	**$/ha**	**$/ha**	**$/ha**
peas	wheat	wheat	wheat		464	429	368	363
mustard*	wheat	wheat	wheat		484	328	36	363
rye grain	wheat	wheat	wheat		265	134	191	142
DP rye*	wheat	wheat	wheat		502	70	262	-33
pasture	wheat	wheat	wheat		388	363	522	449
	lupins	wheat	wheat	wheat	288	357	450	290
	canola	wheat	wheat	wheat	329	63	212	202
	rye grain	wheat	wheat	wheat	25	-102	288	290
	DP rye	wheat	wheat	wheat	-12	-178	193	52
	pasture	wheat	wheat	wheat	188	379	513	-19

*Mustard failed to establish across Mid and Hill soils, DP rye is dual purpose rye for hay and grain. Costs calculated using the Rural Solutions Farm Gross Margin Guide, grain prices are 5 year averages (note that the 5 year average lupin price was $305/t), pasture biomass valued at $35/t/ha. For 2009-2012 the continuous wheat three year cumulative gross margin was: swale $2751/ha, mid-bottom $2116/ha, mid-top $895/ha and hill $1728/ha and for 2010-2013 the continuous wheat three year cumulative gross margin was: swale $1687/ha, mid-bottom $1485/ha, mid-top $493/ha and hill $1275/ha.

Implications for commercial practice

The relatively consistent ability of brassica and legume breaks to improve total cereal yields has been demonstrated (compared to continuous cereal). The overall success of the inclusion of the break crop is determined by the need for alternative management strategies for issues such as weeds, disease and nutrition that arise in continuous cereal systems and the ability to grow a break option that does not result in excessively high losses in the year that it is grown.

Links and references

http://msfp.org.au/wp-content/uploads/2013/06/2012-Break-crop-benefits-across-soil-types-Break-Crops.pdf

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