



## Grass Patch 2015-16 Break Crop : Cereal Rotation Profitability Trial

### BACKGROUND

With the inclusion of canola over the last 8-10 years into cropping rotations in the low to medium rainfall mallee region of the Esperance Port Zone, some growers have experienced significantly lower cereal yields following a canola crop than those achieved following a field pea crop.

In 2013 Grass Patch farmer Ron Longbottom saw this difference average 800kg/ha across the farm's total production figures, with yields from some side by side paddocks differing by more than 1000kg/ha (Table 1). The impact of these differences in yield on overall farm profitability led Ron to question just what the best rotation option might be for his property, 5km north west of Grass Patch.

**Table 1:** Harvest results from 2 sets of adjacent paddocks on Cape Lagoon Farms (Grass Patch) in which wheat was grown in 2014 following either peas or canola in 2013.

	Harvest Results - Paddocks 9G & IB				Harvest Results - Paddocks PC & GHN			
	2013 Peas	2014 Wheat	2013 Canola	2014 Wheat	2013 Peas	2014 Wheat	2013 Canola	2014 Wheat
<b>Paddock Size (ha)</b>	363	363	240	240	185	185	360	360
<b>Yield (kg/ha)</b>	1,599	2,636	1,158	1,746	1,568	3,284	1,172	2,364
<b>Price/tonne (FIS)</b>	\$300.00	\$305.00	\$520.00	\$305.00	\$300.00	\$305.00	\$520.00	\$305.00
<b>Gross Return (\$/ha)</b>	\$479.70	\$803.98	\$602.16	\$532.53	\$470.40	\$1,001.62	\$609.44	\$721.02
<b>Costs* (\$/ha)</b>	\$171	\$204	\$292	\$201	\$192	\$182	\$286	\$202
<b>Net Return (\$/ha)</b>	\$309	\$600	\$310	\$332	\$278	\$820	\$323	\$519
<b>2 Year Net Return (\$/ha)</b>	<b>\$908</b>		<b>\$642</b>		<b>\$1,098</b>		<b>\$843</b>	

Costs\*=Variable Operating

### TRIAL DESIGN

In 2015 Ron, Greg Warren (Farm & General) and SEPWA initiated a two year trial, with funding from SCNRM, to investigate the profitability of different cereal: break crop rotations for mallee soils in Grass Patch; a low to medium rainfall region of Esperance. Five different break crop species; Canola, Field Peas, Faba Beans, Common Vetch and Sugar Beet, were seeded in to 4ha plots in a 28Ha paddock in April 2015 and harvested in October and November 2015. All of these plots were then sown to wheat in early May 2016.

The following soil physicochemical and biological parameters were measured in each of the 5 break crop species plots in 2015:

- deep profile soil nutrition, particularly Nitrogen

- root diseases and root nematodes – evaluated by tests conducted by SA’s Dept of Ag as part of the industry known Predicta-B testing service
- soil moisture

Crop yields were measured from each of the break crop plots in 2015 and 2016 and net returns were calculated.

## RESULTS



**Figure 1:** Vetch vs Field Peas, 7<sup>th</sup> Sept 2015



**Figure 2:** Canola vs Sugar Beet, 7<sup>th</sup> Sept 2015



**Figure 3:** Faba Beans vs Vetch, 7<sup>th</sup> Sept 2015



**Figure 4:** Field Peas vs Canola, 7<sup>th</sup> Sept 2015

Of the 5 break crop species grown in 2015 faba beans were the highest yielding and the most profitable crop, followed by field peas, then canola, then vetch and lastly sugar beet (Table 2). Vetch and sugar beet were both brown manured hence they cost money to grow with no return. Because this enterprise did not include stock no feed value was able to be gleaned from this resource.

**Table 2:** 2015 Break Crop harvest yields, input costs and gross and net margins.

	Field Peas	Sugar Beet	Canola	Vetch	Faba Beans
<b>Direct Input Costs/Ha</b>					
Seed	\$46.00	\$240.00	\$1.65	\$17.50	\$60.00
Innoculant				\$14.80	\$14.80
Fertiliser		\$78.00	\$69.95		
Pesticides	\$55.00	\$340.00	\$57.00	\$68.00	\$78.00
Total	\$101.00	\$658.00	\$128.60	\$100.30	\$152.80
<b>Yields (t/ha)</b>	1.69	0	1.27	0	1.8
Commodity Price (\$/tonne)	\$445		\$560		\$500
<b>Gross Margin/ha</b>	\$752.05		\$711.12		\$900.00
<b>Net Margin/ha</b> (ie less direct input costs)	<b>\$651.05</b>	<b>-\$658.00</b>	<b>\$582.52</b>	<b>-\$100.30</b>	<b>\$747.20</b>

The impact of the break crop species on 2 root diseases, Rhizoctonia and Crown Rot, and soil nematodes is presented in Table 3. When considering these results it's important to understand that they come from 3 sample areas in each break crop species plot in which at least 20 subsamples were taken. While 60 subsamples may sound like a lot of samples it is actually quite patchy so any dense areas of infection could sway results. To do statistical analysis on data like this a large number of sample areas (in the order of 50 per ha which means around 1000 subsamples) is required.

When comparing the results from across the 5 break crop variety plots before and after the break crop growing season we can see there was:

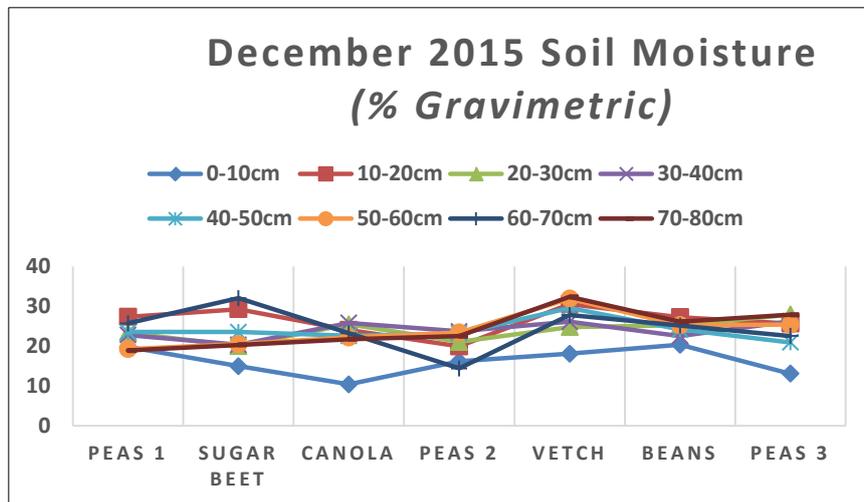
- No change in nematode and crown rot levels and an increase in Rhizoctonia following the field peas.
- A decrease in nematode, rhizoctonia and crown rot levels following the sugar beet crop, the latter two being a large enough reduction to change the infection categorisation level.
- A decrease in nematode levels, a large increase in Rhizoctonia and a decrease in crown rot (but not enough to reclassify the infection level from high) following the canola.
- No change in nematode levels following the vetch crop, a large decrease in Rhizoctonia and an increase in crown rot detected but not beyond numbers that are classified as low.
- Little change in nematode, rhizoctonia or crown rot levels in the Faba bean plot.

**Table 3:** Levels of Soil Nematodes and Root Diseases in March 2015, after a wheat crop in 2014 (wheat is known to be susceptible to nematodes and root diseases) but before sowing of the break crops, and in December 2015 after harvest of the break crops.

2015 Break Crop Plot	Soil Nematodes & Root Disease					
	# Root Lesion Nematodes (#/gm soil)		Rhizoctonia (pgDNA/g)		Crown Rot (pgDNA/g)	
	Mar-15	Dec-15	Mar-15	Dec-15	Mar-15	Dec-15
Field Peas	0.8	0.6	16.4	20.5	197.9	170.5
Sugar Beet	1.5	0.3	59.8	29.7	128.5	34.9
Canola	2.4	0.6	7.5	55.2	109.6	79.0
Vetch	0.9	1.0	20.1	4.4	17.0	52.0
Faba Beans	0.9	0.2	9.4	5.2	101.4	116.5

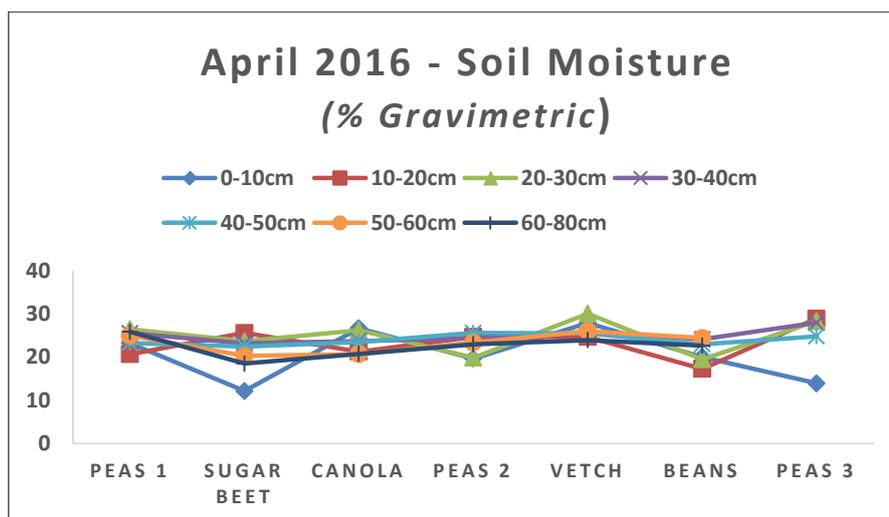
**Where:** Numbers shaded in orange are considered high, numbers shaded in yellow are considered moderate and numbers not shaded at all are considered low.

Soil moisture data collected on December 1<sup>st</sup> 2015 indicates that early summer soil moisture was lower in the canola plot than in the other crop plots and that soil moisture was higher in the sugar beet and vetch plots compared with other crop plots (Figure 5). Both of these plots were brown manured on 24<sup>th</sup> September 2015 so both were covered in mulch and had no crop using moisture from this date on. Crops in the other continued to use moisture until crop-topping time in mid-October.



**Figure 5:** Soil Moisture levels, 1<sup>st</sup> December 2015

Soil moisture data collected on April 7<sup>th</sup> 2016 showed that autumn surface (0-10cm) soil moisture was lowest in the Sugar Beet and Peas 3 plots (Figure 6). Below 10cm depth soil moisture levels in all plots had evened up when compared to December's results which were likely to be a result of rainfall received after December 1<sup>st</sup> combined with summer weed control across the whole site. The Vetch plot has slightly higher overall moisture down to 80cm which could be explained by higher moisture conservation after the early brown maturing date.



**Figure 6:** Soil Moisture levels, 7<sup>th</sup> April 2016

Soil nitrate nitrogen levels recorded from samples collected on the 7<sup>th</sup> April 2016 demonstrated that nitrate levels were highest in the top 10cm of soil in all of the 5 species plots (Figure 7). At the next depth down (10-20cm) nitrate levels were highest in the pea plots and lowest in the canola plot.

Nitrate levels were considerably lower and uniform across all of the species plots at 20 to 80cm depth. While this was not unexpected it's notable that there was a reasonable quantity of nitrate nitrogen present across all plots at these depths available for the 2016 wheat crop to utilise.

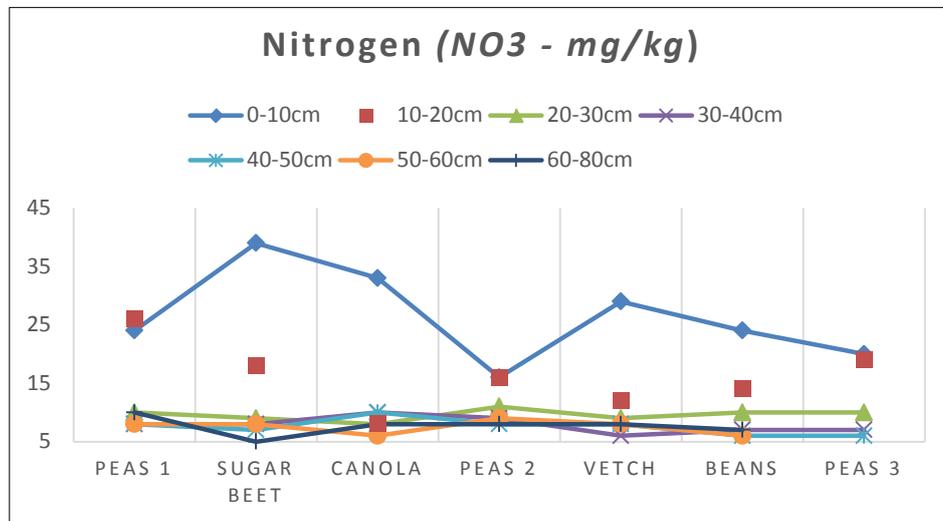


Figure 7: Soil Nitrate levels, 7<sup>th</sup> April 2016

Table 4: 2016 Wheat Yields, Grain Quality & Crop Returns from the Five 2015 Break Crop Species Plots.

2015 Break Crop Species	Sugar Beet Plot		Canola Plot		Field Peas Plot	Vetch Plot	Faba Beans Plot
Top-Up Nitrogen Application (kg/ha)	28	0	0	28	0	0	0
Protein (%)	11.7	11.4	10.9	12.3	12.4	13.7	12.7
Hectolitre Weight (kg/hl)	87.8	81.1	83.8	78.7	81.4	81.2	81.6
Screenings (%)	2.6	3.1	3.2	1.9	3.8	3.6	3.7
Yield (t/ha)	4.61	4.05	3.22	3.44	3.99	4.21	4.02
Classification	H2	APW1	APW1	H2	H2	H1	H2
Price per tonne (\$) (Farm Gate Price)	\$255	\$242	\$242	\$255	\$255	\$285	\$255
Net Return (\$/ha) (Farm Gate Price Less Direct Input Costs)	\$894	\$730	\$529	\$592	\$767	\$950	\$775

In terms of the performance of the 2016 sown crop, wheat grown in the sugar beet plot that received top-up nitrogen yielded best (Table 4). Wheat in the vetch plot closely followed, then the sugar beet plot that was not given top-up nitrogen, the faba bean plot, the field peas plot and lastly the wheat in the 2015 canola plots.

These production results translated to net returns in which wheat from the vetch plot had the highest \$/ha return while wheat in the canola plot had the lowest. The high return achieved from wheat in the vetch plot was a function of both good yield and high grain protein which meant it made H1 classification.

Table 5 brings together the 2016 wheat crop returns and the returns made from the 2015 break crops to reveal which of the 5 break crop : wheat rotations trialled was the most profitable during the last 2 years.

**Table 5:** Rotation Profitability Over 2015 & 2016

ROTATION	Sugar Beet : Wheat		Canola : Wheat		Field Peas : Wheat	Vetch : Wheat	Faba Beans : Wheat
	2015 Break Crop Net Return (\$/ha)	-\$658	-\$658	\$583	\$583	\$651	-\$100
2016 Top-Up Nitrogen (kg/ha)	28	0	0	28	0	0	0
2016 Wheat Net Return (\$/ha)	\$894	\$730	\$529	\$592	\$767	\$950	\$775
2 YEAR TOTAL Net Return (\$/ha)	\$236	\$72	\$1112	\$1175	\$1418	\$850	\$1522

The faba bean : wheat rotation came in first, closely followed by field peas : wheat. The sugar beet : wheat rotation came in last due to very high input costs when growing it in 2015. In this trial the vetch was brown manured hence there was no income from it in 2015, but if you were running a mixed farming operation including livestock, the stock carrying capacity benefits you can get from vetch would move its position in this profitability order.

When deciding which crops to grow it's important to evaluate the risk/return trade-off of the crops you select. To assess risk, factors like the agronomic suitability of a crop to your farm's rainfall variability, frost susceptibility and soil types are important as are the cost of fertiliser requirements, expected on-farm grain price and if on-farm storage and private marketing are needed.

In this trial, for example, all of the 2015 legume crops were sown with no fertiliser and the following wheat crop received 30kg/ha of nitrogen. The 2015 canola crop received 50kg/ha of nitrogen and the following 2016 wheat crop received either 30 or 58kg/ha of nitrogen. As a result the canola : wheat rotation had a higher risk/return as it used an additional 50 to 78kg/ha of nitrogen compared to the legume : wheat rotations.