Cost effective farming – financial analysis

Key findings

- In poorer seasons there is no positive economic reward for high nitrogen fertiliser inputs.
- Oats and vetch for either grazing or hay consistently provided positive gross margins.
- Wheat crops which followed a chemical fallow provided the best gross margin in both trials.
- Aim to maximise profits, not necessarily yields.

Why do the trial?

Many growers are choosing to reduce crop inputs and change crop choices because of financial pressures, the result of poor seasons and the uncertainty of commodity prices. In recent years stored soil moisture at sowing and spring rainfall have been low, producing lower than average grain yields and returns.

Farm costs are continuing to rise, particularly the costs of fertiliser and fuel, meaning growers are faced with the prospects of lower margins and higher financial risk. It has increased the need for appropriate rotations and a tactical approach to crop inputs to better match likely crop yields.

Many growers will compare wheat crops side by side, but rarely realise the cost of producing each crop can vary significantly. Individual grower strategy will guide inputs and as clearly shown in a study on the Eyre Peninsula an increase in crop intensity will almost always increases input costs with little or no benefit to profit (Hunt & Lynch, 2005). Studies in Victoria (O'Callaghan) have shown that the management of input costs is having a greater impact on grower returns compared to the influence of grain yield or quality.

This study aimed to assess the financial consequences of changing farming systems and inputs, specifically investigating the impact of changing break crop type and reduced fertiliser inputs on subsequent wheat yields and longer term profitability.

How was it done?

This research was conducted at the Hart fieldsite as two identical trials but within different seasons.

Trial 1: the seasons of 2005 and 2006
Trial 2: the seasons of 2006 and 2007

There were two components to this project:

1) Assessing three input levels of nitrogen fertiliser
    - low nutrition – nitrogen fertiliser applied for below average yields
    - strategic nutrition – crops initially fertiliser for below average yields and adjusted during the season based on soil water measurements, rainfall, seasonal climate forecasts and yield predictions using Yield Prophet
    - high nutrition – nitrogen fertiliser applied for above average yields

2) Assessing six, different two year rotations

Table 1. The crop choices for each rotation conducted over two seasons for two trials at the Hart fieldsite 2005 to 2007.

Trial 1			**Trial 2**	
2005	**2006**		**2006**	**2007**
Frame wheat	Kukri wheat		Frame wheat	Kukri wheat
Keel barley	Kukri wheat		Keel barley	Kukri wheat
TT Tornado canola	Kukri wheat		TT Tornado canola	Kukri wheat
Kaspa peas	Kukri wheat		Kaspa peas	Kukri wheat
Chemical Fallow	Kukri wheat		Chemical Fallow	Kukri wheat
Oats & Vetch	Kukri wheat		Oats & Vetch	Kukri wheat

In the first season (2005 or 2006) of each trial 6 crop types were sown with 3 levels of nutrition, applied in a split plot design with 3 replicates. In the second season (2006 or 2007) of each trial wheat was sown uniformly across all crop types sown in the previous season.

Table 2. Rates of urea (kg/ha) applied to the treatments in trial 1, between 2005 and 2006, at the Hart fieldsite.

	2005			2006		
	Low	**Strategic**	**High**	**Low**	**Strategic**	**High**
Frame wheat			80			
Keel barley		30	60			
TT Tornado canola	30	80	130			
Kukri wheat				20	0	120

Table 3. Rates of urea (kg/ha) applied to the treatments trial 2, between 2006 and 2007, at the Hart fieldsite.

	2006			2007		
	Low	**Strategic**	**High**	**Low**	**Strategic**	**High**
Frame wheat	30		120			
Keel barley	0	50	100			
TT Tornado canola	50	100	150			
Kukri wheat				20	80	140

Soil samples were taken in autumn each year to a depth of 60cm and tested for available nitrogen and moisture in the strategic plots only.

The plots were 3.0m wide and 10m long, with DAP @ 75 kg/ha applied at sowing.

All plots were assessed for grain yield, protein, test weight, and screenings less than 2.0 mm each year.

Economic assumptions

The following assumptions were used to guide the economic analysis:

- The input levels and yields were valued using 2008 expected prices and costs.
- The inputs and yields used were directly derived from the trials.
- To complete the gross margins, typical farmer costs were used for fuel and oil, repairs and maintenance, and crop insurance.
- When hay was harvested, a local hay-making contract rate of $121/ha was used
- When canola was harvested, it was assumed windrowing was used at a local contract rate of $30/ha.
- The oats and vetch enterprise has been assumed to be either:
    - harvested for hay - in this case the dry matter results were used as a proxy for hay yields; or
    - grazed by a self-replacing merino flock where it was assumed that the first 500kg/ha dry matter was needed for ground cover (not grazed by stock) and that 400kg dry matter was needed per DSE. A local sheep gross margin of $31/dse was used.

Results

As it turned out, the seasons were very poor and so the results provide a valuable insight into the risk of farming in poor seasons.

Specific trial results for each season were previously presented in Hart annual result books (2006 & 2007). Given the series of challenging seasons experienced during the project there was generally very little effect of nitrogen nutrition on grain yield or quality. Hence, the cost of applying post emergent urea to the high and strategic treatments was not economic.
The response of wheat yield and quality to the previous crop was variable with grain yields being significantly higher after the fallow treatment in trial 1 and significantly lower following barley or oats and vetch in trial 2.

Generally there was little difference in available soil nitrogen or moisture between treatments. A key highlight was that very small changes in residual soil moisture were enough to create significant differences in grain yield.

Tables 4 & 5. Grain yield (t/ha), protein (%) and screenings (%) for crop type and nutrition strategy for trial 1 and 2 at the Hart fieldsite.

Crop type	Nutrition Strategy	Trial 1 (2005 & 2006)					
		2005 break crops			2006 wheat		
		Yield (t/ha)	Protein (%)	Screenings (%)	Yield (t/ha)	Protein (%)	Screenings (%)
Keel barley	Low	3.28	9.9	1.8	0.56	16.2	1.8
	Strategic	3.62	10.2	2.0	0.58	15.5	1.9
	High	3.70	11.4	1.9	0.52	16.3	1.9
TT canola	Low	0.84	43.4		0.52	15.5	1.8
	Strategic	0.96	42.2		0.45	16.1	1.7
	High	1.01	41.2		0.42	16.4	2.0
Fallow	Low				0.74	14.1	2.2
	Strategic				0.70	14.3	2.0
	High				0.69	14.3	2.2
Vetch & Oats	Low				0.59	16.0	2.0
	Strategic	3.69			0.48	15.8	1.8
	High				0.51	16.0	2.0
Peas	Low				0.61	15.3	2.0
	Strategic	2.22			0.64	15.3	1.7
	High				0.61	15.2	1.9
Frame wheat	Low	2.39	10.8	2.3	0.33	16.7	4.3
	Strategic	2.37	10.4	2.7	0.36	15.8	3.5
	High	2.64	12.2	2.0	0.32	16.8	3.1
LSD (0.05)							
Previous crop		n/a	n/a	n/a	167.8	1.2	0.4
Nutrition strategy		ns	n/a	n/a	ns	ns	ns
Crop * Nutrition		n/a	n/a	n/a	ns	ns	0.5

Crop type	Nutrition Strategy	Trial 2 (2006 & 2007)					
		2006 break crops			2007 wheat		
		Yield (t/ha)	Protein (%)	Screenings (%)	Yield (t/ha)	Protein (%)	Screenings (%)
Keel barley	Low	0.11	15.6	7.5	1.30	15.8	3.3
	Strategic	0.21	15.5	7.6	1.17	17.2	3.5
	High	0.11	15.7	7.5	1.17	16.8	4.3
TT canola	Low				1.40	17.1	2.4
	Strategic	0.3			1.32	17.3	3.2
	High				1.25	17.2	3.4
Fallow	Low				1.37	17.0	2.4
	Strategic				1.41	16.7	2.2
	High				1.32	17.2	2.4
Vetch & Oats	Low				1.10	17.0	4.1
	Strategic	1.4			0.99	17.7	3.5
	High				1.08	17.3	3.6
Peas	Low				1.26	17.2	2.5
	Strategic	0.3			1.24	17.5	1.8
	High				1.58	16.6	2.6
Frame wheat	Low	0.52	16.4	7.7	1.71	15.6	4.2
	Strategic	0.46	16.3	7.8	1.51	16.0	4.6
	High	0.50	16.1	7.8	1.33	16.7	5.5
LSD (0.05)							
Previous crop					0.25	0.5	1.4
Nutrition strategy					ns	0.4	ns
Crop * Nutrition					ns	ns	ns

In poorer seasons there is no positive economic reward for high nitrogen fertiliser inputs (Figure 1.)

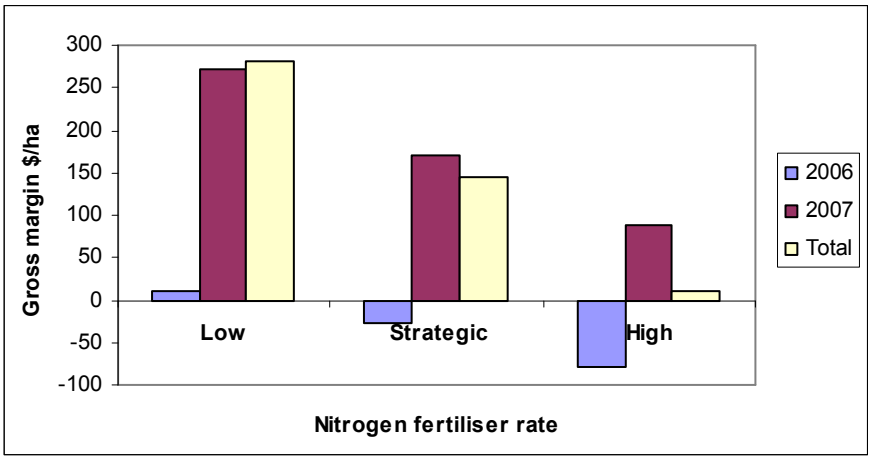

Figure 1. The gross margin response for 1st year wheat, or wheat on wheat, with an increasing amount of nitrogen fertiliser at the Hart fieldsite.

These results indicate very clearly that in poorer seasons such as much of South Australia has been experiencing in recent years, there is significantly higher risks in chasing maximum production by applying a high level of inputs. The strategy of high inputs in poor seasons has a double impact in that costs are higher and yields are poorer, resulting in very poor economic returns for the higher input strategy. A low or strategic approach to nitrogen fertiliser was certainly less costly.

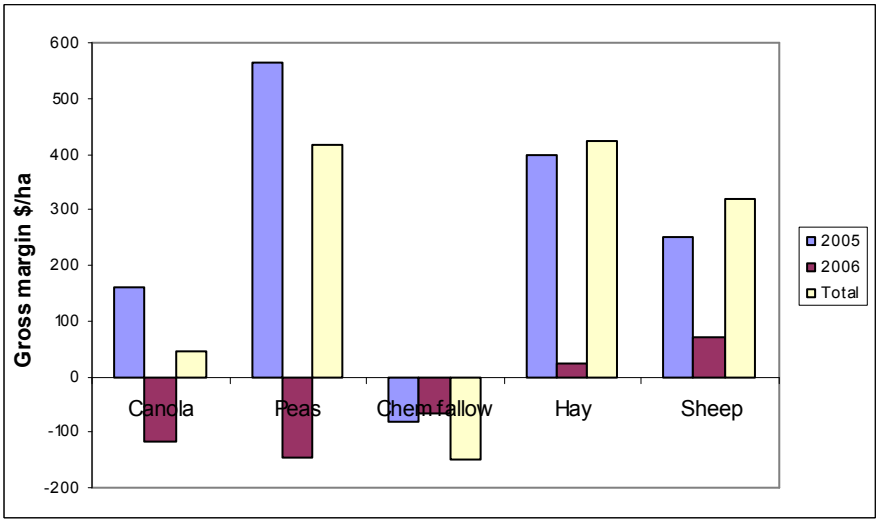

Figure 2. The gross margin response for the break crops grown prior to wheat in trial 1 (2005) and trial 2 (2006) at the low level of nitrogen nutrition at the Hart fieldsite.

For the break crops only oats and vetch for either grazing or hay consistently provided positive gross margins (Figure 2). It highlights that in 2006 the season obviously provided better dry matter production compared to grain production. The cost of the chemical fallow was consistent, as to be expected, and although being negative was not large compared to a

poor season for either canola or peas. Canola and pea gross margins were very dependent on the season.

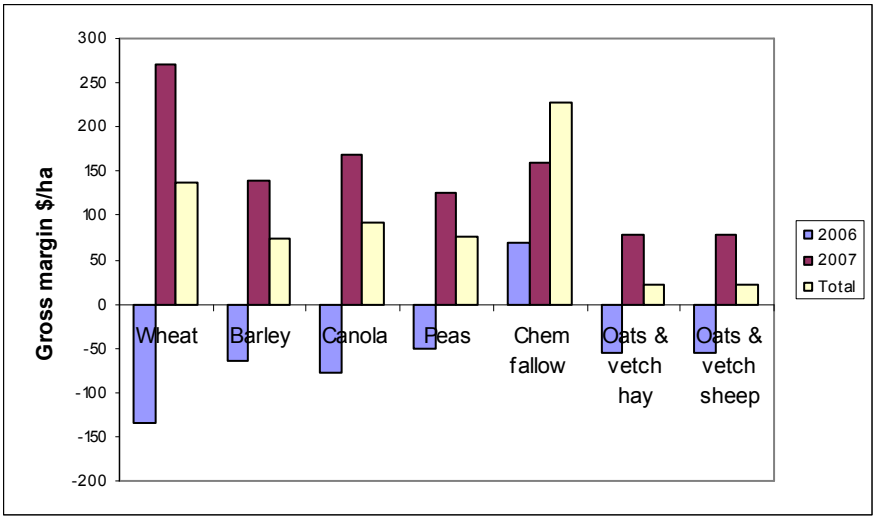

Figure 3. The gross margin response for wheat crops grown after cereal or break crops in trial 1 (2006) and trial 2 (2007) at the strategic level of nutrition at the Hart fieldsite.

For the wheat component of the rotation only the crops which followed a chemical fallow provided the best gross margin in both trials (Figure 3). This is of particular note as the wheat grown on chemical fallow provided the only positive return in 2007. These results occurred because chemical fallow provided one of the lowest losses in the poor season of 2006 and because the wheat responded well in the following year.
The gross margins were positive for all rotations in 2007, with the wheat on wheat rotation being the highest, although this treatment was the most negative in 2006.

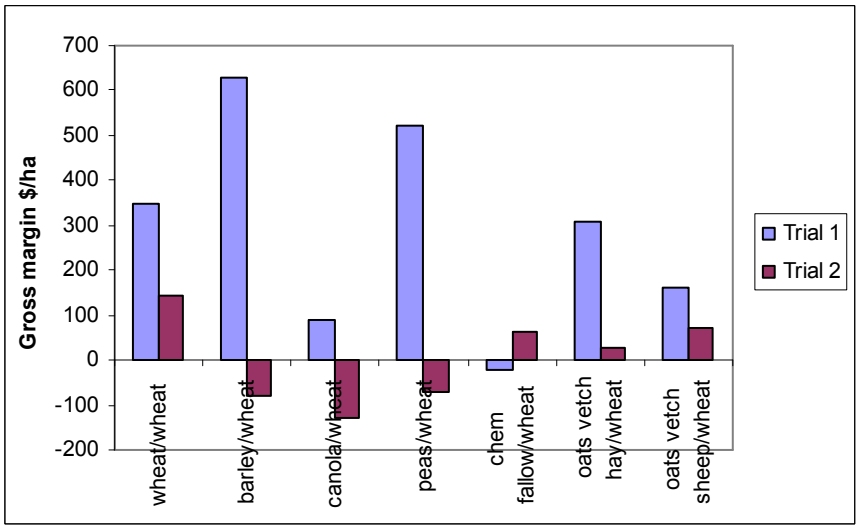

Figure 4. The gross margin response for the 2 year rotation for trial 1 (2005 and 2006) and trial 2 (2006 and 2007) and at the strategic level of nutrition at the Hart fieldsite.

For all levels of nitrogen nutrition the wheat on wheat rotation produced the highest gross margin in both trials. Oats and vetch for hay or grazing also produced positive returns in both seasons, while the chemical fallow also provided a good financial option.
Barley, canola and peas were the most inconsistent options prior to wheat, although the barley and wheat rotation produced the highest total gross margin in trial 1 (Figure 4).

Overall

The main economic finding from this project was that in poorer seasons it did not pay to apply high rates of fertiliser. This caused two problems for economic efficiency:

1) it provided higher costs
2) produced poorer yields and quality, which resulted in poorer gross incomes. In every rotation tested, the high input treatment produced the poorest gross margin.

Oats and vetch for hay or grazing, or chemical fallow were the most reliable break crops. Canola and peas were inconsistent, which aligns with anecdotal grower experiences.

Oats and vetch – Oats and vetch used for either hay or grazing both produced positive gross margins in these poorer seasons and it would be difficult to select one over the other. In the grazing situation if there was an opportunity to spray top the pasture in the spring there is potential for a greater carry over of soil moisture to the following wheat crop.

Fallow - Chemical fallow provides a break crop option for weeds and disease that minimises financial losses and allows for the following wheat crop to provide a positive economic return. While chemical fallow assists in minimising risks the following crop needs to earn significantly higher gross margins for the fallow-wheat to outperform other break crop options and continuous cereals. The farm business also needs to consider the lack of income on the area of fallow during that season.

Oaten hay – this break crop option wasn't a specific treatment in this project, however, the oats and vetch cut for hay was used to represent this crop use. Generally oat crops grown specifically for export hay produce higher dry matter yields compared to oats and vetch. Given that the costs used in this project are similar, the returns are likely to be greater. This would consistently place oaten hay as the most profitable break crop option, even when paying for the use of contractors. However, any rain during hay cutting makes this option very risky and quality downgrading means gross margins can be significantly reduced. Hence, it is only viable on a manageable area.

With the exclusion of chemical fallow there was no significant advantage of a break crop before wheat compared with continuous cereal situation.

The wheat on wheat rotation provided the highest total 2yr gross margin, although within the wheat year of the rotation it was also the most variable. Although the oats and vetch for hay or grazing did not produce the highest total gross margin they were the most reliable options for providing consistent positive returns.

Overall, it is not an effective strategy to be pushing for 100% water use efficiency and maximum grain quality. The careful management of input costs is more likely to have a greater impact on profits compared to grain yield or quality, and minimising losses in the poorer years will provide significant gains.

Farmers wishing to adopt the input levels and rotations indicated as being the best from this trial would also need to consider the impact of machinery requirements, loans, labour and business profitability before making their final decision.

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