Maintaining profitability in retained stubble systems on upper Eyre Peninsula

A joint EPARF and GRDC funded project.

Guideline 12: Economic and risk analysis of break crops compared to continuous wheat farming systems

Background

The Low Rainfall (LR) Crop Sequencing Project commenced in 2011 in field trials at 5 sites across the LR zone of southern eastern Australia.

The aim of this project was to test if one or two year well managed break phases in LR crop sequences would successfully address agronomic constraints, increase the productivity of subsequent cereal crops and most importantly improve the profitability and reduce risk when compared to continuous cereal.
There were 19 crop sequences in each trial site which included both one and two year break phases in 2011 and 2012 followed by three years of wheat from 2013 – 2015. A continuous wheat was also included.

The inclusion of legume crops, pastures and chemical fallow had a significant impact on increasing soil N levels. Rhizoctonia levels also reduced with the breaks, especially where canola was included. Weed seed banks were best controlled with the two-year break.

Cumulative break crop benefits were generally between 0.5–1.5 t/ha in the following wheat year.
One of the key issues with rotational trials is a one off year for a particular crop (either well above or well below average) can affect the outcome on a profit basis.

It was therefore important to take the key findings of the project and analyse the key crop sequences over a range (deciles) of seasons to give a better overall picture of profitability and risk.

Summary of low rainfall crop sequencing work

Including a one or two year break phase in low rainfall paddock rotations can increase profitability over maintaining a continuous wheat cropping sequence. The increase in profitability is due to an increase in yield of between 0.5 t to 1.5 t/ha for the cereal crop following the break. This yield increase is due to lower weed numbers, lower root disease and an increase in nitrogen nutrition.

Break phases that included stock (e.g. medic pastures or vetch) reduced the losses in below average deciles for both season and price.

Where stock was included in the break phases, the profit in the well above average seasons (decile 7-9) was reduced in comparison to continuous cropping.

For break phases that included a grain legume, the grain legume itself must be well suited to the soil types and environment, with profitability at least similar to continuous wheat.

For continuous wheat to maintain profitability, weed numbers and root disease levels need to be contained. To capture the higher profits in above average years requires higher nitrogen inputs at a level that challenges decision making for farmers.

Methodology

The economic analysis was undertaken for 5 of the 19 crop sequences trialled. These sequences were picked to represent different agronomic approaches:

1. Pasture, pasture, wheat, wheat, wheat – self-regenerating pasture, includes stock (PPWWW)
2. Peas, canola, wheat, wheat, wheat (FpCWWW)
3. Vetch, canola, wheat, wheat, wheat – includes stock (VCWWW)
4. Wheat, wheat, wheat, wheat, wheat (CW)
5. Wheat, wheat, wheat, wheat, wheat – reduced nitrogen input (CW (50 urea))

The economic analysis is based on a whole farm gross margin on a per hectare basis which captures income from grain and livestock sales and variable costs such as seed, herbicide and fertiliser inputs. We have also included Machinery ownership costs including depreciation and interest on monies borrowed. Machinery ownership is included due to differing investment requirements between different crop sequences, particularly less machinery investment when stock are included due to less hectares sown to crop. Also included in the analysis is the interest component on monies borrowed for some crop sequences that require more cash to run than others. This analysis has excluded all fixed costs including labour, which were deemed not to alter based on which crop sequence was selected.

The first analysis looked specifically at how each crop sequence performed on a $/ha basis over a range of 5 seasons (decile 1 – well below, decile 3 – below, decile 5 – average, decile 7 – above average and decile 9 – well above average). In this scenario, long term average grain prices were used: Wheat $255/t, Peas $280/t, Canola $490/t, Wool 981 cents clean, Lamb price $3.84/kg net on farm. The grain values were at Port so freight of $37/t was costed in. Important considerations of the analysis also included:

- The stock operation was based on a well-run, self-replacing merino flock running 2.5 DSE/ha.
- Additional feed was costed for the decile 1 & 3 scenarios.
- The yields were based on the loams to clay loams found at the Minnipa site.
- Peas were chosen because it is well suited to these soil types and has consistently been the highest yielding grain legume at Minnipa.

What happened?

A comparison of profitability between crop sequences for each seasonal decile using a fixed average grain price are provided in Figure 1. The above outcomes are the profit on a $/ha basis for the 5 different scenarios.

The analysis confirms that including stock in the farming system can greatly increase farm resilience in below average seasons. For example, in the sequence with two years of pasture (PPWWW), the losses in the below average years (decile 1 & 3) were significantly reduced in comparison to the continuous cropping sequences with the continuous wheat having the greatest losses. This difference in a decile 1 year is $85/ha which over a 2000 hectare program equates to $170,000.

In the above average seasons, the continuous cropped sequences including the continuous wheat (CW) had greater profits than the stock operations, however, nitrogen inputs in the CW scenario were based on those required to drive the yields (i.e. in the decile 9 year the continuous wheat sequence has 90 kg urea applied). If nitrogen inputs are capped (i.e no more than 50 kg urea applied as in CW (50 urea)), then the continuous cropping system is not able to capture this profit advantage in favourable seasons.

Interestingly, the break crop rotation slightly reduced risk in below average years compared to continuous wheat. Provided that a well suited grain legume was grown (i.e. peas) the losses were half that of continuous wheat in the decile 1 year but maintained the upside in the decile 9 year. However, this well suited continuous cropping sequence still had higher losses than when sheep were included.

Where vetch was included and grazed the losses in the below average years were less than the continuous crop sequences but greater than the pasture scenario. It does indicate the higher cost of pasture establishment when compared with a self-regenerating pasture.

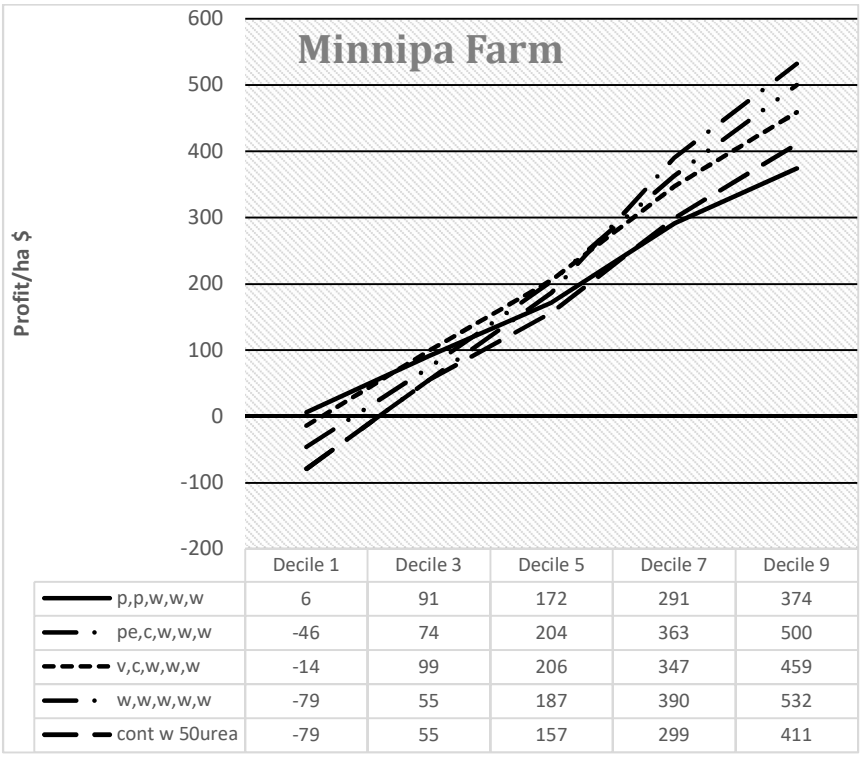

Figure 1. Comparison of profitability between each of five crop sequences for five seasonal decile scenarios (deciles 1,3,5,7,9) using a fixed average price.

Table 1. Commodity prices for different deciles.

	Decile1	Decile 3	Decile 5	Decile 7	Decile 9
Wheat $/t	162	207	255	279	312
Peas $/t	220	240	300	360	450
Canola $/t	350	418	490	530	605
Wool cents/kg clean	734	846	981	1151	1315
Lambs $/kg	2.61	4.28	4.76	5.20	5.32

Two of the crop sequences (PPWWW Fig 2. and WWWWW Fig. 3) were evaluated for season and price.

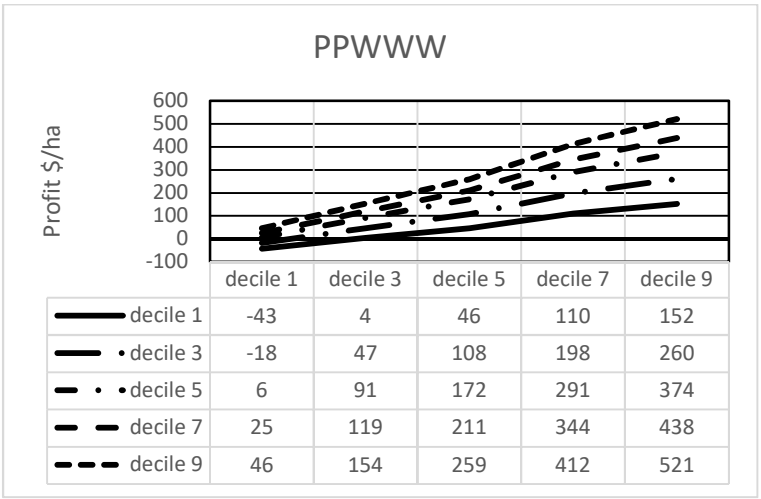

Figure 2. PPWWW season x price interaction.

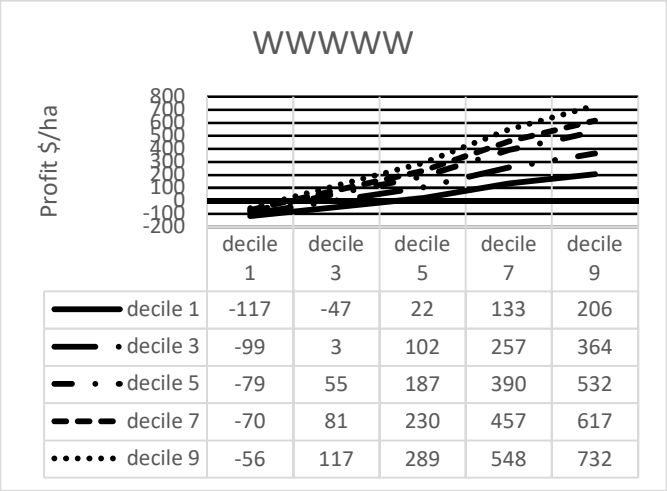

Figure 3. WWWWW season x price interaction.

With both season and price considered the WWWW is still showing more negative whole farm gross margins compared with the PPWWW. To further this analysis it is important to understand whether season or price has the greatest effect on profit. A comparison was then done for the two crop sequences (Figure 4. PPWWW and Figure 5. WWWWW).

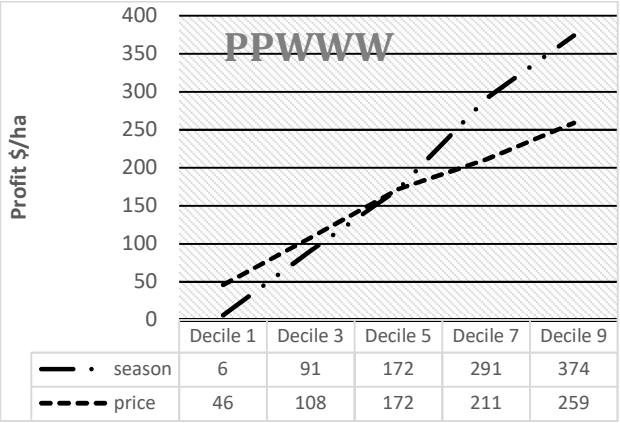

Figure 4. PPWWW decile season vs decile pricing.

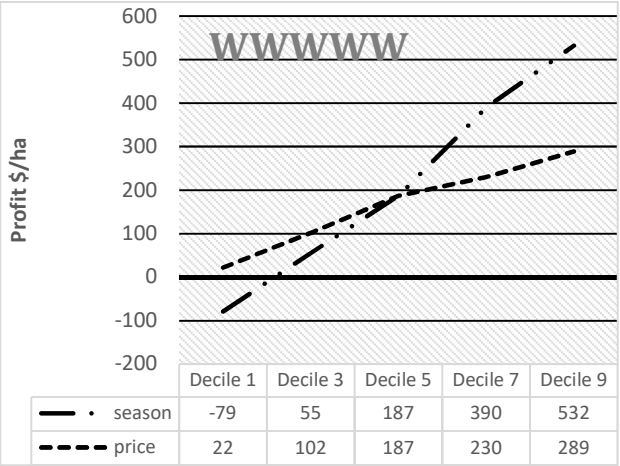

Figure 5. WWWWW decile season vs decile pricing.

With both crop sequences the range of season (deciles) had a far greater effect on whole farm gross margin then a range of prices. For this example it is more important to be able to manage below average seasons.

Summary

Sheep included in a crop sequence will reduce losses in below average seasons but not capture all the upside in above average seasons. This is the least risky option.

Including a two year break with a well-adapted grain legume will reduce the losses in the below average seasons compared to the continuous wheat and also capture all the upside in the above average seasons. This is a reduced risk option.

Continuous wheat can generate good profits in above average seasons as long as appropriate nitrogen inputs are applied but has the greatest losses in the below average years. This is a risky option.

Continuous wheat with lower nitrogen input was also investigated. The maximum urea rate was 50 kg/ha. The outcome was the losses were the same as the normal continuous wheat in below average seasons but the profits in the above average seasons were reduced close to the pasture, pasture, wheat, wheat, wheat sequence because yields were limited by N.

The continuous wheat with less N input becomes the highest risk option.

Practical farmer decision making

Crop sequences that require more in season N decision making are more complex to operate than those that have less.

Where either pastures (pasture legumes) or grain legumes are included the natural N received from these will drive some of the yield without additional N applied. The 2-year pasture has greater residual N that a one-year pea which is greater than continuous wheat.

The inability to capture upside based on artificial N in the continuous wheat is a real issue. Consider the following:

1. Most N is applied before mid-August
2. Most N responses in the low rainfall environment are best when applied early
3. Many above average seasons are due to September/October rainfall, often outside the timing for post emergent N in the low rainfall areas.
4. If you overcome a production issue in the perceived above average scenario by applying higher rates early, there is a high chance you may not get a response if the season is only average or below. This approach increases costs and therefore increases risk in the below average years.

Practically, continuous wheat has had problems with grass weed issues and artificial N efficacy, especially on the lighter soil types as well as root disease issues. The sensitivity of this scenario is indicated by where urea input was capped at 50 kg/ha and its effect on both profit and risk.

A well-adapted grain legume in the rotation combined with a double break (canola) has given good profits and a reasonable risk position. The success of these breaks is critical for this outcome. Issues that need to be considered are; frost (especially for peas), soil type variation on the farm (affect consistency of yield), and disease.

The pasture scenario with stock gives the most consistent profit and the least risk.

Produced by Ed Hunt, February 2018

Acknowledgements

Michael Moodie, Moodie Agronomy

References

1. Ag Price Guide http://agprice.grainandgraze3.com.au/