

# Economics of Crop Rotations in Medium Rainfall WA

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## Key messages

- All paddocks measured by the profitable crop and pasture rotations project were profitable over the 4 year period returning an average gross margin of \$235/ha/yr
- Rotations which have heavy cereal components, 3 or more years being either wheat or barley were consistently among the most profitable
- Current rotations rely heavily on 4 primary crops (Wheat, Barley, Canola, Lupins) in addition to Pasture with 96% of paddock use over the four years (2010-2013) being one of these 5 options.

## Aim

This paper aims to identify the profitability of current crop and pasture rotations in medium rainfall WA, and the economics behind these results.

## Introduction

The focus paddocks project is currently monitoring approximately 184 paddocks across the wheatbelt, the majority of which are situated in the medium rainfall zone. These paddocks, and the rotations being used on them have been assessed on gross margin performance over the past 4 years in addition to the monitoring of a combination of weed, disease and bio-physical attributes.

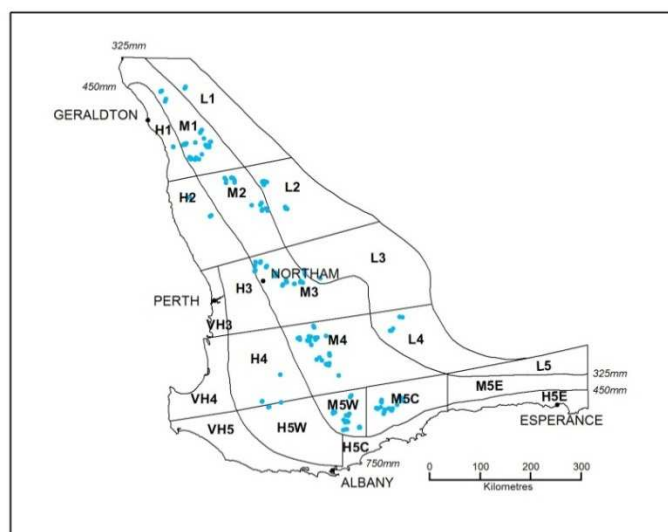


Figure 1: Focus Paddock locations

After 4 years of data there are insufficient rotations of exact same order to allow for reliable statistical inferences to be made, due to this all rotations were assessed based on their composition rather than order, ie Wheat, Wheat, Canola, Wheat, was grouped with Wheat Canola Wheat Wheat.

## Assumptions

It is assumed that any crop other than Wheat is the break-crop in the data collected for the focus paddock project, whilst this is the most common scenario in broadacre cropping in Western Australia, strong canola prices over this period have seen a number of rotations heavily feature this crop. In situations where Canola profitability outstrips cereals, wheat may actually be the disease control break for a canola cash crop, rather than the other way around.

Due to timeframe this study is assuming that the rotations over the 4 years are repeated, which in a number of cases is almost certainly incorrect, specifically those who switch between long term pasture and long term crop rotation over a 10 year period.

Although this flaw exists there is still considerable value in identifying whether there are any underlying weaknesses in the 4 year rotations identified. It is also assumed that the choices are either a crop or pasture and that there was no in season grazing of crops. Paddocks which were scratched in to crops such as oats and then grazed were classed as pasture.

## Data

It is important to note that the rotations being assessed in this are not being judged on average prices, but on the actual input, crop and livestock prices that were applicable in each of the 4 years. It is also important to remember that the wheat price over the past 4 years has largely hovered between \$250 and \$350/t, with the average price from September 2010 to September 2013 being \$306/t. Canola has had similarly strong prices averaging around \$550/t for the last 4 years. These prices are significantly higher than the long term average and as thus may not be indicative of the expected performance in another set of 4 years, likewise livestock prices have varied significantly over the same period with future projections suggesting prices that will be higher on average than those experienced over the last 4 years.

## Results

All paddocks monitored in the focus paddocks project returned positive gross margins over the 4 year period. Whilst there was a significant range of results, 50% of the paddocks returned gross margins of between \$175/ha/yr and \$315/ha/yr.

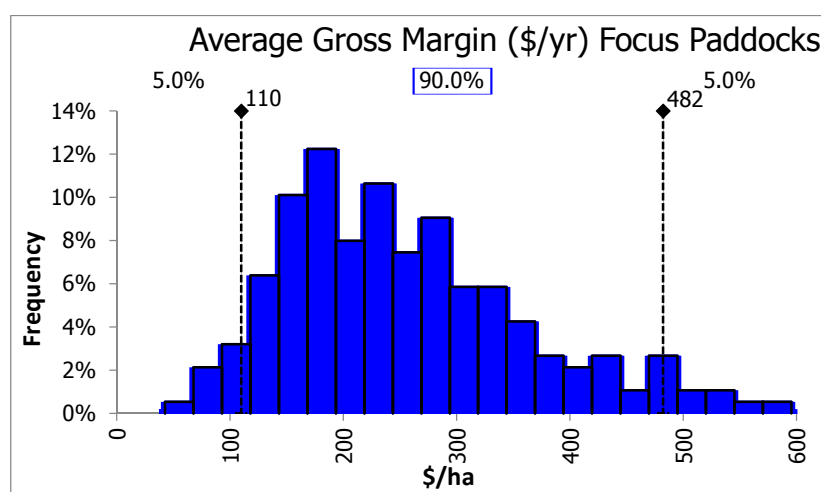


Figure 2: Distribution of Focus Paddock Gross Margins

The data was grouped based on the rainfall zones as defined in Figure 1, with L1,(1) and H1 (1) as well as L2 (6) and H2 (4) paddocks merged into the datasets for M1 and M2 respectively. As illustrated in Figure 1 the majority of these paddocks merged into the zones are not vastly geographically separated.

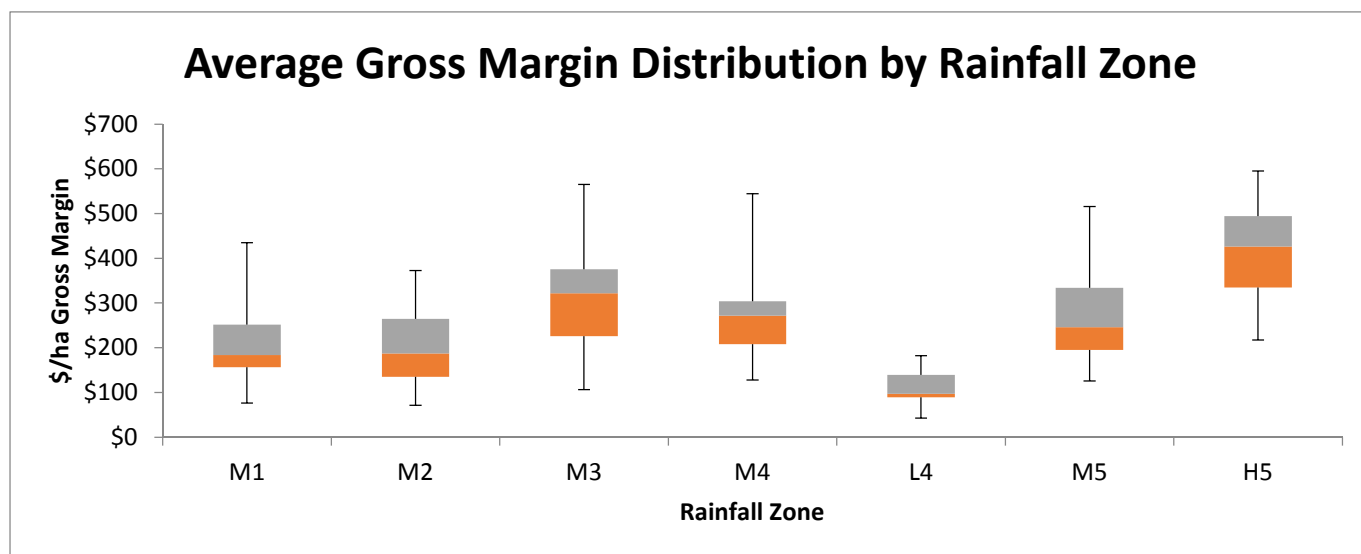


Figure 3: Box plot diagrams of Gross Margin Distributions by Rainfall Zone

There are 2 primary outliers in this data (Figure 2) with the L4 region averaging significantly lower than the rest of the predominantly medium rainfall sample, largely a result of being in a lower yielding environment, and the H5 region, on

the back of impressive results in 2011, 2012 and 2013, generating higher returns than the majority of samples in the dataset.

## Yields

A major factor driving this gross margin performance is yield achieved, and whilst barley and wheat did show higher variability in yield compared to Lupins or Canola, a significant portion of this variability was due to high upper end yields achieved.

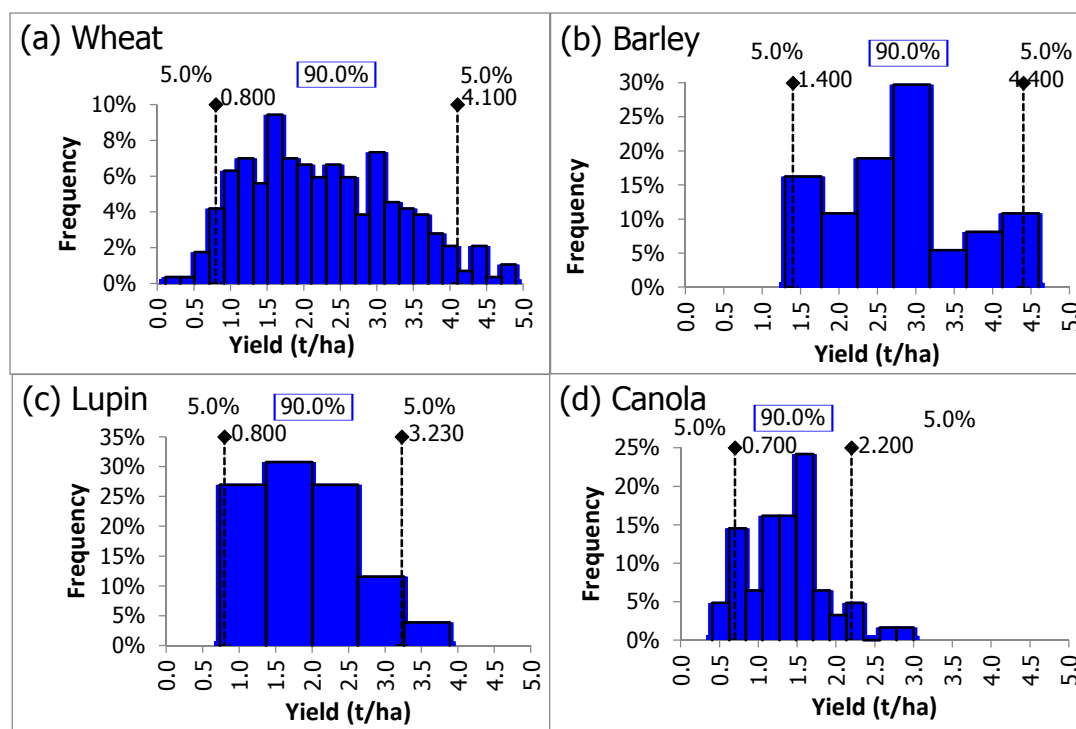


Figure 4:Yield Distribution by Crop Species in Focus Paddocks

Of the 7 regions identified in Figure 3, one had highest gross margin from a rotation of Wheat Canola Wheat Canola, whilst for the remainder of the regions the highest gross margins were generated by some combination of 3 years Wheat and/or Barley and 1 year of Canola.

Interestingly, in the majority of cases there were only minor differences between the gross margin returns of the best performing sequence and the second and third best rotations. For example in rainfall zone M2 a combination of 3 years wheat and 1 year of canola (in any order) averaged the highest return at \$340/ha/yr, whilst the second best combination of continuous wheat, averaged \$320/ha/yr gross margin. This small level of variation could easily be accounted for by better marketing, different chemical or fertiliser prices or any number of other factors not directly related to the rotations themselves.

Whilst Lupins did not feature in the most profitable rotation in any of the regions, it still did make a number of appearances in the 2<sup>nd</sup> and 3<sup>rd</sup> placed rotations, particularly in the northern paddocks (H1 and M1). Equally whilst Pasture did not feature in any of the most profitable rotations it did make a number of appearances in the top 3 for paddocks in the south of the state.

It is worth noting that with the record grain producing seasons contained in the dataset, 2011 in the North and 2013 in the South, it is logical that cropping would appear more profitable than pasture over this 4 year sample.

## Costs

The distribution of chemical costs were not vastly different by crop species, with the majority falling within a very similar range. The exception to this was pasture which had a significant number of paddocks where chemical costs were between \$0 and \$20/ha, i.e. used as a very low cost break option.

Similarly fertiliser costs for cereals and canola follow fairly similar cost distributions, with \$30 to \$100/ha covering a significant portion of results with a normal distribution. Lupins and pasture by contrast are heavily weighted towards lower fertiliser costs with over half of the results for both being between \$0-\$20/ha.

These combined facts suggest that pastures overall were not being managed for peak productivity, with very low fertiliser and chemical usage associated with the choice. The implication arising from this is the potential for profitability improvements on the basis of more productive pasture management.

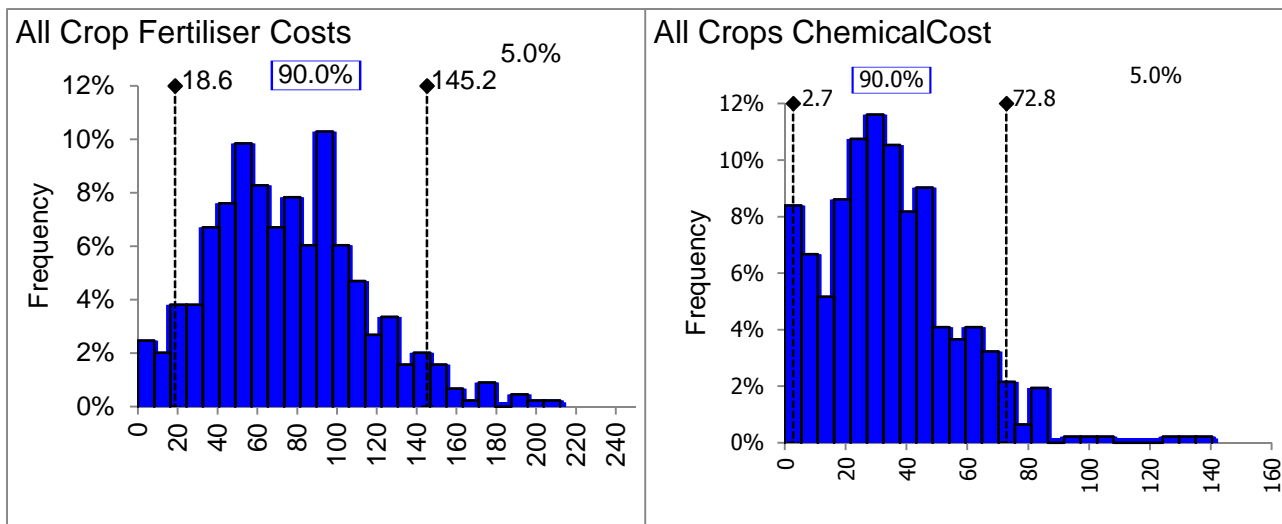


Figure 5: Distribution of Fertiliser and Chemical costs across focus paddocks

### Break Crop Drivers

Perhaps one of the more interesting findings was the lack of any strong correlation between weed or disease numbers and the choice of break crop the following season. However further investigation of the data suggests that this is due to the very low level of disease or weed burden across the focus paddocks sample. Despite a number of large outliers, which are quickly brought under control the following years, 75% of paddocks have weed numbers below 20 plants per m<sup>2</sup>, whilst 50% of paddocks were below 5 weeds per m<sup>2</sup>.

Likewise 90% of paddocks surveyed had either no detectable or very low levels of disease, and in general remained fairly constant over the 4 years of monitoring. However, detection rates of root lesion nematodes increased over the 4 years, which may threaten canola's increasingly dominant position as break crop of choice.

### Conclusion

The data gathered in the focus paddocks project suggests that farm businesses in the medium rainfall zone are currently generating strong gross margins. There is a strong reliance on 4 primary crops, and pasture, with 96% of paddocks in the sample using one of these options, however it appears that these rotations are currently able to keep disease and weed pressures under control.

Despite canola increasingly becoming the break crop of choice for many in Western Australia, strong returns were generated by a large variety of crop rotations, both with and without canola. Pastures appear to have room for improvement with extremely low fertiliser and chemical usage currently.

**Key words**

Crop Rotations, Gross Margins, Focus Paddocks, Medium Rainfall WA

**Acknowledgments**

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