MALLEE AND WIMMERA RAINFALL- Are we making the most of it?

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The aim of this study was to extend work carried out in 2003 *(converting rainfall into dollars)* and investigate the effect of rainfall on farm gross income in the southern Mallee and Wimmera.

Summary

- Crop Year Rainfall (November-October) is contributing up to 61% of variability in gross income received by farmers in southern Mallee but only 23% of variability in the Wimmera. Why? : high rainfall years (1993, 95, 96) were difficult years for Wimmera farmers and they were generally unable to take full opportunity of the rainfall received.
- In the southern Mallee the first 100mm of rainfall received from November, and for the Wimmera the first 200mm of rainfall generated no income.
- Southern Mallee farmers should be achieving a benchmark of $180 gross income per 100mm of rainfall (after the first 100mm).
- Wimmera farmers should be achieving $430 of gross income per 100mm (after the first 200mm)

Background

Much emphasis is placed on the contribution of rainfall to the success of a cropping season. The question is: How much is rainfall contributing to the gross income generated by our cropping enterprise and how much is gross income affected by other factors such as time of sowing, crop choice or weed management? In the quest for optimum efficiency in any enterprise, the implementation of best practice is vital. The ultimate aim is to ensure that the only factors that influence variability in income are those aspects beyond our control such as rainfall. In the absence of best management practice, rainfall may only be a small contributor to variability of income in our cropping enterprise.

In 2003, the BCG-WFS undertook an analysis of 12 years of rainfall and production data from two farms in the Birchip region to determine a benchmark for how rainfall affects cropping gross income. The two farms chosen for the study were considered to be very well run operations, where best management practices have been a goal of the farming business for a long time.

The study showed up to 80% of variability in gross income received was attributed to cropping year rainfall (November to October), leaving the remaining 20% of variability explained by other factors.

The study was extended in 2004 to include 7 farms from the southern Mallee and 4 farms from the Wimmera to determine if the above benchmarks held true for other farming situations.

Method

Rainfall and production data for a 11 year period from 1993-2003 was collected from seven southern Mallee farms and 4 Wimmera farms. For each year, the gross income generated from all crops grown was used to determine a gross income per cropped hectare. This yearly gross income value was then analysed in relation to the collected rainfall data. Commodity prices at harvest for each season were used to determine gross income in order to exclude the effect of different marketing strategies used by each farm business.

The influence of rainfall, during each of the following periods, on gross income was determined:

- Cropping Year rainfall (November to October) (CYR)
- Growing Season Rainfall (April to October) (GSR)
- Summer (November to March)
- Autumn Rainfall (April to May)
- Winter Rainfall (June to August)
- Spring Rainfall (September to October)

Individual farm data was aggregated in order to determine if there were any regional patterns present.

Results

Southern Mallee

A reasonably strong relationship was found between CYR (Cropping Year Rainfall) (R^2=61%) and GSR (Growing Season Rainfall) (R^2=63%) and income (Figure 1).

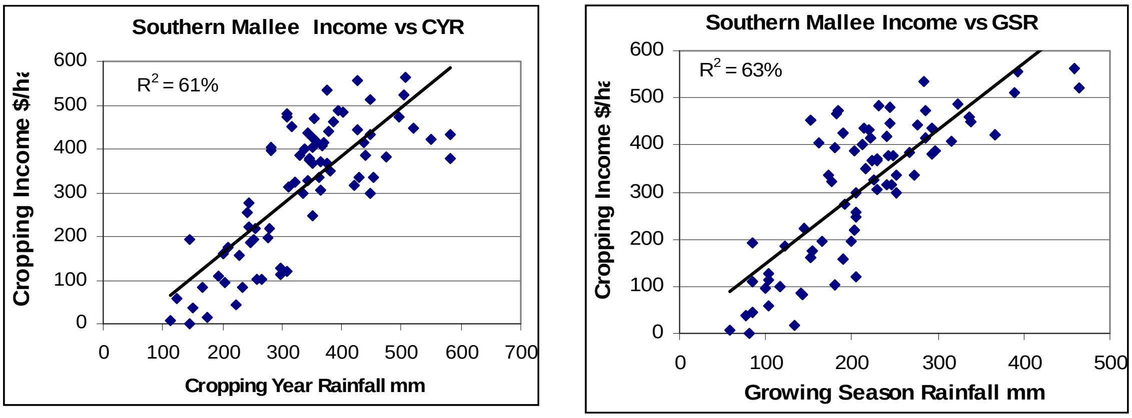


Figure 1. Southern Mallee CYR and GSR vs Gross Cropping Income for 1993-2003.

The remaining variability in gross income received from cropping in the above cases is a result of influences other than rainfall (rainfall used in this study is as total amounts for each rainfall period – rainfall distribution etc could also play a role). The aggregated data for the seven farms showed a slightly weaker relationship for CYR and gross income than the two farms from the 2003 study. This means that factors other than rainfall were contributing more to the variability in gross income.

Analysis of discrete rainfall periods to identify whether any particular period influences gross income more than another, revealed that summer rainfall explained less than 23% of gross income variability across the farms analysed in the southern Mallee (Table1).

Table 1. R^2 values as % for gross income vs discrete rainfall periods in the Southern Mallee

Farm	CY Rain	Summer Rain	Autumn Rain	Winter Rain	Spring Rain
1	67	8	20	77	54
2	79	20	14	59	43
3	56	2	13	58	46
4	67	23	14	50	15
5	50	9	22	40	12
6	67	13	14	57	30
7	72	2	14	78	29

For all Southern mallee farms, autumn rain explained between 12 and 22% of variability in gross income. Winter rainfall for all farms explained between 40 and 78% of gross income received. Spring rainfall on individual farms explained between 12 and 54% of variability in gross income achieved (Table 1).

Wimmera

The aggregated farm data for the four Wimmera farms (Figure 2) showed a very weak relationship between CYR with only 23% of variability in gross income attributable to yearly rainfall. The relationship for Growing Season Rainfall to cropping income was 37%.

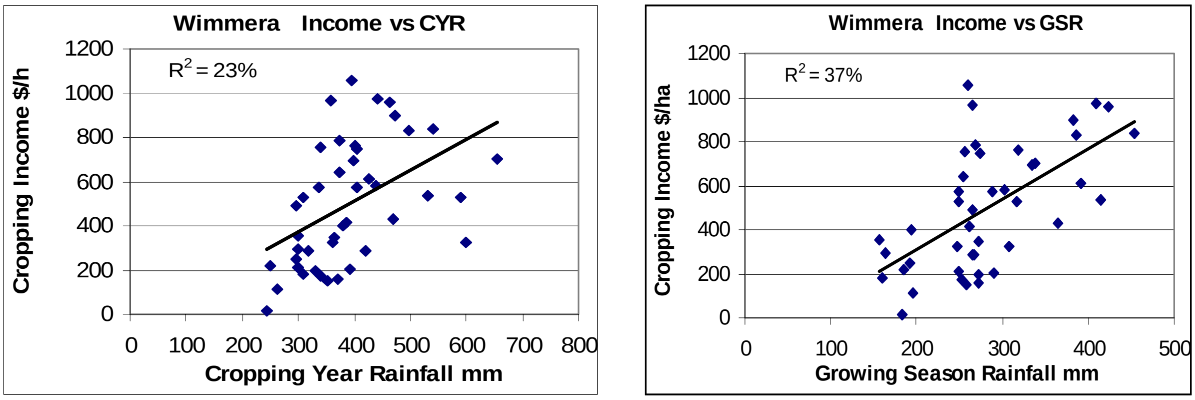


Figure 2. Wimmera CYR and GSR vs Cropping Gross Income for 1993-2003.

The aggregated Wimmera data showed a much weaker relationship between rainfall and gross income than the Southern Mallee.

The discrete rainfall analysis for Wimmera highlighted summer rainfall explaining almost no variability in gross income received. Autumn rainfall explained less than 10% of variability on the Wimmera farms. Winter rainfall explained between 20-62% of gross income variability, and Spring rainfall explained between 8-21% of income variability (Table 2).

Table 2. R^2 values for gross income vs discrete rainfall periods in the Wimmera

Farm	CY Rain	Summer Rain	Autumn Rain	Winter Rain	Spring Rain
1	38	0.5	10	62	8
2	27	2	0.5	20	21
3	35	4	0.3	36	11
4	56	1	5	52	15

Interpretation

Consistent with findings in 2003, Cropping Year Rainfall and Growing Season Rainfall in the Southern Mallee has had a large influence on cropping income over the past 11 years. 61% of the gross income variability could be explained by rainfall occurring between November and October.

This relationship was much weaker for Wimmera farms where Cropping Year Rainfall only explained 23% of cropping income variability. This means that over the last 11 years rainfall has had much less influence over income generated in the Wimmera than perhaps we would have thought.

Why such a difference between the southern Mallee and the Wimmera in relation to how rainfall is influencing income?

One reason could be the incidence of frost. Over the last 11 years the Wimmera has experienced a number of severe frosts that have impacted directly on yield and ultimate income received. The frost in 1998 wiped out much of Wimmera's production potential. Less severe frosts have occurred in 2001-2003, but none the less would have reduced production potential. The extensive use of pulse crops, which are susceptible to frost, would potentially have exacerbated the financial impact. Pulse crops also require rain in the Spring to perform well.

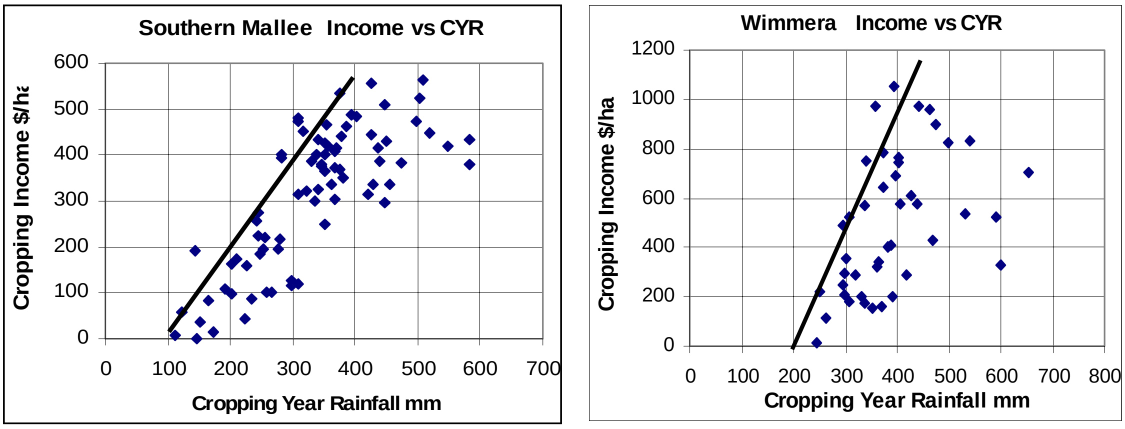
In 1993 the Wimmera also experienced a mouse plague which reduced crop potential.

Gross income in 1993 was also impacted upon by very low cereal prices. In the southern Mallee, Barley was priced at $50/t. $50 being well below the cost of production. Pulse commodity prices have been subject to massive price swings over the last 11 years. Therefore the gross income received was well below long term average prices. In the Wimmera, the wet finish to the season resulted in poor quality grain which further impacted on grain prices.

Soil type must also be considered when analysing these results generally Wimmera soils need more water than Mallee soils to grow a good crop. Although Wimmera clay soils have a very high water holding capacity and generally have low subsoil constraints it is the case that these clays have a much higher Crop Lower Limit (also known as Wilting Point). This means that once the soils are dry, (as they are currently following 8 dry seasons) Wimmera clay soil need more water compared to a Mallee clay loam to produce the same amount of grain. In the Wimmera, most of the years with high rainfall (1993, 1995 and 1996) produced grain at much less efficiency compared to the drier seasons.

Additional information

The Income versus Rainfall data can also be used to determine benchmarks of production income (Figure 3).



$WUE=$180 in crop income / 100mm of rainfall (after allowing for the first 100mm of rain)

$WUE=$430 in crop income / 100mm of rainfall (after allowing for the first 200mm of rain)

Figure 3. Benchmarks of cropping income for the Southern Mallee and Wimmera.

For the seven farms in the southern Mallee no income was generated from the first 100mm but after that every 100mm achieved a gross income of $180/cropped ha. Thus given an average year rainfall of 375mm a gross cropping income of $495/ha should be achievable for southern Mallee farmers. This benchmark is termed $WUE (Dollar Water Use Efficiency) and is a calculation of dollars earned per mm of rainfall.

Benchmarks generated by O'Callaghan Rural Management (ORM) suggest the average cost per cropped ha exclusive of labour is between $200 and $250/ha for Southern Mallee farms. Birchip farms in an average rainfall year should be aiming to achieve a profit of $245 to $295/cropped ha. If land purchases are to be made, this profit figure can be used to calculate how much land is worth, depending over how many years you are willing to pay the land off.

If the breakeven cost of production based on ORM data is between $200 and $250 then an annual rainfall of at least 250mm is required to achieve this point. Over the last 100 years of rainfall, there have been 16 years where annual rainfall has been less than 250mm. Hence in 16% of years it is difficult to achieve a breakeven return on costs when farming in the Southern Mallee.

In the Wimmera no income was generated from the first 200mm of rainfall however after that for every 100mm after that gross income of between $430 of gross income could be achieved. As an example, Rupanyup's average annual rainfall is 425mm. Rupanyup farms should be aiming to achieve $970/cropped ha in an average rainfall year.