Converting rainfall into dollars!

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The aim of this study was to investigate the effect of rainfall on farm gross income in the southern Mallee.

Summary:

- A benchmark of cropping income of $275/ha or $100-120 income per 100mm rainfall was derived from an analysis of the performance of two Birchip farms over 12 years.
- Up to 80% of variability in gross income can attributed to annual rainfall

Background

Much emphasis is placed on the contribution of rainfall to the success of a cropping season, so much so that the weather forecast can command silence in any farmer's presence, when on the radio or TV! The question is: How much is rainfall contributing to the cash flow generated by our cropping enterprise and how much is cash flow 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 management 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 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 are considered to be very well-run operations, where best management practices have been a goal of the farming business for a long time.

During the study, it was felt that if rainfall did account for a large proportion of the variability in cash income from year to year on these two farms, perhaps there was an opportunity to link such cash income to a particular period of rainfall, whether it be summer, autumn, winter or spring.

Method

Rainfall and production data for the 12-year period 1991 to 2002 was collected from two Birchip near- to best-district 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. The same analysis was repeated for wheat as a single commodity. Wheat was chosen as it is the most commonly grown commodity on each farm and would have been part of each rotation in each year of the study.

The various rainfall periods compared were;

- growing season (GSR) (April-October)
- cropping year (Nov-October)
- summer (Nov-March)
- autumn (April-May)

- winter (June-August)
- spring (September-October)

Economic analysis was undertaken to determine gross income achieved per hectare, per mm of rainfall on both farms.

Results

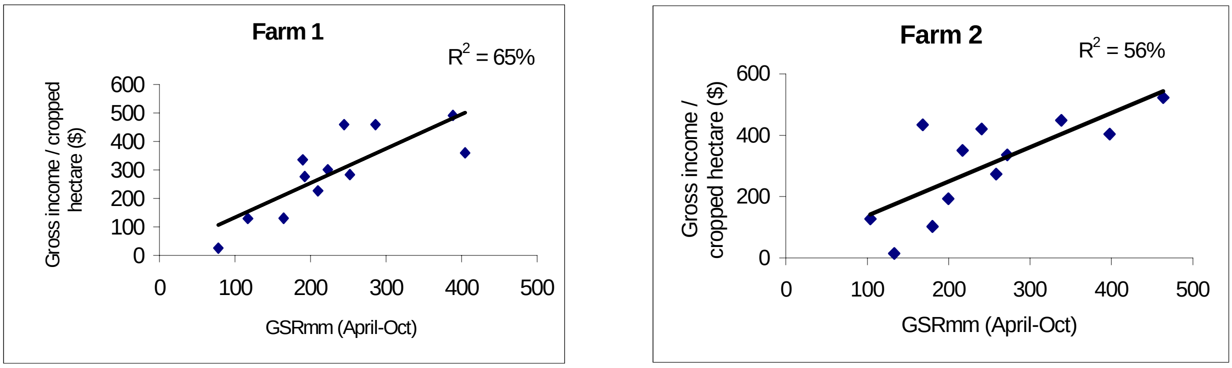


Figure 1. Gross income per cropped hectare vs growing season rainfall (April-Oct) for Farms 1 & 2 (1991-2002).

For both Farms 1 and 2, a strong relationship exists between GSR and gross income per hectare. Based on the management decisions and strategies implemented over the last 12 years, 65% of the variability in gross income was attributed to the rainfall between April and October for Farm 1. For Farm 2 this figure was 56%. The remaining variability in income received in these two cases is a result of influences other than rainfall.

The influence of cropping year rainfall (Nov-Oct) was then assessed. This showed an even stronger relationship, explaining more of the variability in gross income (see Figure 2).

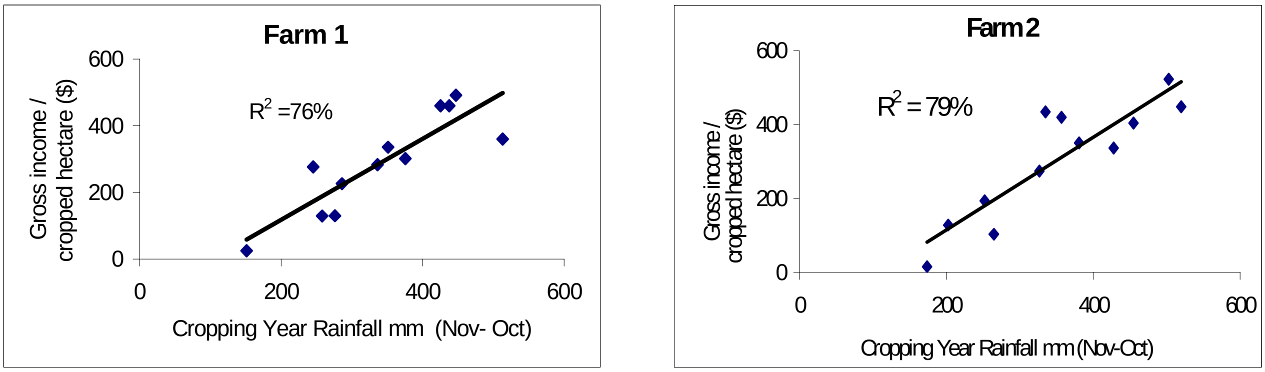


Figure 2. Gross income per cropped hectare vs cropping year rainfall (Nov- Oct), 1991-2002.

In the above, 75-80% of the variation in gross income was accounted for by cropping year rainfall. This means that for these two farms, only 20% of variability in gross income resulted from other management factors such as time of sowing.

For both farms, it was determined that the first 100mm received each year generated no income. This is the point where the regression line would intersect the x axis (see figure 2). Interestingly, this intercept adheres very closely to the French & Shultz theory that for wheat and barley the total evaporation is110mm and 90mm respectively. Every 100mm thereafter contributed between $100 and $120 of gross income per hectare.

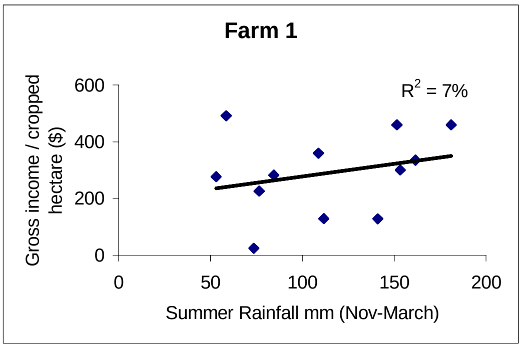
The same analysis was completed for wheat only and the relationship was equally as strong (see table 1). As the cropping rotation for both farms is predominantly cereals, the close relationship is not surprising.

Table 1. Wheat analysis- R^2 for GSR and CYR.

Rainfall Period	Farm 1 (R^2= %)	Farm 2 (R^2= %)
Growing Season Rainfall (GSR)	58%	65%
Cropping Year Rainfall (CYR)	80%	86%

Having determined that rainfall in these two farming situations is a major influence on their whole farms cropping cash flow we then investigated the influence of individual rainfall periods.

Summer Rainfall



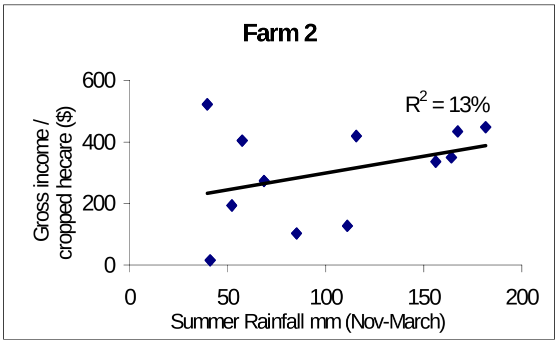
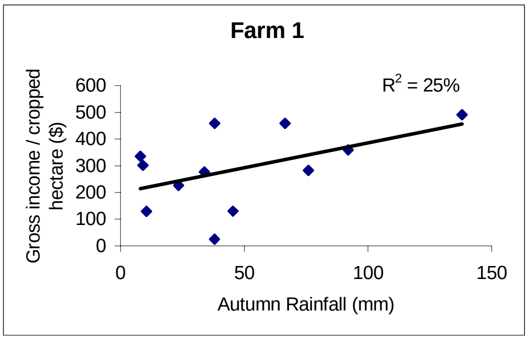


Figure 3. Gross income per cropped hectare vs summer rainfall (Nov-March), 1991- 2002 (note Farm 2 has R^2 of 0.13).

Autumn Rainfall



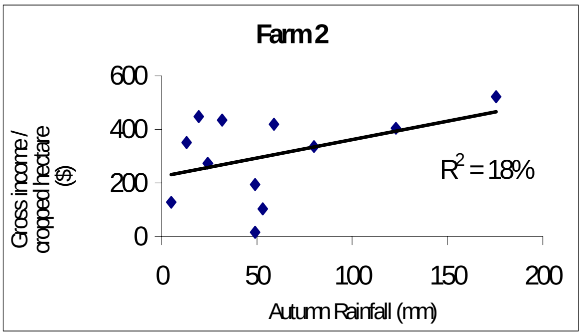
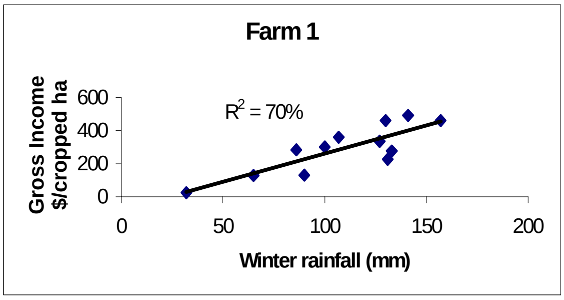


Figure 4. Gross income per cropped hectare vs autumn rainfall (April to May) (note the R^2).

Winter Rainfall



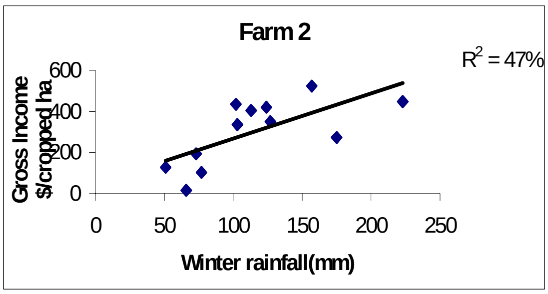


Figure 5. Gross income per cropped hectare vs winter rainfall (June to August).

Spring Rainfall

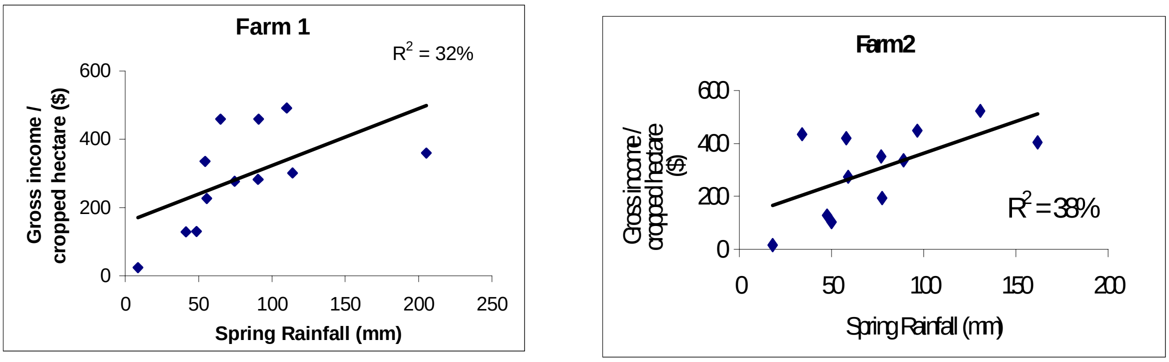


Figure 6. Gross income per cropped hectare vs spring rainfall.

Interpretation

On the two farms used for this investigation, cropping year rainfall (November to October) had a very large influence on gross income. It appears that summer rain, autumn rain and spring rain as stand alone events do not have much influence on gross income (exception being winter rainfall at Farm 1). The real drivers of income are growing season rainfall and crop year income.

The single factor of crop year rainfall explained around 80% of the yearly variation in gross income. In fact, the relationship between rainfall and gross cropping income is so large that other management factors (time of sowing, nutrition, weed control etc) are only contributing 20% of the variability.

As well-run operations, it is likely that the relationship between crop yearly rainfall and gross income (the regression equation ie. $100 to $120 return per 100mm of rainfall) for these two farms is a benchmark for gross income per hectare.

Birchip's yearly average rainfall is around 375mm, some of which will be used by the current year's crop and some not until the following crop. Given the relationship between gross incomes per mm of rainfall in an average year, Birchip farms should be achieving $275 of gross income per cropped hectare.

Of course gross income is only part of the story of a farm's profitability, but income is the first essential ingredient of profit. Only a detailed analysis of farm costs and income will be able to determine the profitability of a farming enterprise. Current benchmarks generated by O'Callaghan Rural Management suggest the average cost per cropped hectare exclusive of labour is about $200/hectare. In an average rainfall year, Birchip farms should then be aiming to achieve a profit of $75/cropped hectare.

This analysis could then be used to determine optimum scale at which a farm needs to be operating. For example, based on an average year in terms of rainfall for a two family enterprise both targeting a salary of $50,000 each, the minimum amount of land that they can be cropping on an annual basis is about 1350 hectares. Assuming a 65% cropping intensity this would mean they would have to be farming at about 2100ha.

Farmers should be able to use the above benchmark to compare how they are performing in an average year. Where a farm's CYR accounts for less than 50% of gross income variability, we should investigate all management practices within the farmer's control and ask the question - what aspect of management should be improved?