Economic benefits of climate risk management

Melissa Truscott

South Australian Research and Development Institute, GPO Box 397, Adelaide SA 5001.
www.sardi.sa.gov.au Email truscott.melissa@saugov.sa.gov.au

Abstract

Seasonal variability causes large variations in grain production percentages. In fact some low rainfall croppers make 80% of their profit from the best 3 years in 10 and the worst 3 years in 10 they make a loss.

Some producers have been using the tools and services (developed or promoted by SARDI) to maximise opportunities in good seasons and minimise losses in bad seasons. Tools which look at relationships between early season rainfall, final wheat yield, growing season rainfall and the Southern Oscillation Index, have been effective in illustrating opportunities and risks in the coming season. Some of these tools relate to individual properties, using property specific rainfall.

Grain growers have developed indexes using such tools and services to assist them with management decisions. These decisions include adjustment to crop area, variety, type, inputs and sowing date. This has helped grain growers maximise profits in good years and minimise losses in poor years, increasing long term profitability and productivity.

SARDI deliver climate risk management workshops to grain growers and other primary producers. These workshops explain the outputs of tools and services and the potential for application of these to their property to assist with management decisions.

Keywords

wheat, yield, rainfall, risk, tools, services.

Introduction

The timing and amount of early season rainfall has been identified as the most important climatic factor influencing farm management decisions (Abrecht, et. al, 1996). Early season rainfall has proven to be a useful tool for predicting the likely yield outcomes for individual seasons on individual properties, in many districts of SA.

Some climate risk management tools and services look at the relationship between early season rainfall and final wheat yield and the SOI. The outputs of these tools have been delivered by SARDI in a timely manner to grain growers, to assist their farm management decisions.

One particular tool developed by SARDI is the SOWHAT program. This uses Microsoft Excel to calculate the relationships between early season rainfall and final wheat yield. It is property specific using farmer rainfall.

Grain growers have used the outputs of early season rainfall in conjunction with other tools such as the Southern Oscillation Index (SOI) to develop an index for crop management decisions. These decisions include adjustment to crop area, variety and crop inputs. These decisions have had an economic benefit to grain growers.

Materials/methods

The SOWHAT program was utilised to look at the relationship between early season rainfall and final wheat yield on 70 individual properties. It is an excel spreadsheet, developed by SARDI, that illustrates the relationship between early season rainfall on final yield, and the probabilities of producing an above average or profitable wheat crop on individual properties. Individual grain growers are asked to post SARDI their daily rainfall for the last 25 years, average wheat paddock yields (in tonnes/hectare), and best paddock yields. This information is entered into spreadsheets and formulas are applied.

The outputs include a totals page, which gives a summary of all the data entered including; long term average rainfall and yield, correlations with yield (r values) for each period of rainfall, potential yield, best paddock yield as a percentage of potential yield and long term trends expressed as rolling 5 and 10 year averages.

A series of graphs plot the early season rainfall against yield. These give an indication to the probability of achieving an above or below average yield at fortnightly stages from the beginning of April through to the end of June. From these a rainfall “cut-off” can be determined. This illustrates when yields are most likely to be above and in most cases below the average (Balston and Egan, 1996).

SARDI run climate risk management workshops to assist growers in their understanding and application of appropriate the SOWHAT program and other tools and services.

Results/Discussion/Conclusions

The SOWHAT program has been utilised to look at the relationship between early season rainfall and final wheat yield on 70 individual properties and has found useful relationships which indicate the opportunities for above average wheat yields.

Figure 1 shows the January to March rainfall compared to final wheat yield for a farmer at Carrieton in the Upper North of SA. His average yield is 1.3 t/ha. It shows that when the rainfall for January to March is greater than 120mm, then all of his yields have been above average. This has occurred in 14 % of years. We believe this relationship is attributed to nitrogen mineralisation, the ability to control weeds earlier and contribution to stored soil water.

Figure 2 shows the April 1st to 15th rainfall compared to final wheat yield for a farmer at Booleroo in the Upper North of SA. His average yield is 1.5 t/ha. It shows that when the rainfall for April 1st - 15th is greater than 12mm, then 100% of his yields have been above average. This has occurred in 23 % of years. Generally most grain growers would not sow on less than 25mm of rain received in the first half of April. However, this 12mm of rain received has indicated an opportunity, and maximising crop area and inputs. When followed up with the producers, it has also indicated that follow up rain has persisted and had indicated an opportunity for early sowing. April 1st to 15th rainfall seems to show up relationships for many of the areas we have performed analyses on. Members of the Bureau of Meteorology (BOM) say that this could be related to climatic influences and ocean temperatures. Further analyses on these relationships is currently being performed by the BOM and SARDI.

Figure 3 shows the April to May rainfall compared to final wheat yield for a farmer at Carrieton in the Upper North of SA. His average yield is 1.3 t/ha. It shows that when the April to May rainfall has been greater than 70mm, then 100 % of his yields have been above average, this has occurred in 24% of years. This indicates an opportunity for maximising crop area and inputs. When his April to May rainfall is less than 35mm, then 85 % of his yields have been below average. This has occurred in 45% of years. This indicates a risk in these circumstances and perhaps caution should be used in the area that is sown and the amount of inputs used during these times.

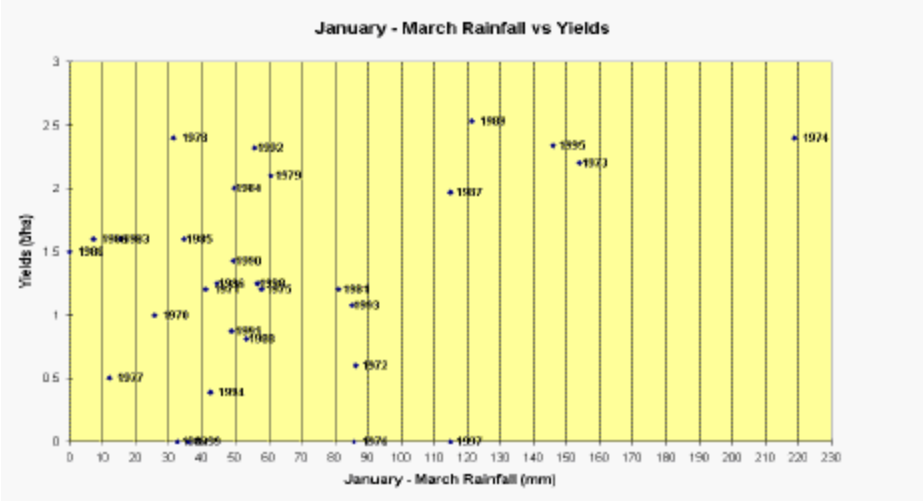

Figure 1 : Effect of January - March total rainfall on a Carrieton (SA) farmer's average wheat yield, 1970 -1999).

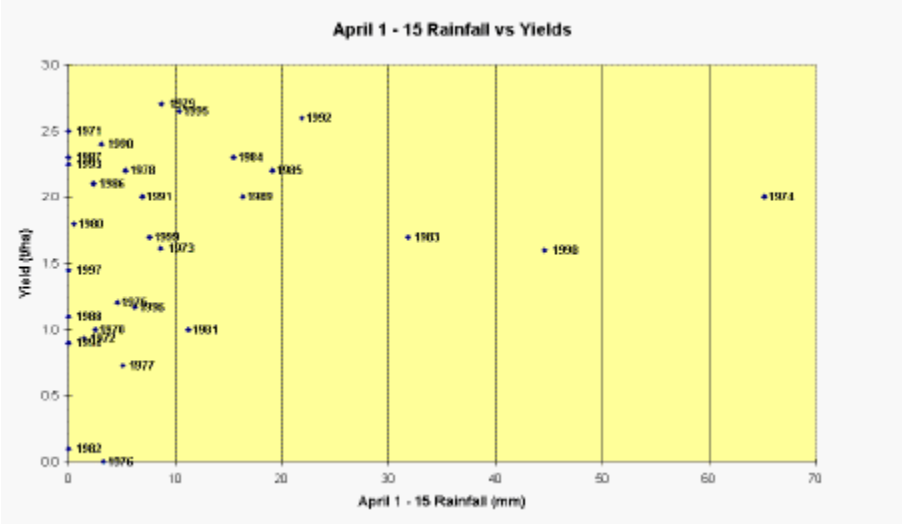

Figure 2: Effect of April 1st -15th total rainfall on a Booleroo (SA) farmer's average wheat yield, 1970 -1999.

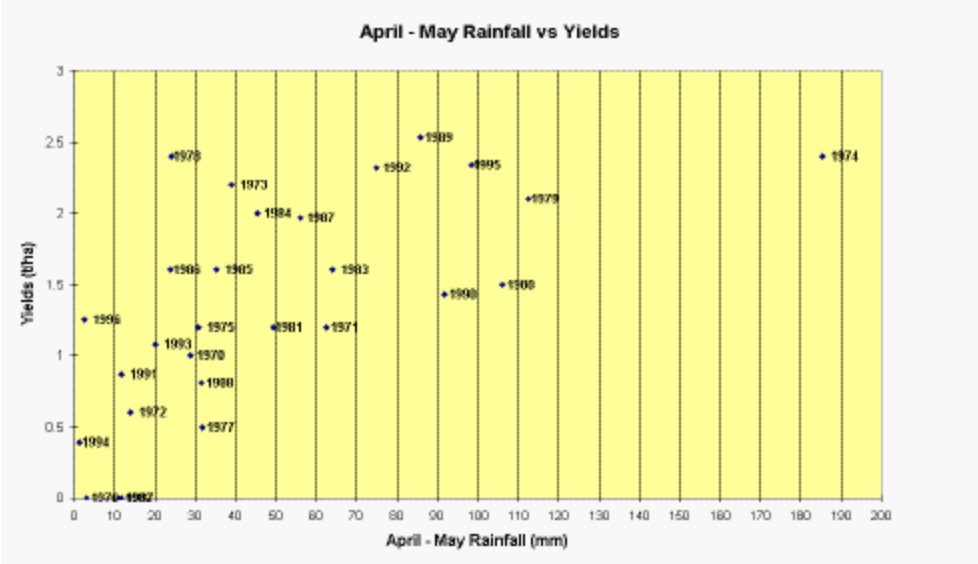

Figure 3: Effect of April - May total rainfall on a Carrieton (SA) farmer's average wheat yield, 1970 - 1999).

Rainfall above a certain threshold from January to March is a useful indicator in the Upper North of SA. Rainfall above a certain threshold from April 1-15 is good in most parts of SA, April - May and April - June rainfall totals give good indications of opportunity and risk years. However, this varies between individual properties. This is why an individual analyses are necessary.

Decisions said to be influenced by the SOWHAT analyses include crop area, soil type selection, crop density at sowing, application of nitrogen, planning of future rotations, predictions of stock feed and pasture inputs. Results are representative of each farm as they are dependant on historical records, soil types and past farming methods. Because of this, results from the SOWHAT program are considered to be more reliable than a district sowing rule.

Some grain yield variability and rainfall variability between years can be attributed to by the Southern Oscillation Index (SOI). The SOI can be used in April - May to help identify the likelihood of poor or good winter spring rainfall. For example, On the Upper Eyre Peninsula and in the Upper North of SA there is an increased chance of wheat yields being below average (tercile 1) when the April - May SOI phase is negative, falling or near zero. Conversely, a positive or rising April - May SOI indicates an increased likelihood of above average yields (tercile 3).

Some growers are using early season rainfall in conjunction with the SOI and other indicators, to create an index to make crop management decisions. An example of such an index is as follows;

- Maximise crop area and inputs and varieties if Jan March Rain > 90 mm and April 1 - 15 Rain > 15 mm; April - May rain > 70 mm and SOI is positive.
- Adopt an average approach to the season if April - May rain > 70 mm and SOI is a phase other than negative or positive.
- Minimise crop area and inputs if April - May rain < 32 mm and SOI is negative.

SARDI has been delivering such outputs from climate risk management decision support tools, at timely intervals to grain growers in SA. These outputs relate to their own properties as they rely on inputs of the farmers own rainfall. The outputs include the relationship between early season rainfall and final wheat yields, potential yield, stored soil water, optimum N rates, the relationship between the Southern Oscillation Index (SOI) to rainfall and wheat yields and rainfall deciles. SARDI also deliver climate risk management workshops to grain growers and other primary producers which explain the outputs of such models and the potential for application of these to their property to assist with management decisions.

The use of early season rainfall and economic impacts is being further tested through a joint GRDC project with the Bureau of Meteorology. Official publications and case studies will be available.

References

(1) Abrecht, D.G. and Balston, J.M. (1996). Proc. 2nd Aust. Conf. Agric. Met.: 111 - 115.

(2) Egan, J.P., Balston, J.M. and Abrecht, D.G. (1996) Proc. 2nd Aust. Conf. Agric. Met.: 308-311.

(3) Balston, J.M, and Egan J.P. (1998) Development and evaluation of "SOWHAT" a decision support tool for sowing decisions based on early season rainfall. South Australian Research and Development Institute.