When to irrigate? Assessing economic costs and benefits

Winter cropping irrigation scenarios, Northern Victoria

KEY MESSAGES

- Pre-irrigating is a key factor to achieving high per mega litre and per hectare returns for barley, faba beans and canola.
- Irrigation of wheat at booting during late winter produced the highest Gross Margin and optimal use of water.
- Wheat is the most likely crop to offer high per mega litre returns during atypical market conditions during drought years under static input price and yield assumptions.
- Irrigated Cropping Council winter crop variety trials report a wide variation in yields and suitability of cultivars. Crop variety selection can help mitigate production risk and firm up crop revenues and subsequent water gross margins.

About the research

Smarter Irrigation for Profit Phase 2 (SIP2) is a partnership between the irrigation industries of sugar, cotton, grains, dairy and rice, research organisations and farmer groups. The aim of the Key Learning Sites, SIP2 project is to optimise the limited availability of water resources to obtain maximum dollars per mega litre across a range of irrigated cropping systems. Led by growers the SIP2 project is supporting sites in the Lachlan, Murrumbidgee, and Murray valleys. The information in this case study is taken from the Irrigated Cropping Council (ICC) managed site at Kerang (Vic) [1].

Pre-irrigate or wait until spring: a partial budget approach?

A useful approach for assessing the benefits and costs involved in changing from one irrigation practice to another, is partial budgeting. A Partial Budget is a technique used to compare the extra costs and returns of the new activity with those of the present activity. When investigating these scenarios, the crop or water Gross Margin (GM) is calculated to identify the contribution the activity makes to farm total GM. For this case study a custom-built GM model for the ICC growing region around Kerang was used.

Using ICC data, the economics of irrigation and winter crop species were assessed for crop yield and profitability under various irrigation treatments. Irrigation water values at the time of sowing (Feb-Apr) were much higher than the nominal $60/ML used to value the variable costs to licence holders to apply the water to field. These inputs were tabled into the decision matrix, along with market values of growing costs to generate a crop and water GM. Pre-irrigation was included in all optimal GM returns, except for wheat. For wheat irrigation at booting offered strong GM returns[2]. in both 2019 and 2020 years. In the latter wheat experiments, a wide variation among spring irrigation treatments and wheat varieties occurred (not included in this report). This initial analysis is summarised in Table 1.

[1] https://smarterirrigation.com.au/industry/grains/
[2] https://irrigatedcroppingcouncil.com.au/research/smarter-irrigation-for-profit-2/

Table 1 Partial budget opproach to irrigation treatments of winter crop species of combined per hectare and ML economic ($/ha) Gross Margin response, using ICC gross margin analysis and referenced water and crop input assumptions.

2019 (price/t)	2020 (price/t)	Irrigation Treatment	Best Gross Margin decision option (@$60/ML)	
Barley ($291/t)		Pre-irrigation + 1 spring	$860/ha	$313/ML
Canola ($605/t)		Pre irrigation + full spring	$1,463/ha	$390/ML
Faba Beans ($600/t)		Pre irrigation + full spring	$1,779/ha	$383/ML
Wheat (329/t)		No pre-irrig. + 1 spring	$780/ha	$520/ML
	Wheat ($270/t)	No pre-irrig. + 1 spring	$725/ha	$659/ML

Gross Margin break-even sensitivity analysis – at what price do commodities have to be to match spot market water prices?

A break-even analysis can be a useful method to sensitivity test what commodity prices would have to reach, for an irrigator not to sell their water for the highest possible return. If a broad acre irrigated grower chooses to use resources in a certain way, then they have given up the opportunity to use their resources in some alternative way. The production systems used in this case study assume water is accessible, although market prices during the research period remained well above the nominal cost applied in the above analysis, with spot prices exceeding $600 /ML. In these highly inflated markets, such as those experienced in 2019, commodity prices also reached extreme levels due to shortages of seed and low national crop yields. With price increases of 15%, 30% and 45% from the base price assumption in the study, results show wheat as the leading crop most likely to achieve a return above a $600/ML spot water price. Other crops, under the most profitable irrigation scenarios (above in Table 1) only reach spot market target rates at the high-end of sensitivity analysis (+45%). These are illustrated in Figure 1, where the red line denotes a target spot per ML of water, as the representative market value.

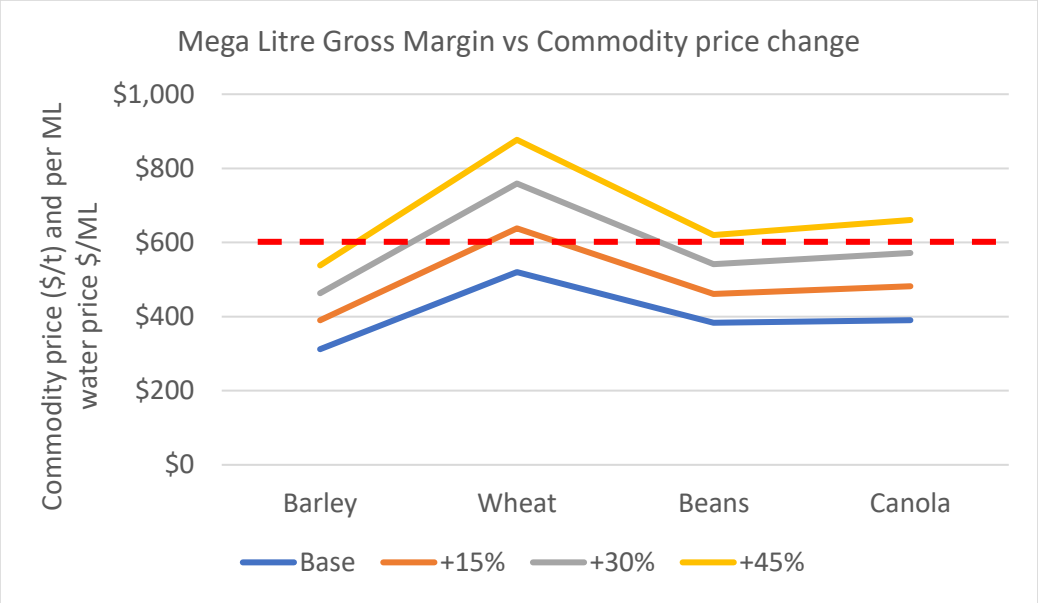

Figure 1 Per mega litre break-even sensitivity analysis of commodity prices of barley, wheat, beans and canola at base price, +15%, +30%, +40% with a target spot price per ML of $600 (red line).

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Northern Region, Victoria - High water prices vs irrigation timing for grain production

Water is a production tool just like any other management input and planning is a critical part of this management. Regardless of how growers manage their water or how much water is available, the goal is to optimise production per megalitre of water – water use efficiency (WUE). WUE is a key metric in dry years when water is limited, and temporary markets reach new levels. Under this scenario, a climate and economic risk assessment can uncover strategies to optimise scarce resources and take advantage of anomalous market conditions.

Optimal application of irrigation is determined by rainfall, crop type and commodity price (among other factors). A better understanding of rainfall amounts, reliability and distribution in each location can assist irrigation management decisions. Figure 2 shows results of a simple Co-efficient of Variation (CoV) test on Kerang growing season rainfall from 1996-2020 (values closer to zero considered unreliable and values closer to 1 are considered more reliable). It shows the months of November and August have the largest monthly totals (line graph) spanning across the winter cropping growing period. The most reliable rainfall months with low CoV values are equally, June and July. May rainfall is the least reliable month until October at the end of the growing season (high CoV). Therefore, crop moisture deficits and potential yield penalties are most likely to occur early at planting. Climate risk management can help prepare for variations in growing season conditions. Research has found the wet and dry phases of the Indian Ocean Dipole (IOD) are strongly correlated with rainfall and temperatures variations in the study region.[3] Tracking these IOD phase predictions can help better manage water resources and commodity marketing decisions, as this climate influence is also the leading driver of Australia's national wheat crop.[4]

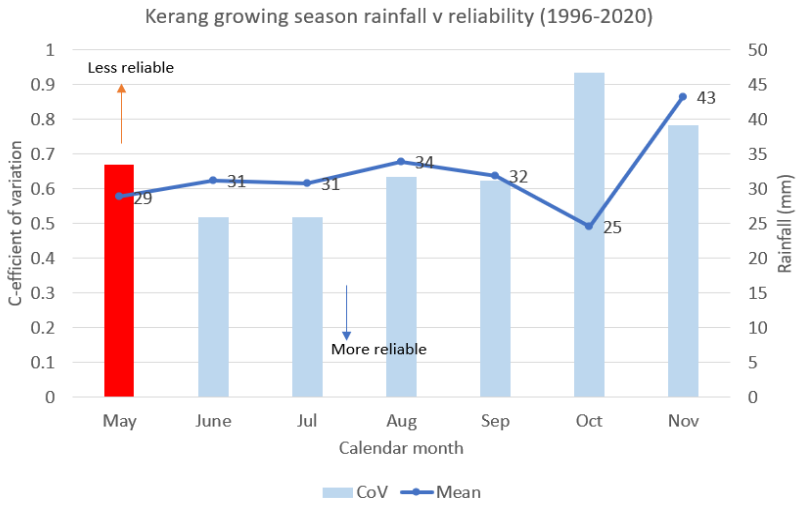

Figure 2 Kerang (Vic) rainfall reliability analysis (red bars – unreliable, blue bars – more reliable) vs average monthly rainfall totals (line graph) over the period 1996-2020 (Source: Bureau of Meteorology).

[3] http://www.bom.gov.au/research/publications/cawcrreports/CTR_051.pdf

[4] https://www.nature.com/articles/srep17252

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Concluding remarks

Using findings from the ICC winter cropping species trials at Kerang, and irrigation GM analysis on winter crop species, this case study assessed economic returns under several market and production scenarios. The irrigation treatment scenarios found the inclusion of a pre-irrigation was essential to achieve a high per hectare and ML scenario across all crops, except for wheat, which showed a clear marker for an irrigation at booting time.

During extreme dry climatic conditions irrigators may achieve comparable or better returns by selling water into the market. A break-even sensitivity analysis found irrigated wheat was the crop most likely to match or exceed high water prices under inflated commodity price scenarios. Other crops were less sensitive in delivering high per ML gross margins under atypical, inflated price scenarios. This study shows drought years can still provide opportunities to generate income when water markets may appear too high or too risky to invest or participate in. Climate risk analysis can also aid in winter crop decision making, particularly when the study location is influenced by the various phases of the Indian Ocean Dipole.

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A full project report on the SIP2 ICC trials can be found at https://irrigatedcroppingcouncil.com.au/research/smarter-irrigation-for-profit-2/

Climate risk analysis for Victoria can be found at https://agriculture.vic.gov.au/support-and-resources/newsletters/the-break

For more information on this economic analysis, please contact Jon Welsh, Principal Economist at Ag Econ, through jon@agecon.com.au.

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