# Irrigation water in dry years: sell, buy or apply?

## A supplementary irrigated wheat scenario, Central West, NSW.

**KEY MESSAGES**

- A seasonal analysis of the temporary water market during a recent period of research showed a gross margin of $319/ML could be achieved if water were sold at a market average price.
- Hay prices and hay production need to exceed the dual economic thresholds of $500/t and 4.5t/Ha respectively, before planting the crop became the preferred option to selling water.
- A sensitivity analysis of purchasing additional 1.5 ML/ha water, assuming a hay yield response of 2t/Ha found Return on Investment was very sensitive to water buy price.
- Central West Farming Systems (CWFS) wheat variety trials found a wide variation in crop yields and suitability of cultivars. Wheat 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. The information in this case study is taken from the Central West Farming Systems (CWFS), managed site at Condoblin[1].

**Central Region, NSW - High water spot prices vs application for hay production**

In many years hay can outperform grain in gross value per hectare. This is particularly relevant when crops have some bulk but lack the moisture to attain high yields of grain. Droughts can result in a scarcity of input resources such as irrigation water, and reduced availability of broad acre crop commodities – often relied upon by livestock operations and feedlots to keep their businesses running. In doing so, markets for hay can be inflated to unusual levels, where the decision maker with access to some irrigation water is faced with alternative options. Under this scenario, an economic and risk assessment can inform decisions to optimise the return from water and take advantage of atypical market conditions.

**A partial budget approach: irrigated grain / hay production v selling water.**

A useful approach for assessing the benefits and costs involved in changing from one irrigation practice to another, is a Partial Budget method. A Partial Budget is a technique used to assess the likely value of introducing a new activity by comparing it with the existing situation. Put simply, you are comparing the extra costs and returns of the new activity with those of the present activity. When investigating these scenarios, the crop Gross Margin (GM) is calculated to identify the contribution the activity

[1] https://smarterirrigation.com.au/industry/grains/

makes to farm total GM. A custom-built GM model for the CWFS growing region around Condobolin was used to further refine the analysis, benefitting from prepopulated regional data.

In a recent project undertaken by CWFS, the economics of irrigation and wheat varieties were assessed for grain and hay yield. Irrigation water values at the time of sowing (Feb-Apr) were tabled[2] to input into the decision matrix, along with market values of hay[3] to serve as input into the GM. A first-pass analysis found making hay far exceeded grain as a profitable alternative to selling irrigation water on the temporary market. An additional cost for nutrient removal has been added to the hay gross margin to account for new season parity with a grain harvest scenario[4]. This initial analysis is summarised in Table 1.

*Table 1 Sensitivity test results of combined per hectare economic ($/ha) Gross Margin response, using CWFS wheat gross margin analysis and referenced water and hay data time series.*

| | Decision option | | |
|---|---|---|---|
| **Line item** | **Harvest grain ($/Ha)** | **Cut for hay ($/Ha)** | **Sell irrigation water ($/ML)** |
| **Revenue** | $1,200 (3.2t /ha*$375/t) | $3,124 (5.21t @ $600/t) | $311 |
| **Costs** | $660 | $1.342 (inc. contract hay making) | N/A |
| **Gross Margin per Ha** | $540/Ha | $1,784/Ha | $933/ha |
| **Gross Margin per ML** | $180 | $595 | $311 |

## Gross Margin sensitivity analysis – applying 3 ML /Ha to cut wheaten hay or sell 3 ML?

If an irrigated wheat 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 system tabled below assumes 3ML/Ha applied irrigation water. The economics of hay production is reported in $/ML to align with the market price of water, where selling water is the most obvious alternate decision. The analysis found that only when hay yield exceeds 4.5 t/Ha and price is greater than $500 /t, water gross margin returns surpass selling the water into the open market (green shaded cells) at $311 /ML.

*Table 2 CWFS applied irrigated wheat water. gross margin ($/ML) sensitivity test: hay price ($/t) and hay yield (t/ha).*

| **Water Gross Margin $/ML** | | **Hay price ($/t)** | | | |
|---|---|---|---|---|---|
| **Hay Yield (tonnes/ha)** | | **$300** | **$400** | **$500** | **$600** |
| | **3.0** | -$136 | -$36 | $63 | $163 |
| | **3.5** | -$87 | $29 | $147 | $263 |
| | **4.0** | -$37 | $97 | $230 | $263 |
| | **4.5** | $13 | $163 | $313 | $463 |
| | **5.0** | $63 | $229 | $397 | $563 |
| | **5.5** | $113 | $296 | $480 | $663 |

[2] https://waterregister.waternsw.com.au/water-register-frame

[3] https://www.afia.org.au/index.php/40-news-events/grain-hay-reports

[4] https://grdc.com.au/news-and-media/news-and-media-releases/south/2018/11/be-mindful-of-nutrient-loss-from-cutting-failed-crops-for-hay



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## Gross Margin sensitivity analysis – is it worth buying more water and increasing hay yield?

*Table 3 Key assumptions to sensitivity test buying additional 1.5ML water with 1.5ML already on hand, with the view to boosting hay yield.*

| | | |
|---|---|---|
| **Water on hand = 1.5 ML/Ha** | **Water purchased = 1.5 ML/Ha** | **Hay yield response = 2t/Ha** |
| **Low water price = $280/ML** | **Average water price = $311/Ha** | **High water price = $389/Ha** |
| **Return on Asset equation = $ ML profit (loss)/purchase price** | | |

To estimate changes to irrigation water GM with an additional 1.5 ML/Ha applied, a sensitivity analysis was undertaken. The analysis includes three water price point scenarios as shown in Table 3 ($280, $311, $389 per ML). The irrigation yield response from the additional water was assumed to generate an additional 2t hay/Ha. The calculated yield response is a best estimate as irrigation response will vary depending on paddock characteristics including soil type, available nutrients, and plant available water. To establish the marginal benefit of this practice change changes in crop GM and subsequent Return on Investment (ROI) per cent from new costs and benefits were calculated.

Figure 1 shows the ROI being very sensitive to water buy price under the yield response scenario. A low water price showed a marginal benefit and ROI of 51%, although a steep decline occurred soon after the seasonal average ($311/ML) water price was achieved. Where water was purchased at the top of the market ($389/ML), ROI showed the additional water purchase became a loss-making exercise, with minus 5% ROI measured.

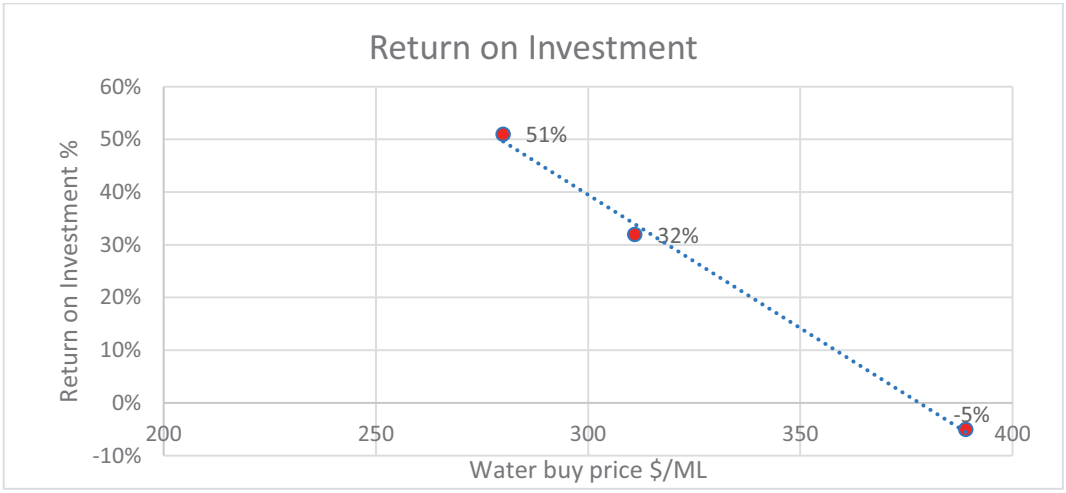


*Figure 1 Marginal cost / benefit scenarios resulting from additional 1.5 ML/ha purchased at three price points ($280, $311 and $389 per ML) and Return on Investment.*

## Concluding remarks

Applying the SIP2 research findings from the wheat variety trials and irrigation gross margin analysis on grain and hay production, this case study assessed economic returns under several market and production scenarios.

The results of the hay price and hay yield scenario, using an average seasonal value of irrigation water found that under sub-optimal crop and market conditions an irrigator can achieve comparable returns



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by selling water into the market. When hay yield exceeded 4.5t/Ha and hay price exceeded $500/t, high gross margin returns on irrigation water could be achieved. Both hay and grain yields can be increased by choosing the highest performing variety for your local area, as a considerable range exists between cultivars.

Further sensitivity analysis found additional water can be purchased to increase yield and offer a high ROI. Although for this analysis the results showed returns decline sharply after the seasonal average price of $311 was used in the water gross margin calculations. 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.

*A hay v grain irrigation decision support calculator can be found here:*
*https://agriculture.vic.gov.au/support-and-resources/tools-and-calculators/hay-vs-grain-calculator*

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