



How much does wheat respond to spring irrigation?

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- Limited allocations have made decisions on the most profitable use of irrigation water very difficult
- Farmers who watered wheat in spring were often surprised by the high water use or lack of yield response
- A review of some irrigated wheat trials and methodologies showed that the response to spring irrigation was between 1.0 and 2.0 t/ML

Over the last six drought seasons decisions on how to maximise profitability from low irrigation allocations has been difficult.

Often farmers had to decide whether to watch winter crops die or give them a water and forego water for summer crops. Unfortunately by the time many crops were watered the 'horse had bolted'. The first spring watering often resulted in water use of 1.5 ML/ha or more, which was surprisingly high. Although in more 'normal' seasons one spring irrigation resulted in good yield responses this was not the case with many crops in the drought seasons. These crops needed a second or third watering but there was either no water available or the price for buying temporary water was too high.

So what yield response should we expect from spring irrigating wheat? This article shows the responses from three projects and a water use efficiency (WUE) calculation example.

1. Logie Brae Project 1998–2000

The Logie Brae Landcare group located near Finley set up spring irrigation demonstrations in several wheat paddocks over a three year period from 1998 to 2000 (reported in *Farmers' Newsletter* No.s 151, 152 and 155). The border check layout paddocks were watered once in spring with one bay left unwatered. The watering was accurately timed using gopher soil moisture equipment. The yield of the watered bays next to the non watered bays was compared. These seasons had relatively good rainfall and odd paddocks had been pre watered.

The average yield of the *non watered bays* was 4.0 t/ha. The average yield of the *watered bays* was 4.9 t/ha and the average irrigation water use was 1.0 ML/ha. Consistently in each of the three years yield response to one spring irrigation was 0.9 t/ha.

- ▶ The Logie Brae Project resulted in a yield response to spring irrigation of 0.9 t/ML.

2. Thompson & Chase research trial

In 1980 Irrigation Research Agronomists John Thompson and David Chase conducted a trial – *Effect of limited irrigation on growth and yield of a semi-dwarf wheat in southern NSW*. The

trial was located at Yanco Agricultural Institute and had six spring irrigation treatments, replicated. This was the first major trial in southern NSW to investigate responses of wheat to spring irrigations and the results are still relevant today. Spring rainfall in 1980 was very low.

The yield on non watered treatments (dryland) was 1.0 t/ha and low partly due to excess biomass (760 shoots/m²) as the trial was fertilised for higher yields. The irrigation water use for each spring irrigation was 75 mm (0.75 ML/ha).

Comparing irrigated & dryland yields

The grain yield for *one spring irrigation* (0.75 ML/ha) was 2.5 t/ha which was 1.5 t/ha greater than the *dryland yield* (1.0 t/ha).

- ▶ The yield response to one irrigation was 2.0 t/ML.

The grain yield from *four spring irrigations* (3.0 ML/ha) was 5.6 t/ha which was 4.6 t/ha higher than the dryland yield. Hence the yield response to four spring irrigations was 1.5 t/ML.

Similarly the grain yield from *six spring irrigations* (4.5 ML/ha) was 7.0 t/ha which was 6.0 t/ha higher than the dryland yield. The yield response to the six spring irrigations was 1.3 t/ML.

- ▶ Overall as spring irrigation increased, yield per megalitre decreased.

Comparing irrigation treatments

The yield from *four irrigations* was 5.6 t/ha, which was 3.1 t/ha greater than the yield from *one irrigation* (2.5 t/ha). The crop needed an extra 2.25 ML/ha to gain the 3.1 t/ha increase. The yield response of four irrigations compared with one was 1.4 t/ML.

The yield from *six irrigations* was 7.0 t/ha, which was 1.4 t/ha greater than the yield from *four irrigations* (5.6 t/ha).

- ▶ The yield response of six irrigations compared with four irrigations was 0.9 t/ML.

With the four spring irrigations, the first was applied at the start of stem elongation (DC30) and the last applied at the end of flowering. The six irrigations treatment had two additional irrigations applied in the grain filling stage.



3. Irrigated cereal variety evaluation

The irrigated cereal variety evaluation project – *High yielding genotypes of winter cereals for irrigated regions of south east Australia* – reported in the previous article in this edition targets 10.0 t/ha yields, and uses the Eight Tonne Irrigated Wheat Club management package to meet the requirements of 10 tonne cereal crops.

In 2007 the trial site received fallow rainfall and effective growing season (GSR) rainfall totalling 94 mm. The trial was pre irrigated with 170 mm (1.7 ML/ha). The total water available from the fallow, GSR and pre irrigation was 264 mm. Assuming a water use efficiency of 15 kg/mm, 264 mm of available water would be predicted to yield 4.0 t/ha of grain.

In addition to the rain and pre irrigation, the trial received five spring irrigations (totalling 3.6 ML/ha) and yielded 10 t/ha. Thus the extra yield from spring watering was 6.0 t/ha.

- ▶ **The yield response to spring irrigation in the irrigated cereal project was 1.7 t/ML.**

4. WUE based on median rainfall

In terms of crop production, water use efficiency (WUE) can be defined as the amount of grain produced per millimetre of available moisture (stored soil moisture, effective rainfall and irrigation).

Determining water use efficiency on the basis of median rainfall can be used for any district. In the example following the median rainfall for Griffith is used.

- The available rainfall for the November–March fallow period at an efficiency of 30% is 31 mm (ie of the total rain received 30% remains in the soil as subsoil moisture).
- The growing season rainfall (GSR) from April to October of 212 mm has 110 mm subtracted for evaporation which leaves 102 mm.
- Thus the available water from fallow and GSR to grow a dryland crop is 133 mm.

Assuming a WUE of 15 kg/mm, the potential yield in the Griffith area (based on 133 mm of available moisture) is 2.0 t/ha.

If 90 mm (0.9 ML/ha) is applied as one spring irrigation and assuming a WUE of 15 kg/mm the yield from rainfall (2.0 t/ha) and the irrigation (1.4 t/ha) would be 3.4 t/ha. The yield response to irrigation would be 1.6 t/ML. This method assumes rainfall is regular both before and after the irrigation.

- ▶ **Based on calculations of a theoretical water use efficiency of 15 kg/mm, yield response to one spring irrigation is 1.6 t/ML**

Conclusion

The yield responses in wheat to spring irrigation in the three projects and WUE example described in this article generally ranged from 1.0 to 2.0 t/ML. In former crops many factors may alter these trial or predicted responses.

Delayed timing of irrigation leading to moisture stress will reduce yield and result in excessive irrigation moisture use. Hence the potential yield response to spring irrigation would be reduced.

Moisture response differs with crop stage. Head emergence is more sensitive to moisture availability than grain filling so the response to irrigation at head emergence is likely to be higher than at the grain filling stage, as in the 1980 Yanco trial.

Timing of rainfall in relation to growth stages and irrigations may either increase or decrease yield responses to irrigation.

Crop management in relation to yield potential is important. A missed best practice (key check) which reduces yield will reduce response to irrigation.

Further information

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Figure 1. A review of some irrigated wheat trials and water use methodologies suggests that a spring irrigation will result in a yield response between 1.0 and 2.0 t/ML.