



# Matching wheat to soil type & layout to maximise \$/ML

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## in a nutshell

- Farm size, soil type, layout, farmer preferences and water allocations determine the farm enterprises, intensity of irrigations and the wheat management systems on any one farm
- A range of irrigated wheat management systems may be used on the one farm in any one season
- Soils ideal for rice growing which are generally poorly structured and poorly drained suit non or limited irrigation wheat systems while better structured non rice soils with well drained layouts are suited to multiple irrigation wheat growing systems
- A comparison of wheat systems found wheat direct drilled into rice with or without a spring irrigation had the best gross margins per megalitre
- The profit per megalitre for the multiple spring irrigation system was higher than the popular one spring irrigation system

***Over the last five drought seasons, farmers who have had water have stretched out the water to irrigate wheat and other winter crops to maximise yield per megalitre while hoping for follow-up rains or additional allocation as the season progressed.***

These decisions have been on the basis of income per megalitre of water. It has been about looking after what you have (winter crops and pastures); with any left over water to be used for rice. In these water-desperate times, farmers with rice stubbles have utilised the subsoil moisture (to a greater extent than previously) to direct drill crops into the stubbles.

We know there will be less water in future so water rather than land will be the key driver of farm viability and whole farm watering decisions. Therefore we need to match the crop management system to soil types and layouts to maximise water use efficiency and profit per megalitre.

The *Profitability and Sustainability of Rice Farm Systems* report (1996) found farmers in the eastern Murray Valley were operating four different rotations or wheat management systems on the one farm according to rice soil classification.

Soils suitable for rice are generally poorly structured and have poorly drained layouts so the risk of waterlogging for wheat in wet winters is high. Thus wheat direct drilled into rice stubble is generally not irrigated in spring. Yields are lower but water use efficiency is high.

The better structured non rice soils with well drained layouts are suited to wheat growing systems which can be safely

irrigated in spring. Eight tonne target wheat systems are suited to these soils. Yields are high but water use efficiency is lower.

Since 1996, further research, changing water availability (irrigation and rainfall), new types of layouts and better understanding of wheat growing has extended the range of systems under which wheat is grown on irrigation.

The typical current wheat management systems (undoubtedly there are variations on these) are:

- dryland
- unwatered (irrigation layout)
- direct drill into rice stubble
- direct drill into rice stubble with one spring irrigation
- pre-irrigation only
- one spring irrigation – often called the Logie Brae Landcare Group System
- 3–4 spring irrigations – this is the 8-tonne club system.

## Comparing yield & water use for different systems

We know farmers already have good knowledge of matching crop types to soil types and layouts. We know not every paddock is suited to growing 8-tonne club wheat. Maximising profit per megalitre is about farmers using their experience of their farm to best match up soils layouts and type of wheat (or crop). So how does the potential water use efficiency and profitability per megalitre of each system compare?



Data from many sources has been collated and analysed, and combined with some assumptions, to form the basis for the following discussion on water use by different wheat growing systems.

In Figure 1 the total water use from rainfall and irrigation and grain yield is compared for six wheat systems.

### Assumptions

The yield is based on a high water use efficiency of 20 kg/mm so it implies the use of good agronomy and irrigation management and zero yield loss from waterlogging for any of the wheat growing systems.

The water use of the **unwatered (irrigation layout) system** is based on a short fallow and median growing season rainfall for Griffith of 312 mm (although Griffith statistics are used, the principles apply to all irrigation valleys). The crop water use was based on 30% fallow efficiency plus growing season rainfall less 110 mm for evaporation plus irrigation water.

The **direct drill into rice stubble system** assumes 125 mm soil water is left over from the rice. The pre-irrigation system (watering up) is based on 150 mm and the 3–4 spring irrigations system, 90–100 mm.

### Water use comparisons

The lowest water use system is the **unwatered (irrigation layout) system** which has the lowest yield as the water use is based on dryland short fallow and growing season rainfall.

The second lowest water use system is the **direct drill into rice stubble system** which utilises the water left over after the rice crop. It gives a potentially high yield of 5.2 t/ha assuming there is no yield loss from waterlogging. This simple system has been very popular particularly in the last few drought affected seasons.

Also popular is the **one spring irrigation system (Logie Brae system)**. This system ranks third in terms of water use, which is 412 mm water and yields 4.5 t/ha which is less than the rice stubble system.

The **direct drill into rice stubble with one spring irrigation system** has the risk of waterlogging from the spring irrigation and rain after watering. However the potential yield of 6.9 t/ha with this system is very high for relatively low water use. Some of the new terrace contour and V ditch layouts may suit this system.

The **pre-irrigation system** has the second highest water use, at 462 mm. The high autumn water use in recent seasons has resulted in a swing away from this system with farmers preferring to sow on rainfall moisture and carryover water for spring. However pre-irrigation is often used for poorly drained flat layouts to supply subsoil moisture where the risk of waterlogging from spring watering is high. Watering up is also common on bed layouts which are watered in spring.

The drought and lack of irrigation water has prevented most farmers using the **3–4 spring irrigations system** to target 8 t/ha yields. This system uses more water at 582 mm but produces a good yield response of 8.1 t/ha.

### Profitability comparisons

The profitability of each wheat system was determined for profit per megalitre (gross margin/ML) and profit per hectare (gross margin/ha). Wheat price was assumed at \$250/tonne, water costs \$30/ML and current high fertiliser costs used (based on 2008 prices).

The **direct drill into rice stubble with one spring irrigation system** had a profit of \$255/ML. It also had the highest gross margin per hectare of \$1087/ha of all the systems.

The **direct drill into rice stubble system** had the second highest profit per megalitre of \$212/ML and fourth highest profit per hectare. This demonstrates the value and relative simplicity of the double crop rice wheat system.

Perhaps surprisingly the **3–4 spring irrigations (8-tonne club) system** had the third highest profit per megalitre of \$178/ML and second highest profit per hectare of \$1037/ha. Although this system uses more water (582 mm compared to the one spring irrigation at 412 mm), the gross margin per megalitre and per hectare is higher. The high variable cost for 8 tonnes may seem to be a large disadvantage compared with the other systems but most of the extra expenditure occurs from the first node stage onwards when decisions for extra expenses can be made more confidently. A good season after sowing may allow an unplanned change from a 4–5 tonne target to an 8 tonne target because the crop just happens to have the ideal range of 500–800 shoots/m<sup>2</sup> at the first node.

The **pre-irrigation system** had the fourth highest profit per megalitre and per hectare. This was higher than the one spring irrigation system which had the second lowest profit per megalitre and per hectare. The unwatered (irrigation layout) system is basically a dryland system so it had the lowest profit per megalitre and per hectare.

### Best match gives best result

Farmers should match up the most profitable per megalitre and profitable per hectare wheat systems to the appropriate soil type and irrigation layout. This will maximise profit per megalitre on a whole farm basis. This may result in several different wheat systems being grown on the one farm, which requires a range of management from simple to intensive. 🌱

### References

Herbert, I and Lacy, J (1996) *The links between rice farm profitability, productivity and sustainability*. Farmers' Newsletter, No.148, 1996, pp 31–36

### Further information

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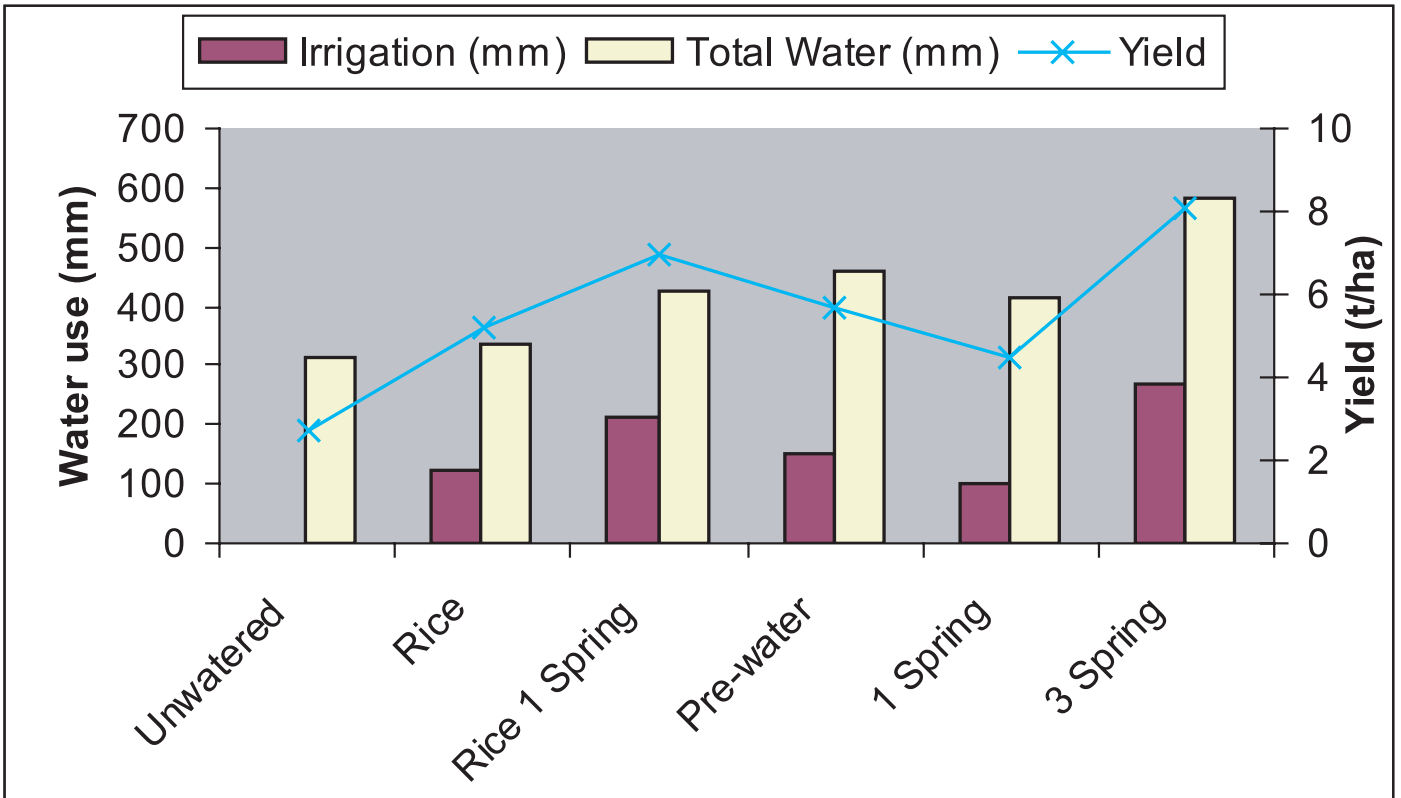


Figure 1. Irrigation, total water use (irrigation and rainfall) of wheat systems and potential yield at 20 kg/mm/ha water use efficiency.

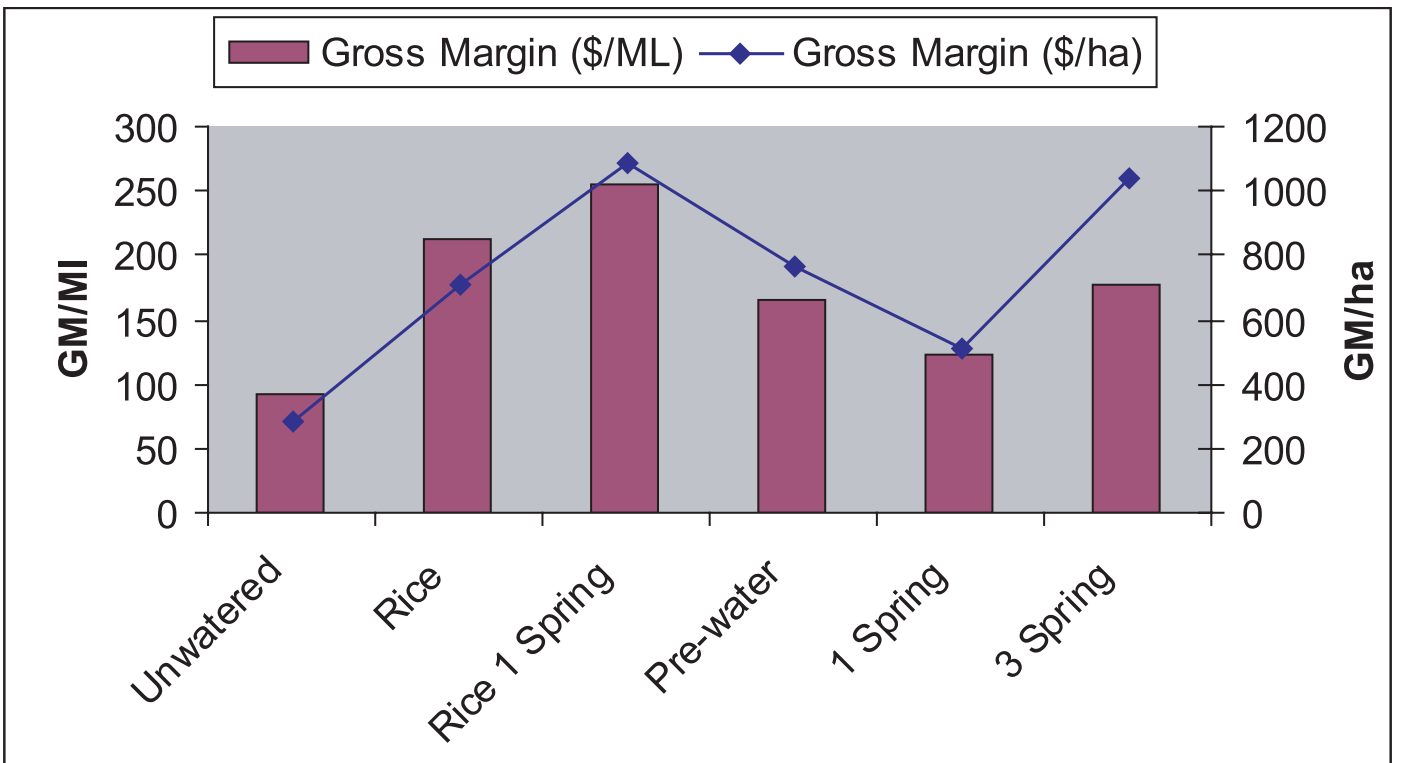


Figure 2. Gross margin per megalitre (\$/ML) and per hectare (\$/ha) for each wheat growing system.