

Research Projects

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Wheat after Rice enhancing water use efficiency

Australia's rice industry is an important part of the farming economy, producing about \$500 million a year in export earnings.

But growing rice does have environmental costs.

Rising watertables and soil salinity are major threats to the sustainability of irrigated agriculture in many areas, including the rice growing regions of southern New South Wales. Current land use practices could see between 20 and 30 per cent of these regions become moderately salinised in the next 30 years as a result of rising watertables. Water leaking from rice fields contributes to this problem.

Rice is grown under ponded conditions until shortly before harvest, and therefore the soil retains a large amount of water after harvest. This soil water, topped up by winter rain, will continue to slowly drain beyond the root zone and into the watertable unless it can be removed.

Growing winter crops immediately after a rice harvest is thought to be one way of decreasing the amount of water leaking into the watertable. The winter crop is able to use not only the water stored in the soil after rice, but also some of the rainfall that occurs after the rice is harvested. This practice makes good economic sense, given



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that farmers are using 'left-over' water to grow another crop rather than wasting it as it drains below the rootzone.

Wheat is the crop usually grown in rotation with rice, but only a small proportion of rice stubbles are sown to wheat (or other winter cereals) immediately after harvest. More commonly, farmers leave the rice stubbles idle for another 12 months and then sow wheat.

Rice stubbles and cultivated fallows restrict weed growth and evaporation. The end result is a soil profile that is wet and which continues to slowly leak into the watertable. The problem is exacerbated when it rains.

CSIRO Land and Water scientists are working with the CRC for Sustainable Rice Production, the Australian Centre for International Agricultural Research and local irrigation farmers to evaluate the impact on watertables of growing wheat after rice.

Using wheat as a sponge

Results from recent experiments in a field near Griffith suggest that wheat can be very effective in 'mopping up' after rice.

Three different treatments were applied after rice harvest:

- the rice stubble was left in the field (stubble retained fallow, no wheat sown)
- the stubble was burnt and wheat was direct drilled in April.
- the stubble was burnt and wheat was direct drilled in June.



The big winner appeared to be the early (April) sown wheat. In this case the crop lowered the watertable by an average of half a metre from July to September, and consistently kept the watertable more than 1.4 metres below the soil surface. In comparison, the watertable depth ranged from 0.4 to 1.6 metres when the stubble was retained (see Figure 1).

The watertable in the early wheat rose in October due to the influence of the adjacent paddock which was flooded and sown to rice.

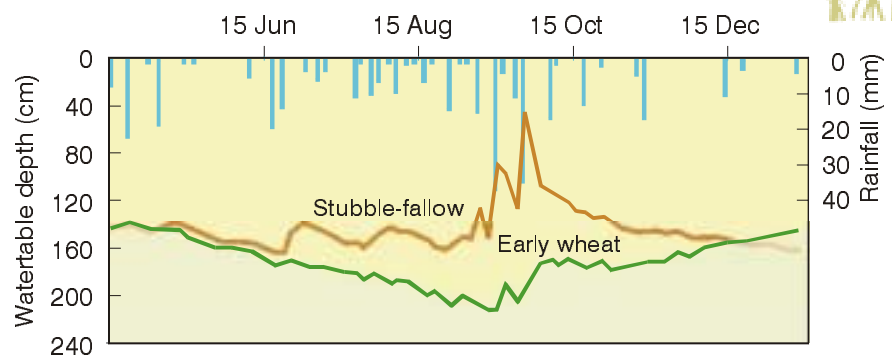


Fig 1

Initial results showed that not only did the early wheat use water left in the profile, but it also used the rainfall and some water from the watertable.





In contrast, the soil water content increased in the stubble left fallow during the wheat season and it appears there was significant leakage of the stored soil water and rainfall into the watertable (see Figure 2).

Wheat yields of 4.7 t/ha (early wheat) and 3.8 t/ha (late wheat) were achieved without applying any irrigation water.

It is not possible to do the hundreds of field experiments necessary to answer all questions for all situations. However, it is possible to simulate growing the crop and its effects on watertables in response to different weather, management and site conditions.

The CSIRO crop model SWAGMAN Destiny is an appropriate tool for this task (SWAGMAN stands for Salt, Water And Groundwater Management).

But to be confident that the model predictions are reliable, it is necessary to calibrate the model for typical wheat varieties in the local environment, and secondly to check that the model predictions compare favourably with actual measurements in the field. Results from many experiments show that the model predictions of crop growth, yield, evapotranspiration, depth to the watertable and soil water content are remarkably good.

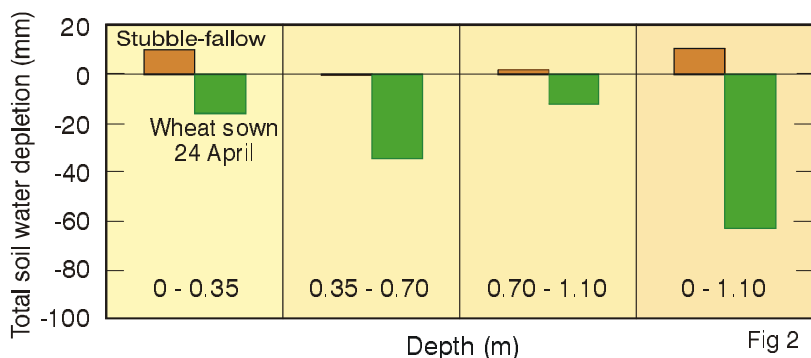


Fig 2

Will it always work?

The results from one site in one season may not be representative of what happens over the entire range of soil, watertable, seasonal and management conditions. For example, would crop water use from the watertable have occurred if it had been a wetter winter?



What next?

The field experiments will be continued, covering a greater range of site and seasonal conditions for demonstration purposes and for further model validation. The fluxes of water to (recharge) and from (upflow) the watertable also need to be determined.

Model simulations will be used to predict the extent of the impact of wheat after rice on watertables for various situations, and how to maximise the benefits.

Finally, if the results indicate a significant benefit for watertables by growing crops after rice is harvested, there is the challenge of promoting the adoption of this practice by rice farmers. As a first step, the research team has started investigating farmer perceptions and their experience of growing crops after rice.



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