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Irrigation a load of ROT

By Gary Alcorn

Using a rule of thumb (ROT) method for surface irrigation management does not always improve application efficiencies and in some cases may lower crop production. Associate Professor Steven Raine at the National Centre for Engineering in Agriculture says ROT must go the same way as 'over the fence observations' when it comes to smarter decision making about water use efficiency.

"The message is that there is a need to measure performance on individual fields and adopt appropriate field specific management practices.

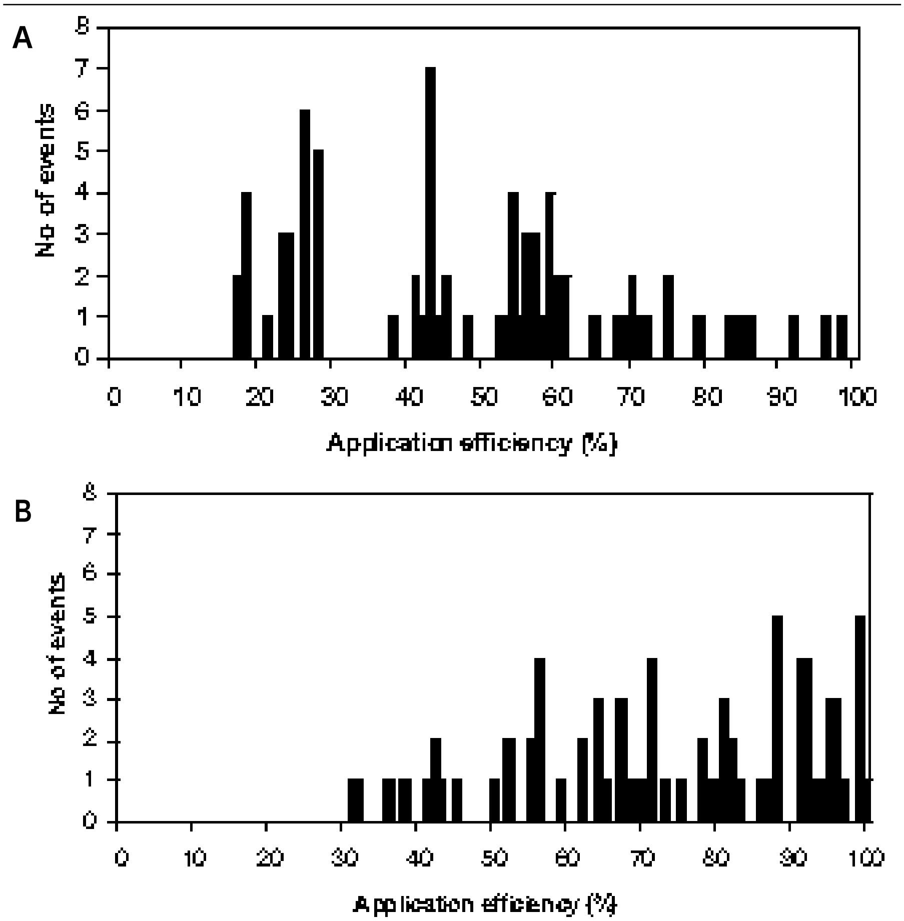
"For some fields, the performance of surface irrigation may not reach industry targets and consideration should be given to using either centre pivots or lateral move machines on these soils," he said.

FIELD MEASUREMENTS

IRRIMATE measurements across 79 furrow irrigation events conducted by cotton growers in southern inland Queensland showed application efficiencies ranged from just 17 per cent to 100 per cent with an average of 48 per cent. These results are similar to previous work in the sugar industry which found furrow irrigation application efficiencies of 30–90 per cent.

Losses to deep drainage averaged 42.5 mm per application — or up to 2.5 ML per hectare per year. Based on these figures, deep drainage losses could be costing the Queensland cotton industry alone up to 300 GL per annum and more than $100 million in potential crop production.

FIGURE 1: Application efficiencies — where (A) is farmer managed and (B) is Strategy 3 (flow rate 6 l/s and time to cut-off equal to 90 per cent of advance time)



ROT STRATEGIES

The potential to improve the irrigation performance by using common ROT management practices was assessed using the surface irrigation model SIRMOD. The simulations compared three ROT management practices commonly adopted in both the cotton and sugar industries:

- **Strategy 1:** Flow rate as measured and time to cut-off equal to the advance time;
- **Strategy 2:** Flow rate six litres per second and time to cut-off equal to the advance time; and,
- **Strategy 3:** Flow rate six litres per second and time to cut-off equal to 90 per cent of the advance time.

RESULTS

Applying a simple decision rule (Strategy 1) to stop all irrigations when the advance reached the end of the furrow results in vastly improved performance (Table 1). Average application efficiency increases to 72 per cent with a large number of irrigations exceeding 90 per cent efficiency.

But the range of efficiencies remains far too wide at 30–100 per cent. More than half the irrigation events were still below industry target levels (that is 75 per cent application efficiency) and average deep drainage was still more than 25 mm per irrigation.

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TABLE 1: Summary of the simulations for the 79 irrigation events giving averages (and standard deviations in brackets) for each of the three performance measures

	Application efficiency (%)	Deep drainage (mm)	Requirement efficiency (%)
Farmer managed (as measured)	48.2 (21.2)	42.5 (37.3)	93.6 (16.7)
Strategy 1 (Flow rate as measured, tco = tadv*)	72.0 (18.0)	25.8 (29.9)	88.9 (21.1)
Strategy 3 (Flow rate 6 l/s, tco = 90% tadv*)	73.6 (19.2)	16.0 (23.0)	82.3 (22.7)

*tadv is the time taken for the advance to reach the end of the furrow

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Using Strategy 3, deep drainage losses were reduced to 16 mm per irrigation (Table 1). This represents a water saving, on a seasonal basis (six irrigations) of about 160 mm or about 1.6 ML per hectare.

But the average requirement efficiency drops to 82 per cent suggesting that if this strategy was adopted without also changing the irrigation schedule then many fields would be experiencing significant crop stress and potential yield loss. In some cases, the advance did not reach the end of the field suggesting this strategy was not always suitable.

Even after the adoption of ROT practices, at least 30 per cent of the paddocks monitored would still need radical changes in irrigation design or management to achieve acceptable application efficiencies.

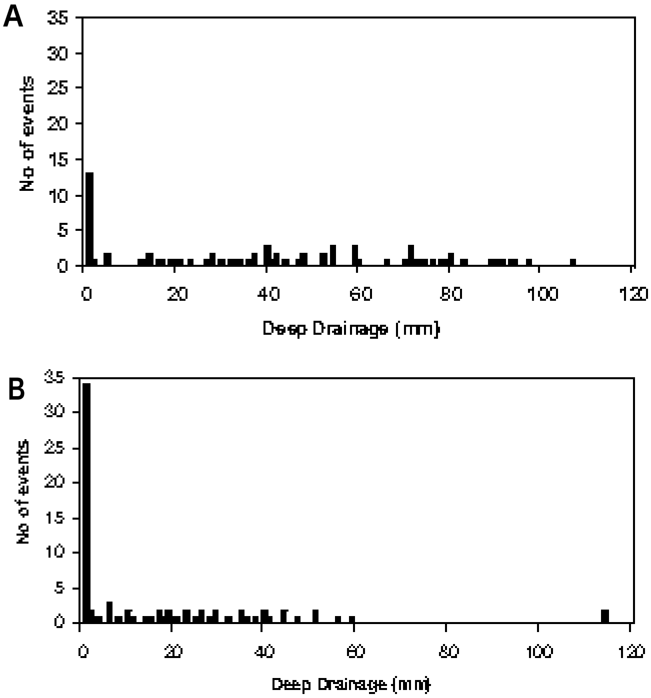
"There is a need to identify these low performing fields using performance evaluation monitoring so that site specific optimisation can be conducted or consideration given to replacement of the surface irrigation with centre pivots or lateral move machines," Steven said.

He is adamant that even where application efficiencies are improved adequately by implementing ROT practices, another different 30 per cent of fields would need a change in irrigation scheduling to ensure that crop yields were not affected.

"This work highlights that while in some cases there are benefits from the use of ROT practices, there are dangers in adopting ROT practices without appropriate monitoring and measurement," Steven said.

This source of this article is a research paper "Irrigation Application Efficiency and Deep Drainage Potential under Surface Irrigated Cotton" (2004) by R.J. Smith, S.R. Raine and J. Minkevichsoils and agronomy courses taught at the University of Queensland.

FIGURE 2: Deep drainage — where (A) is farmer managed* and (B) is Strategy 3 (flow rate 6 l/s and time to cut-off equal to 90% of advance time)



*Two extreme points > 200 mm deep drainage have been omitted from this plot.

FIGURE 3: Requirement efficiencies - where (A) is farmer managed, and (B) is Strategy 3 (flow rate 6 l/s and time to cut-off equal to 90% of advance time)