May 2015

Evaluating furrow irrigation performance

Key messages: Results from the 2006-07 season

- 45 percent of events had an excellent application efficiency of over 90 percent
- 35 percent of events had a poor application efficiency of less than 80 percent
- It is imperative to evaluate performance before making a change in practice as you may inadvertently reduce the performance of an already efficient field.
- For those events that were optimised in order to save water, the average water saving was 0.18 ML/ha for each irrigation event.
- 65 percent of events had a high distribution uniformity of above 90 percent
- High application efficiency was often achieved under deficit irrigation conditions, where scheduling and management is very important.

If you want to produce more bales of cotton per ML of water used, an irrigation evaluation is an important tool for improving your water use efficiency. The only way to maximise these efficiencies is to measure them.

During the 2006-07 cotton season, 47 furrow irrigation evaluations were successfully conducted by the then Cotton CRC Water Team across nine farms located in the Gwydir and Namoi Valleys. Individual irrigation events were evaluated using Irrimate™

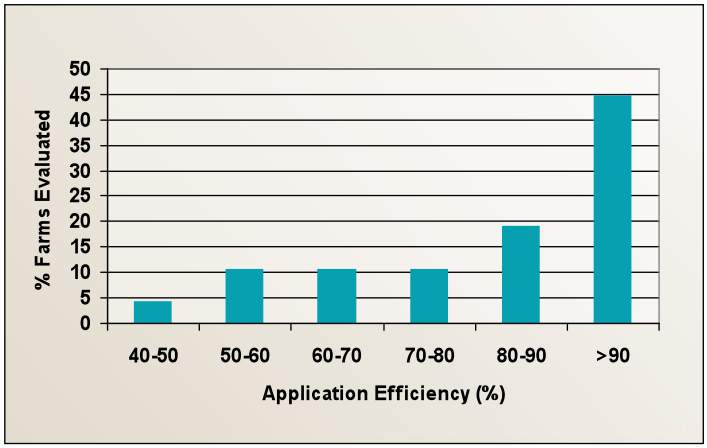

Figure 1: The range in application efficiency – 35 percent of irrigations had an application efficiency of less than 80 percent.

based on the grower's usual management practices.

While simply measuring the inflow and runoff from a field can be a useful first step, the Irrimate™ service provides a number of additional performance measures, such as application efficiency and distribution uniformity, that cannot be obtained from simple volume measurements alone.

Evaluating performance

Optimum irrigation performance is achieved when both application efficiency and distribution uniformity are high with the requirement efficiency satisfied according to your requirements.

Application efficiency is a comparison between the amount of water applied and the amount retained

This fact sheet has been adapted for CottonInfo from a former Cotton Catchment Communities CRC publication. It was originally produced by Janelle Montgomery NSW DPI, David Wigginton NSW DPI.

in the rootzone, whilst distribution uniformity is a measure of how evenly the water has been applied. The aim is for both of these measures to be as high as possible.

Requirement efficiency describes how well the deficit has been met. This measure does not have to be 100 percent, but if it is not, deficit irrigation is occurring and this must be taken into account when scheduling irrigations.

Figure 1 - About 35 percent of irrigations had an application efficiency of less than 80 percent. An application efficiency of 80 percent should be considered as a standard for minimum performance, whilst application efficiency of greater than 90 percent is achievable under furrow irrigation, as indicated in the figure.

Figure 2 – Over half of the measured events had a requirement efficiency of less than 100 percent, indicating that deficit irrigation was occurring. This does not need to be of concern, as deficit irrigation usually results in reduced deep drainage potential and increased capacity to capture rainfall, although the irrigation interval must be shortened and management must be precise.

However it is important to view application efficiency and requirement efficiency together. For the events

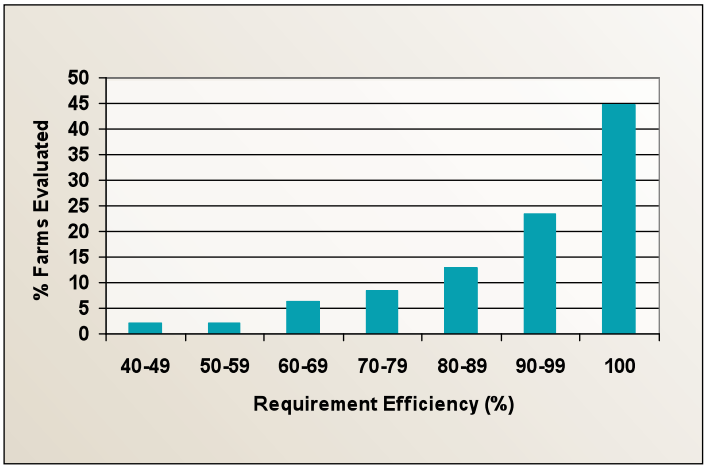

Figure 2: The range in requirement efficiency – deficit irrigation is occurring in a large proportion of events.

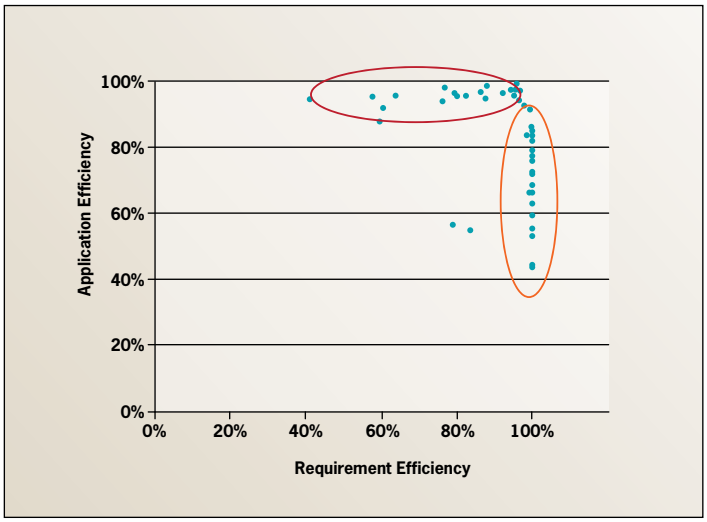

Figure 3: The relationship between application efficiency and requirement efficiency – Application efficiency was most often lower when the deficit was being fully satisfied (orange circle).

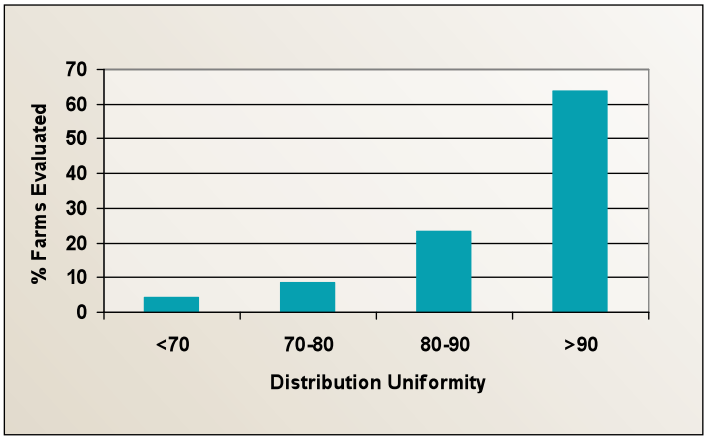

Figure 4: The range in distribution uniformity from 51 irrigation events.

measured, application efficiency was most often high when deficit irrigation was occurring (Figure 3 red circle). In contrast a high requirement efficiency often resulted in lower application efficiency figures (Figure 3 orange circle).

Figure 4 - Distribution uniformity was also high with 64 percent of the events having a distribution uniformity greater than 90 percent. A high uniformity does not guarantee an efficient irrigation. To achieve such uniform applications, often more water is applied than is necessary.

What does this mean?

These results show there is still considerable room for improving irrigation performance of furrow irrigation systems. About 35 percent of the events had an application efficiency that could be considered below standard, whilst numerous others could no doubt be improved further.

On the other hand, almost half of the events measured performed very well, with an application efficiency of over 90 percent. Undertaking a performance evaluation of these fields is also critical, as many growers seek to change their irrigation practices, it is imperative to ensure that any change is actually worth undertaking. *For almost half of these events, a change in practice without first measuring current performance may have led to a decrease in efficiency!*

Using the Irrimate™ system you can simulate your actual irrigation event using computer modelling. The model can then be used to assess alternative management strategies by changing one or a combination of management variables to establish the most efficient irrigation application strategy.

The results of our 2006-07 irrigation evaluation trials found that often, irrigation performance of furrow irrigation systems can be improved with simple management changes, such as reducing the time siphons are running and/or the rate at which irrigation water is applied to the field.

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Potential water saving

Many of the events evaluated above were optimised to determine the improvement in performance that might be possible. Some of these events were modified to try and increase distribution uniformity, and in some cases achieving this was only possible by increasing the amount of water applied.

However 23 of the events were modified in an attempt to improve application efficiency and hence save water. The amount of water applied was reduced by up to 0.41 ML/ha/irrigation, with the average reduction 0.18 ML/ha per irrigation event. To put this into perspective, over 500 ha and seven irrigations, this would amount to a total saving of 630 ML. This could grow an extra 80 ha cotton or provide enough water for one irrigation cycle on this farm. Alternatively this water could be traded.

What the growers had to say:

Grower 1

What was the most important thing you learned from this work?

These trials reinforced the need to match infiltration requirements and system delivery, but to not exceed this in order to optimise efficiency. The information has also been useful to see the relationship between our probe readings and the amount of water we pump and will lead to better future production through better decisions about water availability.

What will you do because of these results?
We have started to steepen grades or split fields in order to speed up flow down the field. We have also reinforced promptness in workplace, as it is vital to manage the irrigation precisely in order to maximise performance.

What was the most challenging aspect of this work?
Matching the area irrigated efficiently with the labour component required careful consideration. It is important to run water by the clock and not by the sun. For example we only allow water to be in the taildrain for one hour before changing, or even changing instantly on long runs.

Grower 2
What was the most important thing you learned from this work?
The effectiveness of the irrigation applied - this in a field that we had shortened to increase efficiency - we hoped! It exceeded my expectations by considerably reducing watering time (water on field) and reducing the amount of total water required over all - the information obtained from the measurements and models showed that we attained our aimed application (refill) without large seepage losses.

What will you do because of these results?
We will continue to shorten fields to less than 700 metres, continue with double siphons for all incrop irrigations and try techniques to further improve water use efficiency - i.e., make the water go further.

What was the most challenging aspect of this work?
Getting irrigators to pull siphons early enough! But we did actually improve the watering operation because the water came out more evenly reducing the need to be always checking and stopping and starting rows.

What the consultant had to say:
What was the most important thing you learned from this work?
That our existing practice was indeed accurate for this farm. Reinforced that what we were doing was efficient. Can move ahead and concentrate on other things as we now know how efficient we are.

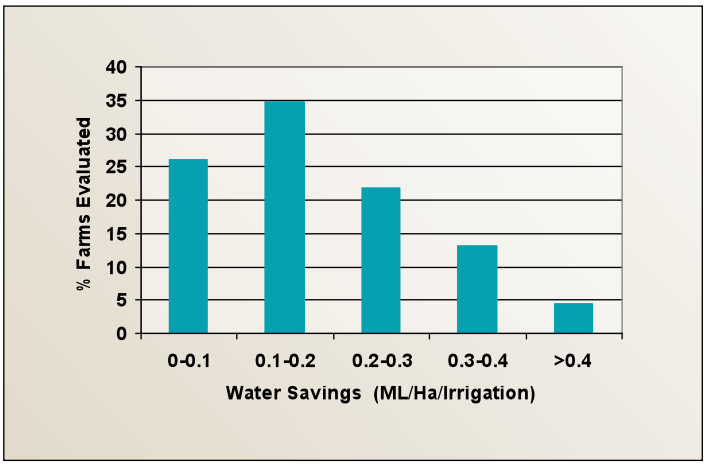

Figure 5: Potential water savings.

What will you do because of these results?
Continue paying attention to detail with regard to measuring and monitoring crop water use and aim to match irrigations to water use so as to remain as efficient as possible.

What was the most challenging aspect of this work?
To now extend this to other farmers. Get them to measure and manage their irrigations. Some farmers need to know what they are missing out on in $$ or bales/ha so they can then do the sums to see if it is practical to move to shorter irrigation times.

For more information:

Visit www.cottoninfo.com.au/water-management

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