

# Big profit increase from better water use efficiency

By Jenny Foxton

## LEADING EDGE

A research project taking a whole-farm view of irrigation has shown significant production increases of up to \$600 per hectare could be obtained by making greater use of irrigation water.

If these water savings were diverted to extra production, this could equate to an extra 10 to 20 per cent of irrigated area planted where land area is not a limiting factor.

Seasonal deep drainage losses on irrigated farms have been measured in the order of one to two megalitres per hectare per season. Significant increases in farm production could result if some or all of this water could be diverted to extra production.

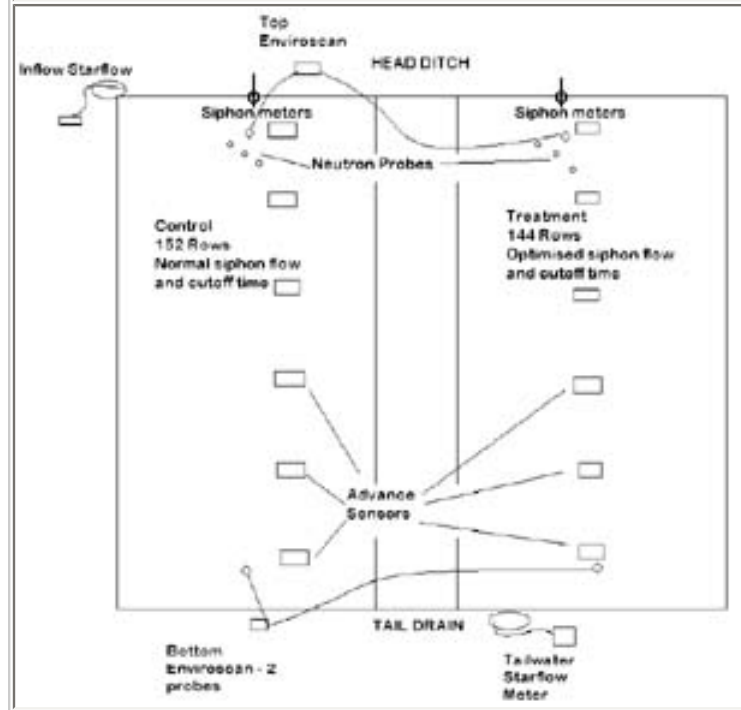
The projects, funded by the Queensland Rural Water Use Efficiency (RWUE) and the Cotton Research and Development Corporation and run by the National Centre for Engineering in Agriculture (NCEA) have identified and measured significant water losses from tailwater and deep drainage in cotton furrow irrigation.

According to research team member, Paul Dalton of Dalton Consulting, tailwater losses and excess pumping, re-pumping and de-siltation costs in many cases represent up to three per cent of the gross margin value of cotton production. As well as these cost reductions, significant water lost to drainage below the rootzone can also be easily saved for extra production.

"These water management issues represent a significant potential economic loss to the Australian cotton industry," Paul said.

Unlike many previous water use efficiency trials, this project aims to marry the engineering side of soil water utilisation with the agronomic aspects of irrigated crop production to achieve maximum yields and maximum water use

FIGURE 1: Field trial plan



GLI flow sensor with the Irrimate logger measuring siphon flows.

efficiency.

Paul undertakes research through the NCEA while Andres Spragge, Queensland Department of Primary Industries at Dalby, provides technical assistance, data collection and extension services. Agronomic advice on irrigation scheduling, plant mapping and crop management is provided by Tony Lockrey of Total Ag Services.

One trial at Neville Walton's property at Macalister on the Darling Downs compares a research field using the latest irrigation techniques with a control field irrigated under normal practices.

The difference in the trial paddock is all about timing. By using double siphons to push the water through more quickly, the flow through time is reduced. The aim is to maximise volumetric and agronomic efficiency. Normal paddock practice involves single siphons and shutting water off when it runs tail water or in other cases after tailwater has run for several hours.

"This produces potential water savings because there is less opportunity for water to get below the root zone, and potential waterlogging reductions due to reduced inundation times," Paul explained.

From a cotton grower perspective, Neville Walton sees advantages in management flexibility and lifestyle.

"I'm now watering for 10 to 12 hours instead of 16 to 20 hours over 600 metre runs," Neville said.

But he feels the real gains can be made in lighter soils, where moisture infiltrates the soil at a faster rate, and by using longer furrows.

"The main thing I see right now is to keep the watering times down, which makes for easier water management. You get to tailor application rates and times to your own farm."

A similar water use efficiency trial undertaken by Paul Dalton in the Goondiwindi area last year demonstrated how the crop became rank through a reduction in waterlogging.

"Unfortunately we did not see a yield increase in this trial, but the rankness showed that the crop had a significant physiological response due to



Installation of the Enviroscan probe tube.



Starflow flow sensor in-situ in a concrete pipe



The Starflow logger and laptop take data from the instrument.

the waterlogging reduction caused by more efficient watering.

“Other work has found that the potential for waterlogging yield losses is high due to excessive irrigation inundation times,” Paul said.

According to Andres Spragge, the project team aims to produce “workable” management options for farmers so they can realise the potential of his crop.

“The aim of the three year rural water use efficiency project is a 10 per cent increase in efficiency in water use,” Andres said.

“The culture and perceptions of irrigators are a key to improving the efficiency of irrigation. Ninety-six percent of irrigated cotton uses flood irrigation so we’re going to make the biggest changes if we work with these farmers.

“A 10 to 15 per cent improvement in water use efficiency is easily achievable across the board with small management changes,” he added.

He says apart from trial work, the cotton industry has minimal water monitoring systems on-farm.

Current irrigation monitoring included soil moisture monitoring (neutron probes, C-probes and Enviroskans) and water meters on pumps.

“But little is known about how to match the water applied to a field with the water required by the soil and crop.

“The system of water monitoring used in this trial represented, for the first time, a means to match water applied to a field with that required by the crop,” he said.

The inclusion of an agronomic monitoring system which included soil moisture monitoring and plant mapping, would ensure that reductions in waterlogging due to more efficient irrigation, did not result in a detrimental effect on crop growth (rankness) and yield.

After picking at the Macalister site, the project team will look at yield and cotton quality comparisons to produce summary data.

The main emphasis in the data collection was to get a better handle on managing drainage.

Paul Dalton says the advantages of flow metres in the siphon is that we can use them in multiple



Engineering consultant Paul Dalton (left), looks at a cotton crop in a water use efficiency trial on Neville Walton’s (right) farm west of Dalby.



Andres Spragge explains the trial results to a group of farmers.

locations to assess all fields on the site.

## EXPERIMENT DESIGN

The basic variation in irrigation management being trialled is the effect of optimised application siphon flow rates and irrigation siphon shut-off times. The variation in these between treatment and control may determine that scheduling, growth regulation, pest management, nutrient and harvest time will be different due to less waterlogging. So these are managed independently on both treatment and control blocks.

The option for a second pix treatment within the treatment is available if needed in case the crop grows significantly rank due to decreased waterlogging.

The performance indicators are broadly classed in terms of volumetric, agronomic and economic with the aim of optimising all three. Various measured parameters formed the basis for these performance indicators as described below.

## VOLUMETRIC EFFICIENCY

The field equipment set-up and site plan are shown in Figure 1.

### Irrimate sensing equipment

Irrimate flow and advance monitoring equipment was installed at the site for the pre-water irrigation. For the in-crop irrigations this equipment was used to measure irrigation flowrate and cut-off time optimisation of the treatment block. The volume of water applied to individual furrows is measured using the GLI impellor flow meters (typically used with the Irrimate siphon meter – see photo, page 57).

### Neutron probe

Neutron probe access tubes were installed in the treatment and control blocks. Gravimetric and bulk density soil samples were taken in conjunction with initial probe readings to get an accurate volumetric calibration of the neutron probe relative to the soil type.

### Enviroscan

Two Enviroscan systems were installed at the site. These were installed at the top and bottom of each block to gain an understanding of any variation in soil moisture relations due to the

treatment at both the top and bottom of the field.

## Starflow

Starflow meters were installed in the inlet and tailwater main pipes to get bulk flows onto and out of the blocks. The photos on page 59 show the Starflow in a concrete pipe and the logger being downloaded with a laptop computer.

## AGRONOMIC EFFICIENCY

The soil moisture sensing devices will be used for irrigation scheduling. Apart from this equipment there is no other equipment required for agronomic efficiency monitoring, but a protocol of recording agronomic values is in place.

## ECONOMIC EFFICIENCY

No in-field equipment is required for the economic efficiency monitoring but a protocol of recording inputs and outputs for the two blocks is in place.

A series of workshops on irrigation engineering and agronomy monitoring for maximising efficiency will be conducted during the coming winter. Those interested should contact Paul Dalton on 0417 613 514 for attendance and locations.