

Cotton can benefit from vegetable irrigation research

By Gary Alcorn

LEADING EDGE

Cotton growers should be able to learn something more about irrigation efficiency from their cauliflower, potato and sweet corn producing counterparts in the Lockyer Valley of Queensland.

A 2002 research paper, 'Using commercial uniformity and yield data to improve irrigation management', by Scott Barber and Steven Raine reveals how system modification and farmer participation can fine tune water use efficiency in various horticultural enterprises to lift income from \$1042/ML to as much as \$1283/ML.

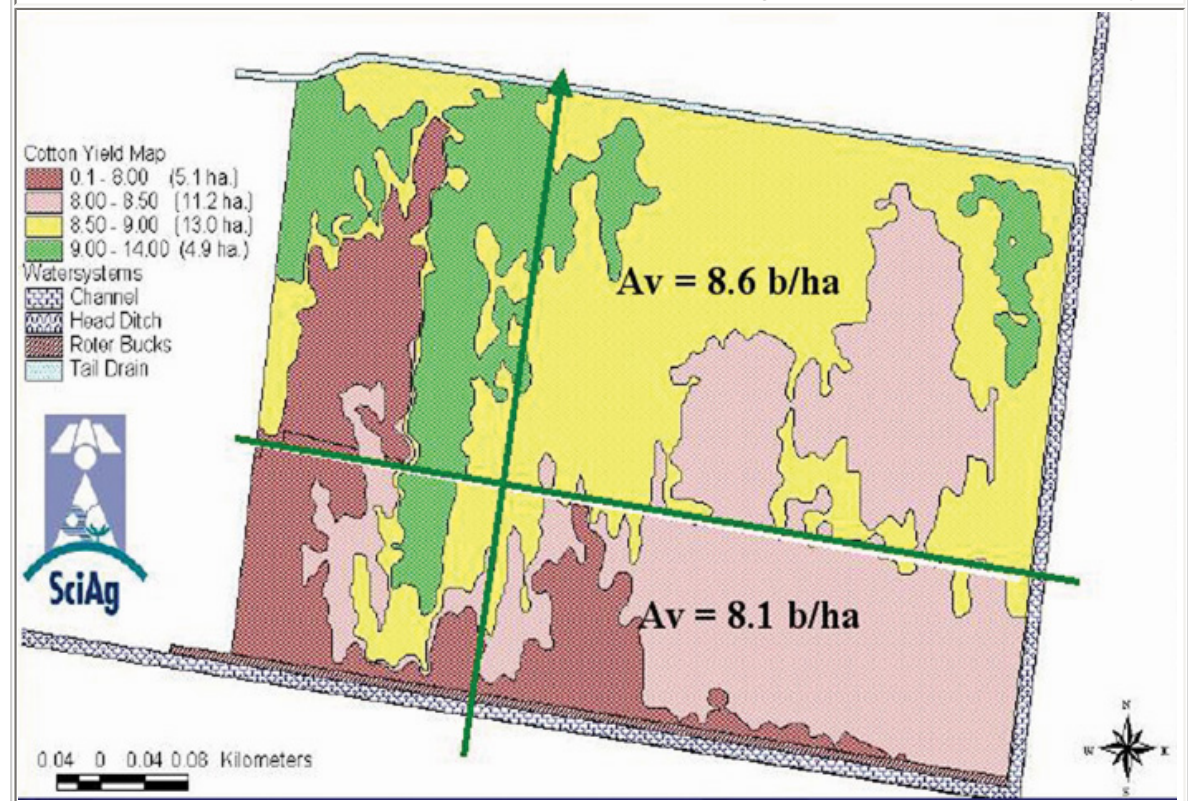
Speaking at the Irrigation Association of Australia conference at Dubbo in May, Scott, now Regional Engineer in the Conservation Engineering Unit of NSW Department of Sustainable Natural Resources, said there was strong correlation between irrigation distribution uniformity (DU) and crop yields across various vegetable and some tree crops.

"Motivation of growers to improve or change their current practices requires the demonstration of direct dollar benefits resulting from improved practices," says Scott.

"One extension approach which has gained irrigator support in southern Queensland involves an analysis of the irrigation system performance (particularly with pressurised systems) which relates the results to crop yields.

"Irrigators appear to have responded to this approach, preferring to discuss the mechanics of their irrigation rather than the more abstract

FIGURE 1: Yield variation can often be traced to low irrigation distribution uniformity



concepts of soil moisture monitoring and scheduling," he said.

Does this research have any relevance to cotton growers? Yes, says Steve Raine, Principal Scientist (Soils, Irrigation, and Land Use) at the National Centre for Engineering in Agriculture, University of Southern Queensland.

"The ability of the irrigation system to apply water efficiently and uniformly to the field is a major factor influencing the agronomic and economic viability of cotton production," he says.

"Growers often measure the volume of water applied to the whole field and then calculate the average depth applied.

"But, because this is a calculated average over the whole field, one half of the field has received less than the average and one half more than the average.

"So if the average volume applied over the field is the volume needed to meet the crop requirements, one half of the field has been over-irrigated while the other half of the field has been under-irrigated," he said. "Both extremes reduce the efficiency of application and reduce yield."

Where the uniformity of the irrigation application is high, the areas under or over irrigated are generally small and the potential yield or water losses are also small.

Fields with low DU may need extra water applied to properly irrigate 'hard-to-wet' areas.

"This additional water application may lead to increased problems associated with crop waterlogging, deep drainage, lower irrigation efficiencies and increased tailwater pumping and losses," Steve said.

In-field measurements on over 180 surface irrigation events under commercial conditions have found application efficiencies over the season commonly range between 60–85 per cent.

One of the major reasons for low efficiencies is the relatively low uniformity of application

associated with many furrow fields. But these uniformities and efficiencies can often be increased by the selection of more appropriate furrow inflow rates and by pulling siphons earlier to reduce potential deep drainage losses.

“Optimised management of commercial surface irrigation through these simple low cost changes (such as using IRRImate revised flow rates and times to cut-off) have been found to improve application efficiencies for single irrigations by as much as 30 per cent and to improve seasonal application efficiencies by up to 15 per cent.

“The evenness of water application using drip and overhead systems is normally much higher (distribution uniformity of 90–95 per cent) than for furrow systems (distribution uniformity of 60–90 per cent) and should normally translate into smaller in-field crop yield variations with these systems,” he said.

Back to the horticultural trial – solid set and drip irrigation systems were selected so the compounding influences of irrigator machine speed variation, variable supply hose hydraulic performance and variable elevation head were eliminated.

In all cases, growers were invited to be involved in the site selection and measurement process. Where possible, they were also asked to record:

- Dates and times of irrigation start-up and shut-off;
- Tensiometer readings at regular intervals; and,
- Catch can or rain gauge data at the site.

Cooperators measured and weighed market-ready beetroot, broccoli, cauliflower, lettuces and potatoes in commercial scale plantings to derive data which could link yield response to irrigation volumes.

For more than 60 commercial trials, crop response was often correlated to the volume of seasonal irrigation applied. Currently carrots in the Lockyer and Fassifern Valleys are being examined.

Conclusions

Measuring crop performance under commercial practices provided a useful approach to irrigation system evaluations, increased the relevance and interest of irrigators in water use efficiency. The linking of distribution uniformity and crop yield data with system performance models has also enabled substantial 'value-adding' of the field data and improved the identification of irrigation production benchmarks (ML/ha, \$/t, \$/ha, t/ML, \$/ML). This approach is directly relevant to irrigators and is simple enough for them to undertake with minimal assistance.

"The methodology deals with the irrigator's resultant profitability in conjunction with irrigation efficiency, provides direct environmental benefits and satisfies all parties interested in the irrigation industry," Scott said.

This approach may revolutionise irrigation benchmarking for commercial farming enterprises, as lower DU implies that a range of irrigation depths and crop yields potentially exist. This process can enable an individual grower to collect a large sample of information for a particular crop benchmarking exercise.

Typically, commercial benchmarks are generated by gaining average yield and water use data for a particular crop which means only one benchmark of irrigation (ML/ha) and yield (t/ha) is collected for a particular site. The approach discussed by Barber and Raine may result in many benchmarks for a given site without the added complication of different farm management practices varying crop outputs, as is often observed when comparing benchmark data from different farms.