CottonInfo **Information** *when you need it*

2016 smarter irrigation technology tour

Southern NSW

PREAMBLE:

This tour brings together irrigators across four commodity sectors - cotton, sugar, rice and dairy. While growers produce a different product, the efficient use of water, fertiliser, labour and energy unite them in their quest for better farming options.

Tour participants will see various surface irrigation layouts and hear from irrigators who have fully automated their systems. Importantly, they will also get an insight into the decision process for investing in these systems, how they manage any associated risk and their adoption of complementary water management tools and technologies.

The tour will also provide a platform for researchers from the **Smarter Irrigation for Profit** project to discuss their latest research. The project, is a partnership between the major irrigation industries of cotton, dairy, rice and sugar, and is led by the Cotton Research and Development Corporation (CRDC) in conjunction with Dairy Australia, the Rural Industries Research and Development Corporation (RIRDC), Sugar Research Australia and other research partners, through funding from the Australian Government's Rural R&D for Profit programme.

We hope you enjoy the trip and gather some new ideas to apply when you get home. Join our Facebook group to see live pictures and ideas from innovators in the irrigation industry: www.facebook.com/SmarterIrrigation.

For more information, visit: www.cottoninfo.com.au/publications/water-smarter-irrigation-profit-projects.

This project is supported through funding from the Australian Government Department of Agriculture and Water Resources as part of the Rural Research and Development for Profit and Sustainable Rural Water Use and Infrastructure Programmes, in addition to CRDC, RIRDC, Dairy Australia, Sugar Research Australia, NSW DPI, STBIFM, NCEA, Rubicon and Padman Stops. Photos in booklet: Ruth Redfern, CRDC/CottonInfo.

ITINERARY:

Day 1 - Monday 5 December: Travel to Shepparton	
4:45am	Coach departs Moree, NSW, and picks up along Newell Highway.
6:30pm	Coach arrives Shepparton, VIC. Growers making their own way to also arrive. Accommodation: Quality Hotel Parklake, Shepparton.
7:15pm	Tour welcome dinner: Quality Hotel Parklake, Shepparton.
Day 2 - Tuesday 6 December: Rubicon farm and factory tour. Shepparton to Cobram	
8:30am	**Rubicon:** • Overview of water technology • Overview of the Total Channel Control network, which has been rolled out in the Goulburn/ Murray, Coleambally and Murray Irrigation districts • On-farm solutions: FarmConnect on-farm case study • Visit to Rubicon's manufacturing facility and flow test lab (used to pre-test water flow meters)
12:15pm	**Farm visit 1:** Russell and Cathy Pell, Wyuna. Dairy farm, irrigated cropping and pasture.
2:15pm	**Farm visit 2:** MacKenzie Craig, Nathalia. Fat lamb production, irrigated cropping.
4pm	**Farm visit 3:** Ray Thornton, Yalca. Corn and irrigated cropping.
7pm	Accommodation: Barooga County Inn Motel. Dinner at Barooga Hotel.
Day 3 - Wednesday 7 December: Padman Stops facility and farm visits. Cobram to Griffith	
8:15am	**Padman Stops:** Overview of irrigation structures and associated automation.
10:30am	**Farm visit 4:** Noel and Glen Baxter, Berrigan. Cotton, maize, automated Padman Stops system.
2pm	**Farm visit 5:** Rob Black, Coleambally. Cotton, maize, pipes through the bank, portable automation.
4pm	**Farm visit 6:** Ben Witham, Coleambally. Cotton, grain, automated pipes through the bank.
7:30pm	Accommodation: Kidman Wayside Inn, Griffith. Dinner at LaScala.
Day 4 - Thursday 8 December: Farms and research facility, Darlington Point and Whitton	
8am	**Farm visit 7:** Matthew Stott, Darlington Point. Almonds, cotton, grains, GL bankless and siphons.
10am	**Farm visit 8:** Peter and Dallas Stott, Whitton. Cotton, grains, automated bankless.
12pm	**Farm visit 9:** Research facility - IREC field station and regional trial site, Whitton.
1:30pm	**Farm visit 10:** Tim and Roger Commins, Whitton. Cotton and fish, siphons and bankless.
3pm	Start to make way home, o/night Dubbo. Accommodation and dinner TBC
Day 5 - Friday 9 December: Travel home	
	Travel home. Arrive back in Moree.

farm visits

FARM VISITS: Russell and Cathy Pell, Wyuna

Victorian farmers almost double maize yield per megalitre of water

FarmConnect®

"I've certainly grown a better product and that's what we're really after and we've been able to achieve that by fast watering and controlled watering."

Situation

Russell and Cathy Pell run an 806 hectare property on the banks of the Goulburn River near Wyuna, Northern Victoria. They grow maize, lucerne, millet and pasture supporting a 650 head dairy herd.

Recent automation of their supply service meant their service point now delivered accurately measured, consistent high flows at short notice. This level of service meant the Pells could irrigate much more efficiently and effectively if they upgraded their existing manual surface irrigation system.

They were motivated to find a solution that would enable them to sustainably irrigate while maximising yield per megalitre of water applied. They also wanted to improve their lifestyle - like many other surface irrigators they found manually irrigating time-consuming, laborious and sleep-depriving.

They looked at a range of options, including converting to drip irrigation. "I certainly considered going with drip and it's certainly got its place but I'm very conscious of energy use and I'm very conscious of the cost of putting it in." Russell said.

RUBICON™

Solution

After doing their homework, they installed high-flow gates and automated them using a FarmConnect High-Performance Surface Irrigation Solution. The solution involved installing five in-channel BayDrive™ actuators to manage water through the farm channel system and 49 BayDrive bay outlet actuators. Additionally, four soil moisture sensors and a rain gauge were installed to provide accurate information on crop water demand. Each device is connected to a farm radio network and remotely monitored and controlled by cloud-based FarmConnect software.

With high-flow gates, the Pells can apply water to bays at 22ML/day, twice the rate previously. Irrigation duration has reduced from around 6 hours per bay to around 1½ to 2 hours. This reduces infiltration below the root zone, runoff and waterlogging. Using FarmConnect software, gates open and close automatically to schedule, which is a big improvement on Russell having to go to site and open and close gates through the day and night. The software sends regular status updates and if there are any problems, the system will send a text message to Russell's phone.

Accurate soil moisture data provides up-to-the minute information on crop water demand so they can precisely determine the optimal time to irrigate.

Results

The new system immediately had a huge impact on productivity in the first season. Precisely-controlled high flows reduced waterlogging leading to significantly increased growing time. Closely monitoring soil moisture meant that the Pell's millet and maize crops could be watered less often than they use to.

"The thing that I've learnt is that I watered twice as often as I needed to, Russell said. "By watering five times instead of 10, I got 10 extra days of growing time during summer — it absolutely bolted during December and January — so it was probably worth closer to 20 days of extra growing time given weather we've had lately."

Soil moisture monitoring also helped determine the effectiveness of rainfall so they could avoid either irrigating too early after rain or stressing the crop by watering too late.

The result was higher yields and a better quality crop, while using less water. The Pells produced nearly 4.0 tonnes of maize per megalitre of water applied, which is double the average for the surrounding area of 1.9 tonnes. "Maize crops around this area average around 16 tonnes of dry matter per hectare. The result we got last year was close to 27 tonnes, and our ambition is to achieve even better. You need all these bells and whistles to be able to achieve these type of yields." Russell said. This translates to a $1,000 per hectare increase in revenue compared to the farm's 22 tonne average.

And the Pells enjoyed the peace of mind of being able to remotely monitor the farm while on holiday. "When we saw that moisture was required we could then engage and start irrigating, while we were on holiday - how good is that? I certainly would recommend FarmConnect to others. This type of technology is where the future of farming lies."

A Rubicon Water product

Rubicon Water's advanced technology optimises gravity-fed irrigation, increasing water availability and improving farmers' lives. With Rubicon's FarmConnect, farmers can grow higher-value crops using less labour, water and energy.

Founded in 1995, Rubicon has more than 20,000 gates and meters installed in 10 countries.

"Maize crops around this area average around 16 tonnes of dry matter per hectare. The result we got last year was close to 27 tonnes."

Watch the video here:

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FARM VISITS: Mackenzie Craig, Nathalia

Mackenzie Craig and his family run an 800-hectare mixed grain and prime lamb enterprise, with 200 hectares developed for irrigation. In 2011, the Craig family commenced upgrading 130 hectares of the border check layout with Padman bay outlets (Flat Stop), with erosion wings and automated water control using Rubicon FarmConnect technology.

Being a city boy, Mackenzie said he didn't have experience to rely on, so he needed technology to overcome that shortfall. He loves technology and is very comfortable using it. His technology includes soil moisture sensors that indicate optimal time to irrigate, and remotely-controlled automated field devices that precisely manage water application.

A smart meter connected to their farm turnout enables Mackenzie to accurately calculate the volume of water applied by providing real-time flow information. Cloud-based, FarmConnect software enables the system to be managed from the computer and smartphones.

Mackenzie said that automation itself doesn't save water; it is fast flow and scheduling that will save water, but that is almost unmanageable to do manually.

Further information:
www.rubiconwater.com/news/usa-latest-news/farmconnect-customer-wins-top-water-award-usa

Rubicon BayDriveTM actuator which is remotely-operated and designed to automatically open and close the gates of the outlet.

No more sleepless nights with FarmConnect®

FarmConnect®

"It will probably prolong my life on the farm"

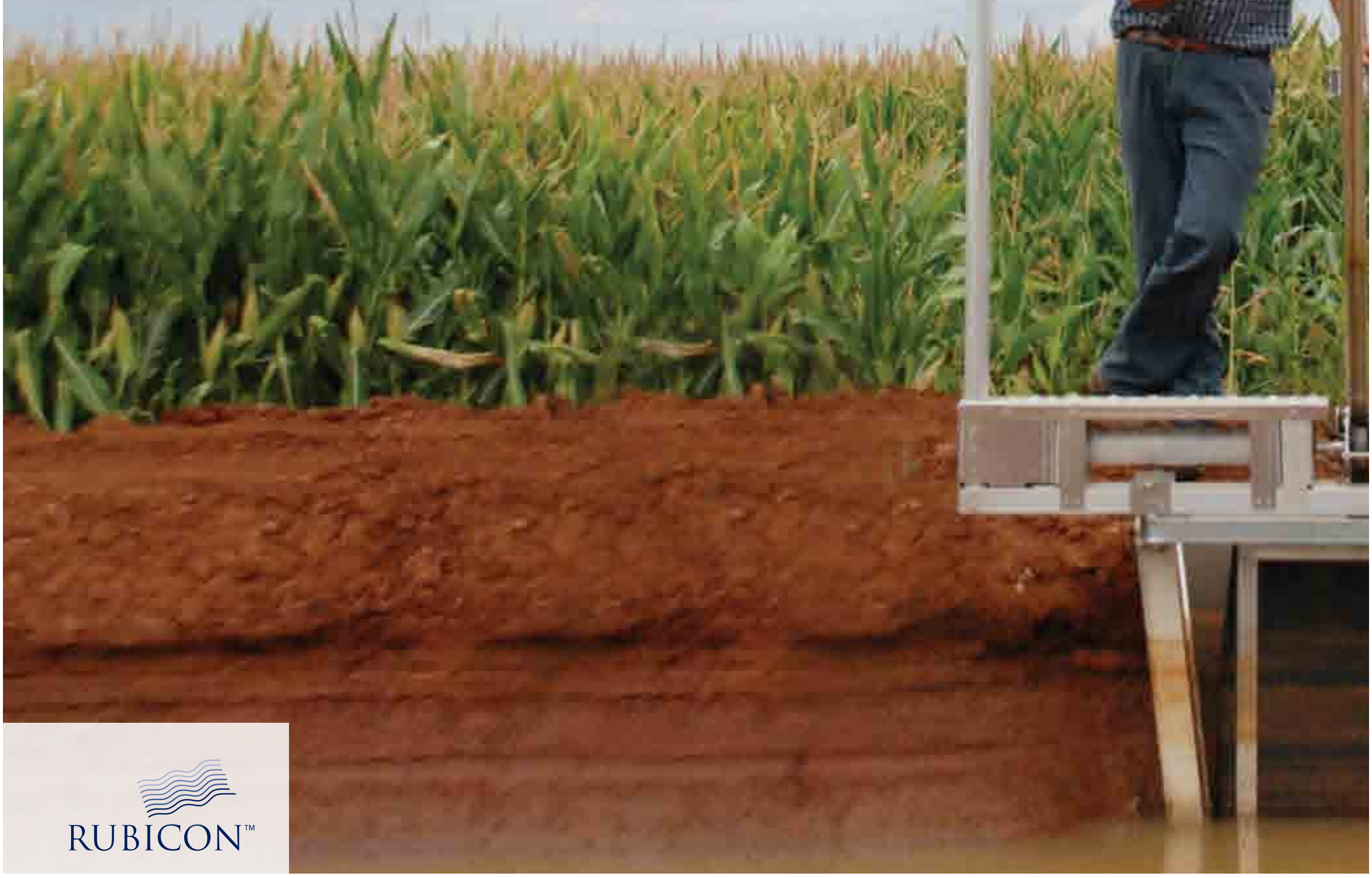
Situation

Ray Thornton runs a 240 hectare property located at Yalca in Northern Victoria, growing wheat, barley, faba beans canola and maize.

With his old irrigation system much of the workload was centred around the four hours it took to manually irrigate each bay. He constantly had to stop what he was doing elsewhere on the farm to close and open bay outlet gates. He invariably found he was running late, which led to over watering. Irrigating also meant getting up throughout the night to manage gates. "The alarm clock would go off and I would go out and change one, then I would get back to sleep and the alarm clock would go off again. So it was sleep depriving."

Looking to improve his lifestyle and ultimately generate more profit, Ray decided to take advantage of government irrigation modernisation funding and convert his border-check surface irrigation to an automated, high-flow system.

Ray's on-farm irrigation upgrade coincided with upgrades to his supply service, which involved decommissioning a supply channel and replacing it with a pipe and riser system. Ray replaced the rest of his bay outlet gates with high flow gates and looked for a system to automate them.



RUBICON™

For Ray, three things were important: robust and reliable hardware, software that he could use on the move and a system that would automatically alert him if there were any problems. "You need to be able to run it from somewhere else without having to try and log onto your home computer. Some of the systems don't have fact reporting, so you don't know if they have opened or shut or if there has been an issue with an outlet".

Solution

Ray met all these needs and more by choosing a FarmConnect High-Performance Surface Irrigation Solution. The solution involved installing 69 automated BayDrive outlet actuators, a soil moisture sensor and a rain gauge to provide accurate information on crop water demand. Each device is connected to a farm radio network and remotely monitored and controlled by cloud-based FarmConnect software.

The system enables Ray to set his bay gates to automatically open and close in sequence according to a precisely timed schedule, making it practical to implement the short run times needed for high flow irrigation.

Results

Ray's life is no longer dominated by managing irrigation. He now sets an irrigation to commence and the system takes care of it. "With the automation it doesn't matter, you just set it going and away it goes."

Comprehensive fault reporting means Ray can be off site and rely on the system to inform him of progress. When a roly-poly plant became lodged in a bay gate preventing it from closing Ray could take action before it became a problem, despite being 30km away from the farm.

"I was in Numurkah at the time and the phone rang and the message came through to say that outlet seven has had an issue; it couldn't close properly. I then manually closed it from my phone from Numurkah. So it is nice to know that it actually works, the fault checking does work."

He said the system had eliminated the need to get up in the middle of the night, providing a better night's sleep and a greater quality of life. "I am getting towards the end of my farming career and it will be nice to be able to continue on for so many years without the stress of irrigating. I moved to auto steer on the tractors, probably six or seven years ago, and that has done the same thing. So that has been a major plus and now with the automated irrigation it is a bigger plus again."

As well as lifestyle improvements Ray said he could envisage benefits in yield, crop quality and water savings. With less waterlogging crops have the potential to achieve higher yields and greater profitability. "That's the thrust of everything, more money in the till at the end of the day. That's what we all strive to do."

A Rubicon Water product

Rubicon Water's advanced technology optimises gravity-fed irrigation, increasing water availability and improving farmers' lives. With Rubicon's FarmConnect, farmers can grow higher-value crops using less labour, water and energy.

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FARM VISITS: Rob Black, Coleambally

Rob Black has irrigated using drip, centre pivots and siphons, and has finally found a system that suits his farming structure, layout and life style – automated pipes through the banks (PTTB's). Rob has 1366 ha developed for irrigation with only 100 ha of siphon irrigation left, which he plans to convert to PTTB's.

Rob Black, with a Padman Stops transportable dual timer.

Rob's PTTB irrigation system consists of Padman Stops' PEXL (pipe end also known as a dropbox), 18" (450mm) pipe and bubbler combo. The drop box is fitted with a water tight rubber flap door, which is opened and closed with a winch, and automated using a Padman Stops Portable Dual Timer.

The slope of the field dictates the width of the bays. The flatter the paddock, the wider the bay. In his steeper country (1:1000), the bay width is around 44m (24 x 1.8m beds); in the flatter country (1:5000), the bay width is much wider at 90 m (50 x 1.8m beds).

The water supply flow rate is dictated by the farm inlet or bore. The bore capacity is 11 ML/day, but with the recycle pump operating, Rob can increase the flow rate to a maximum of 15 ML/day. On his new development on flatter country, Rob will have a supply flow rate of 15 ML/day from the bore, and 8 ML/day from the recycle pump. This higher flow rate will require larger structures with greater capacity, so Rob will be using a 2' (foot) drop box to water 32 beds in bays, which are 1000 m long – fast watering.

Irrigation layout:
Irrigation water from the main supply enters each bay through a Padman Stops dropbox/pipe/bubbler into a pontoon (rotabuck area). This pontoon, which is at least 100mm below the furrow with zero slope and crossfall, distributes the water into a 4-5 ha down-slope bay.

Water fills the pontoon area, and spills over into the furrows between the beds. The bay has 24 x 1.8m beds and is around 600-700m in length, with a slope of 1:1000. The first 50 m of the field has no slope and no cross fall to assist with even watering of the rows. The water then flows down the normal slope of the field (1:1000).

It's a fast flow system with a capacity of 11 ML/day. Rob is putting half as much water again, compared to a 63mm siphon system and watering for 7 hours, compared to 12 hrs with the siphons. This system does have recycled tail water, so increases the flow rate back in the main supply.

Automation:
Rob uses Padman Stops' portable dual timer which he sets to automatically open and close the PTTB's rubber flap door at particular times. He recommends at least 4 per field, but the number really depends on the size of your field and the number of bays (shifts). Rob also uses them in his main supply channels. He also uses a Padman Stops SMS Chatterbox in the 1st bay so he can get his timing right for the rest of the bays in the field.

Why PTTB and not bankless channels?
"I've been an earthmover for much of my life and I believe you need good drainage, so I prefer a system that has some slope so when it rains, we can get the water off."
- Rob Black.

System at a glance:

System	Pipes through the bank
Crops	Maize, cotton, wheat and barley
Area (ha)	40 ha field, 4-5 ha bays
Row length (m)	600-700 m
Bay Width	24 beds (1.8m) per bay (steeper fields) up to 50 beds per bay on flatter country
Pontoon area	Minimum 100 mm below furrow. 50 m top of field no cross slope, so slope
Cost ($/ha)	To convert from siphon to PTTB, no major earthworks, just cost of structures and to grade the pontoon.
Supply flow rate (ML/day)	10-15 ML/day
Steps between bays (mm)	0
Time to irrigate bay (Hrs)	7 hrs
Bay Slope	Zero slope, and no cross fall for first 50 m, then 1:1000 slope to tail drain. Flatter fields up to 1:5000
Automation	Padmans' dropbox with portable dual timers and chatterbox set up in first bay - to get your timing right.

Further description of irrigation and automation infrastructure:

- **Padman dropbox (pipe end), pipe and bubbler combo**: A pipe end or dropbox is a concrete box that is installed on the end of a concrete or plastic pipe and is opened and closed with a 100% watertight rubber flap door: www.padmanstops.com.au/product/pexl-pipe-end-extra-large.
- A bubbler is an erosion control structure to prevent scouring of the bay: www.padmanstops.com.au/product/450mm-bubbler.
- **Portable dual timer**: An Electronic Dual Timer (EDT) will automatically open and close bay outlets, channel checks at pre-set times and can be easily moved between bays: www.padmanstops.com.au/product/portable-electronic-dual-timer-charger.
- **SMS Chatterbox:** Chatterbox is used to measure the time it takes for water to run down a field. It is placed in a defined spot in the bay and will send a text message when water reaches this point. This time can then be used to pre-set the portable dual timers for the remaining bays: www.padmanstops.com.au/product/sms-chatterbox-bay-monitor.

Pictured left: Padman Stops SMS chatterbox.

Pictured right: Padman Stops PEXL (pipe end also known as a dropbox), 18" (450mm) pipe and bubbler combo.

FARM VISITS: Ben Whitham, Coleambally

Owner: Witham family
Manager: Ben Witham
Irrigation Area: 580 ha
Water Source: Surface water CIA, 30 ML/day, gravity fed. Bore water 30 ML/day.
Soil type: Red duplex (shallow sandy-loam over dispersive slaking red clay-loam). Red & grey self-mulching clays.
Irrigation system: Pipes through the Bank (PTTB)

Overview: site one
The pipes through the bank irrigation system consists of a Padman Stops PE900, 750 mm pipe and bubbler combo. It has the watertight, rubber flap, winch-operated door, which is automated using a Padman Stops Portable Dual Timer. Each gate has a flow rate of 30 ML/day, watering 78 beds that are 1.8 m wide (bay width 140m) and a field length of 750 m (Bay area 10.5 ha). The field area is 21 ha. A small bankless ditch (pontoon) was built with a grader in place of the rota bucks, approximately 80 mm below the furrows. To ensure the bankless ditch completely drains and dries out, a control structure was placed at one end of the main recycle drain, so the field can be accessed for in-crop machinery operations.

Automation: Not currently automated.

Overview: site two
The pipes through the bank irrigation system consists of a Padman Stops PEXL, 450 mm pipe and bubbler combo. It has the watertight, rubber flap, winch-operated door, which is automated using a Padman Stops Portable Dual Timer. Each gate has a flow rate of 15 ML/day, watering 36–40 beds that are 1.8 m wide (bay width 65–72m) and a field length of 700 m. The field area is 67 ha.

A small bankless ditch (pontoon) was built with a grader in place of the rota bucks, approximately 80 mm below the furrows. The main supply channel is lower than the bankless ditch to ensure the bankless ditch completely drains and dries out so the field can be accessed for in-crop machinery operations.

Automation: Padman Stops Portable Dual Timers which are set up to automatically open and close the rubber flap door on the PTTB's at particular times. Ben has 12 portable dual timers, which only take a few minutes to set up on the Padman Stops drop boxes (PEXL pipe and bubbler combo). Timers are set by previous experience to ensure all rows run through. They are removed at the end of each irrigation, and recharged ready to move to the next gate.

System at a glance:

Site	Site 1	Site 2
System	Pipes through the bank	Pipes through the bank
Crops	Maize, cotton, wheat and barley	Maize, cotton, wheat and barley
Area (ha)	21 ha field	67 ha field
Row length (m)	750 m	700 m
Bay Width	140 m	65-72 m
Pontoon area	Yes, 80mm below the furrows	Yes, 80mm below the furrows
Cost ($/ha)	$320/ha (structures, polish & pontoon)	$310/ha (automation and structures)
Supply flow rate (ML/day)	30 ML/day	15 ML/day
Steps between bays (mm)	n/a	n/a
Time to irrigate bay (Hrs)	6 hrs	6 hrs
Bay Slope	1:2000	1:2500
Automation	Not currently automated	12 Padman Stops Portable Dual Timers

For Ben, the change from siphons to pipes through the bank was driven by labour, faster watering and elimination of rota bucks. Eliminating rota bucks makes in crop field passes trouble free, and has solved the problem of knocking down and re-building them during the season. The PTTB system has resulted in improved labour and machinery efficiencies.

Site 2: Padman Stops Portable Dual Timers set up on Padman Stops drop boxes (PEXL pipe and bubbler combo).

FARM VISIT/RESEARCH FACILITY: IREC, Whitton

Owner: Irrigated Research and Extension Committee (IREC)
IREC Chair: Rob Houghton
IREC Executive Officer: Iva Quarisa
Field Station Manager: Richard Stott
Irrigation Area: 35 ha
Water Source: Surface water MIA, 15 ML/day, gravity fed. Bore Water 30 ML/day.
Soil type: Poor red duplex (shallow sandy-loam over dispersive slaking red clay-loam).
Irrigation system: Bankless channel – furrows across bays with rollover banks.

Overview:

A 35 ha bankless development consisting of beds in bankless layout, with roll over banks. Banks are replaced with a low road with shallow feed bankless each side, 0.35m below the field. The deeper field supply (0.55m below the field) fills the lateral bankless feeders, which then fill and overflow into the field furrows. The field is completely flat with zero fall-down and across the bay. There is 150 mm step between each bay. The first and last bays are smaller than the centre bay.

The bankless site consists of 6 fields which are divided into 2 separate water units (three bays in each). East (bays 1, 2 & 3) and West (bays 4, 5, 6). All 6 fields can be in-crop and watered as 1 irrigation unit, or the system can be split in ½, so only the 3 eastern fields or 3 western fields are incrop and watered during a season.

Automation:

Includes Rubicon ultrasonic depth sensors and a BayDrive Maxi™ fitted to a Padman Stops' PE900 pipe ends and maxi flow 1200mm centre sections on rollover beds in bays (see Figure 1 - 'culvert with head wall').

Field size:

Bay 1: 6.5 ha, Bay 2: 9.0 ha, Bay 3: 3.5 ha, Bay 4: 3.8 ha, Bay 5: 9.0 ha, Bay 6: 3.5 ha.

Flow rate:

An initial flow of 10-15 ML/day fills the first bay. When the drain is released into the second bay, both the supply flow and drainage flows are combined so up to three times the initial supply flow is used to irrigate the larger second bay. High flow rates per hectare mean that water is on and off each field in less than eight hours per bay, and water moves quickly into the next bay. When the second bay is full, the main supply is turned off, and the drainage water irrigates the last bay with very little tail-water.

System at a glance:

System	Furrows across bays with rollover banks
Crops	Maize, cotton, wheat and barley
Area (ha)	35 ha field
Row length (m)	130–336 m
Bay Width	260 m
Pontoon area	n/a
Cost ($/ha)	$1500/ha (automation and structures)
Supply flow rate (ML/day)	10-15 ML/day
Steps between bays (mm)	150 mm
Time to irrigate bay (Hrs)	Largest bays 8-10 hrs, smallest bays 3-5 hrs
Bay Slope	Zero slope and no cross fall
Automation	Rubicon ultrasonic depth sensors and a BayDrive Maxi™ fitted to Padman Stops PE900 pipe ends.

Irrigation process:

The main supply fills the field supply channels. All tail drain gates are closed. East Supply Gate is opened and the irrigation water fills the bankless feeder channels (of Bay 1) which are located at the top and bottom of the field. These channels are 0.35 m below the field, so they fill and eventually spill over onto the field, running up the furrows between the beds from either end of the field. Once the bay is full (beds completely subbed, and a predetermined height is reached) Stop 1 is opened. The water drains back down the furrows, off the field into the bankless feeder channels (0.35 m below field level). From here, the water flows back into the field supply channel and into Bay 2.

Bay 2 is now receiving full flow rate from the main supply point as well as drainage off the Bay 1, so has a higher flow rate, up to 3 times initial supply rate.

Once Bay 2 is full, Stop 2 is opened and it drains into Bay 3. At the same time (and while Bay 2 is draining into Bay 3) East Supply is closed to prevent any further water entering the eastern fields, and the West Supply gate is opened so that the main supply fills the field supply channel for Bay 4. This subsequently fills the bankless feeder channels located at the top and bottom of field Bay 4, and Bay 4 gets watered. While Bay 4 is filling, Bay 2 is draining into Bay 3 until irrigated, when Stop 3 is opened to drain. Less than 0.5 ML remains in the furrows, and due to continued subbing, only a small percentage actually runs out to the drainage system. Once Bay 4 is full, Stop 4 is opened and the water and main supply drain into Bay 5. Once Bay 5 is full, the main supply is switched off, Stop 5 is opened and the drainage water from Bay 5 drains into Bay 6 which is enough to water that bay , resulting in very little tail-water.

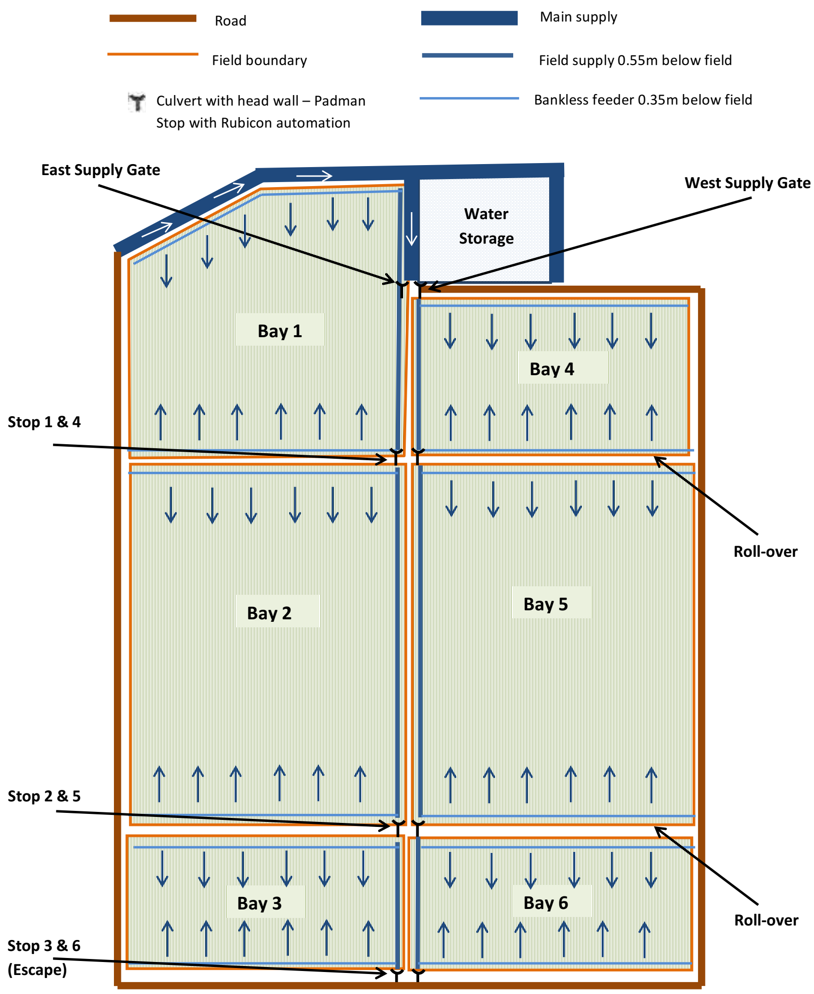


Figure 1: Irrigation Plan – IREC Bankless channel – Roll over beds along bays

Irrigation structures and automation:

Padman Stops PE900 pipe end: Pipe End 900 is a pipe end or drop box with a 100 per cent watertight durable reinforced rubber flap door which can be attached to Padmans low profile, high flow MaxiFlow bridge culvert. To suit 900 mm pipe – flow rate 50 ML/day. www.padmanstops.com.au/product/pe900-pipe-end-900.

Padmans Maxi 1200 flow culvert centre sections:
www.padmanstops.com.au/product/maxiflow-1200-culvert-3-piece.

Rubicon ultrasonic depth sensor and BayDrive Maxi™ fitted to a Padman Stops: A BayDrive™ is a remotely operated farm channel gate actuator designed to automatically open and close gates. It can automatically be actuated either when a predetermined water level is attained or by time. It can also be remotely manually operated through web based software or locally using a toggle switch located on the back of the radio node. In this case, the depth sensor is used to provide a depth of water which can trigger the gate to open. Thus the BayDrives™ open when a pre-determined water level is attained. To determine this level, the grower users a laser level to mark the top of bed height in the field onto the concrete structure. The grower will simply subtract an amount off this figure to ensure he does not over top the bed.

The resulting figure is entered into the software. The levels are changed between irrigations simply by editing the level in the software. www.rubiconwater.com/catalogue/baydrive#tab-features-tab.

Left: Padman Stops PE900 pipe end.
Below: Padmans Maxi 1200 flow culvert centre sections
Right: Rubicon ultrasonic depth sensor and BayDrive Maxi™ fitted to a Padman Stops

FARM VISITS: Peter and Dallas Stott, Whitton

Owner: Stott Family
Manager: Peter and Dallas Stott
Irrigation Area: 1790 ha
Water Source: Surface water MIA, 100 ML/day, gravity fed. Bore 15 ML/day.
Soil type: Red duplex (shallow sandy-loam over dispersive slaking red clay-loam), sandy clay loam, red and grey self-mulching clays.
Irrigation system: Bankless channel - furrows along bays (also known as terraced bays, with beds in bays); and Bankless channel – furrows across bays with rollover banks (also known as rollover furrow in bays).

Overview: Furrows along bays, 'House Block'

This field is 36 ha consisting of traditional terraced bays, with beds in bays. Water is pushed into the field via a bankless channel and once beds have subbed (achieved blackout), gates into the next bay open automatically. Water drains back through the gate into the next bay. Bays are around 10 hectares with 440 metre run length and 136 x 1.8 metre beds per bay. There is a 150 millimetre step between bays. Padman Stops PE900 Bay outlets are installed between the bays, with a supply flow rate of 25-30 ML/day.
The irrigation layout is provided in Figure 1.

Dallas has had to deal with some difficult soils, and the bankless system has allowed him to successfully grow cotton in poorly subbing soils.

Automation: Winch operated bay outlet which Dallas Stott and Andrew Bell have automated using their own design and software.

Overview: Furrows across bays with rollover banks, 'Andersons'

A 311 ha bankless development consisting of a beds in bankless layout with roll over banks. Banks between bays are replaced with a low road with a shallow feed bankless each side which start just below furrow level and slopes at 0.02% downhill towards the main bankless supply channel (field supply). This deeper field supply (0.55 m below the field) fills the lateral bankless feeders, which then fill and overflow into the field furrows. The field is completely flat with zero fall down across the bay. There is 150 mm step between each bay. The field layout is presented in Figure 2.

An initial flow of 55 ML/day (field A), 25 ML/day (fields B,C,D), fills the first bay. When the drain is released into the second bay, both the supply flow and drainage flows are combined so 2-3 times the initial supply flow is used to irrigate the larger second bay. High flow rates per hectare mean that water is on and off each field in 10 hours per bay and water moves quickly into the next bay. This continues through to the second- last bay, when the main supply is turned off, and the drainage water irrigates the last bay with no further tail water.

Field supply (main bankless) has 2 PE Maxi1000 side by side, easily handling high flow rates. The irrigation layout is provided in Figure 2.

Automation: This system is not currently automated.

"My favourite design is this 'Mike Naylor Roll-Over System', as we call it. We have no tailwater to recycle and we have long machinery runs, which greatly improve our machinery efficiency."
- Dallas Stott.

System at a glance:

Site	Site 1 – House Block	Site 2 - Andersons
System	Bankless Channel: Furrows along bays	Bankless Channel: furrows across bays with rollover banks
Crops	Cotton	Cotton
Area (ha)	36 ha field	311 ha field
Row length (m)	440 m	Fields A: 400 – 600 m, 400 m
Fields B,C,D: 300 m	140 m	65-72 m
Bay Width	Bay 1: 143 m	Yes, 80mm below the furrows
Bay 2 & 3: 245 m	$320/ha (structures, polish & pontoon)	$310/ha (automation and structures)
Bay 4: 124 m	400 m	15 ML/day
Pontoon area	n/a	n/a
Cost ($/ha)	$1700 - $2000/ha (earthworks, automation and structures)	$1800 - $2300 /ha (earthworks, automation and structures)
Concrete alone $200-$300/ha	1:2000	1:2500
Supply flow rate (ML/day)	25-30 ML/day	Field A: 55 ML/day Field B,C,D: 25-35 ML/day
Steps between bays (mm)	150 mm	150 mm
Time to irrigate bay (Hrs)	7 -10 hrs (water on and drained off)	10 hrs (water on and drained off)
Bay Slope	1:20000 (0.005%)	Flat
Automation	CFI – Dallas Stott and Andrew Bell's own automation	Not currently automated

Figure 1: Furrow along bays, House Block

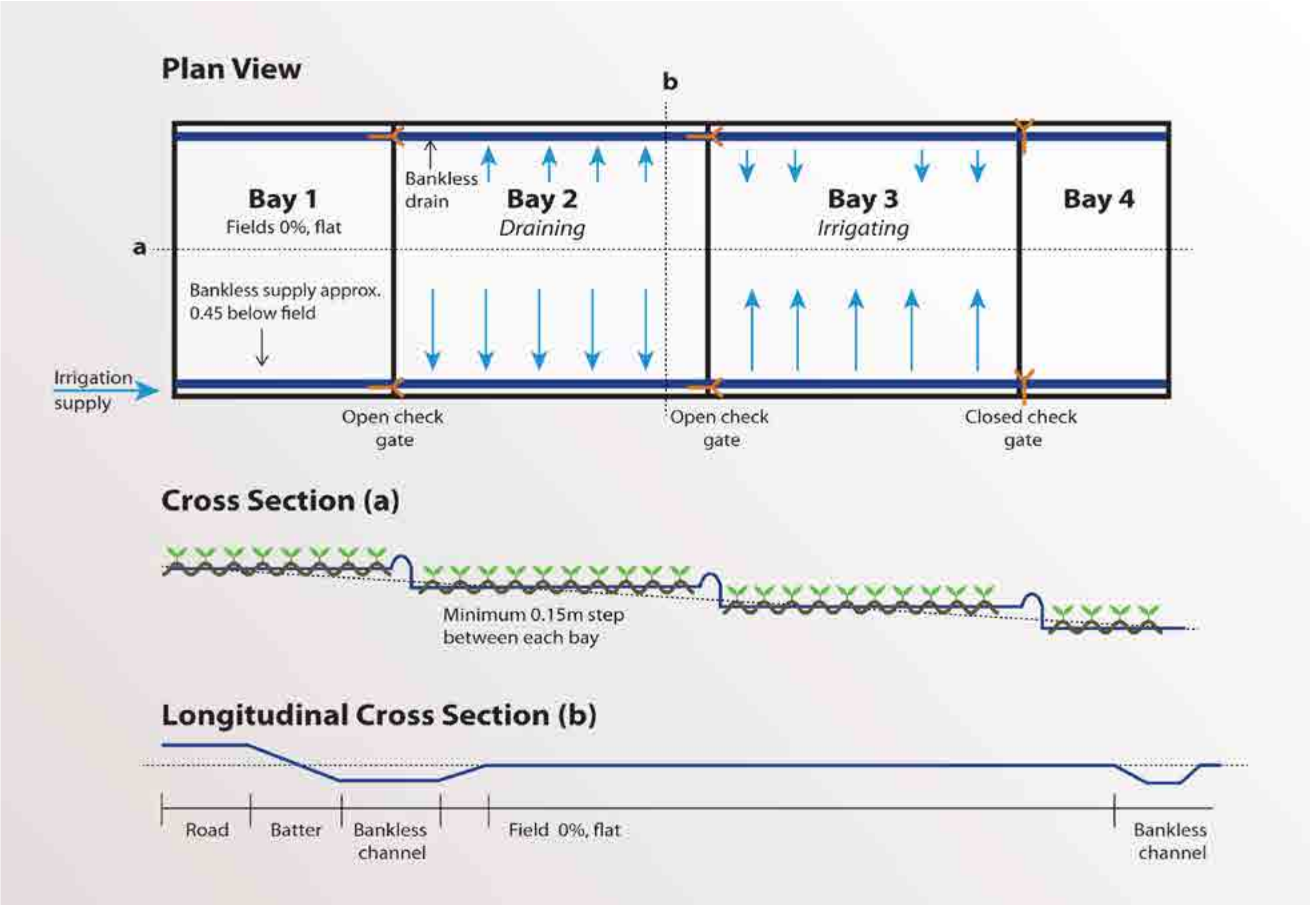


Figure 2a: Furrows across bays with rollover banks

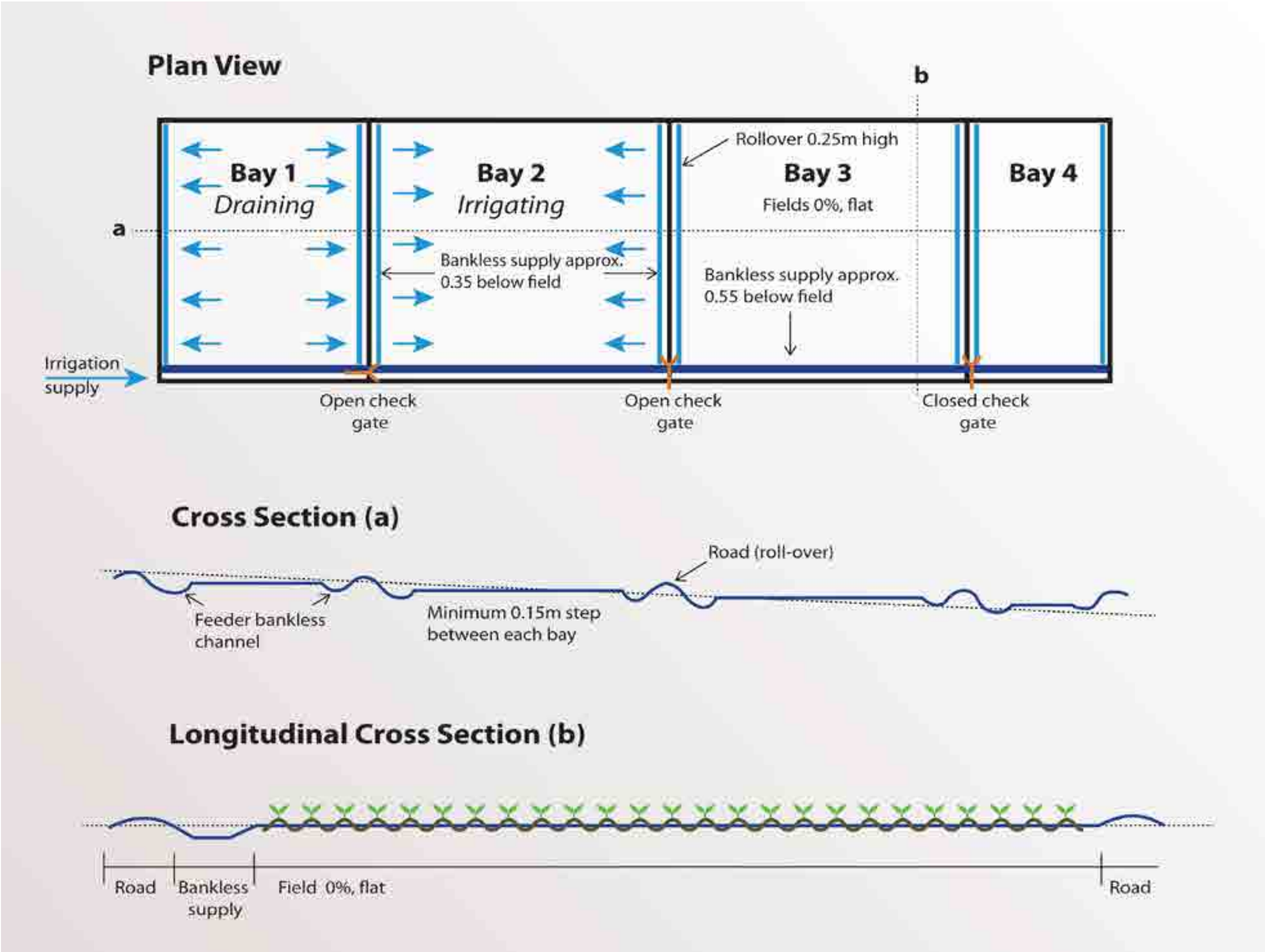
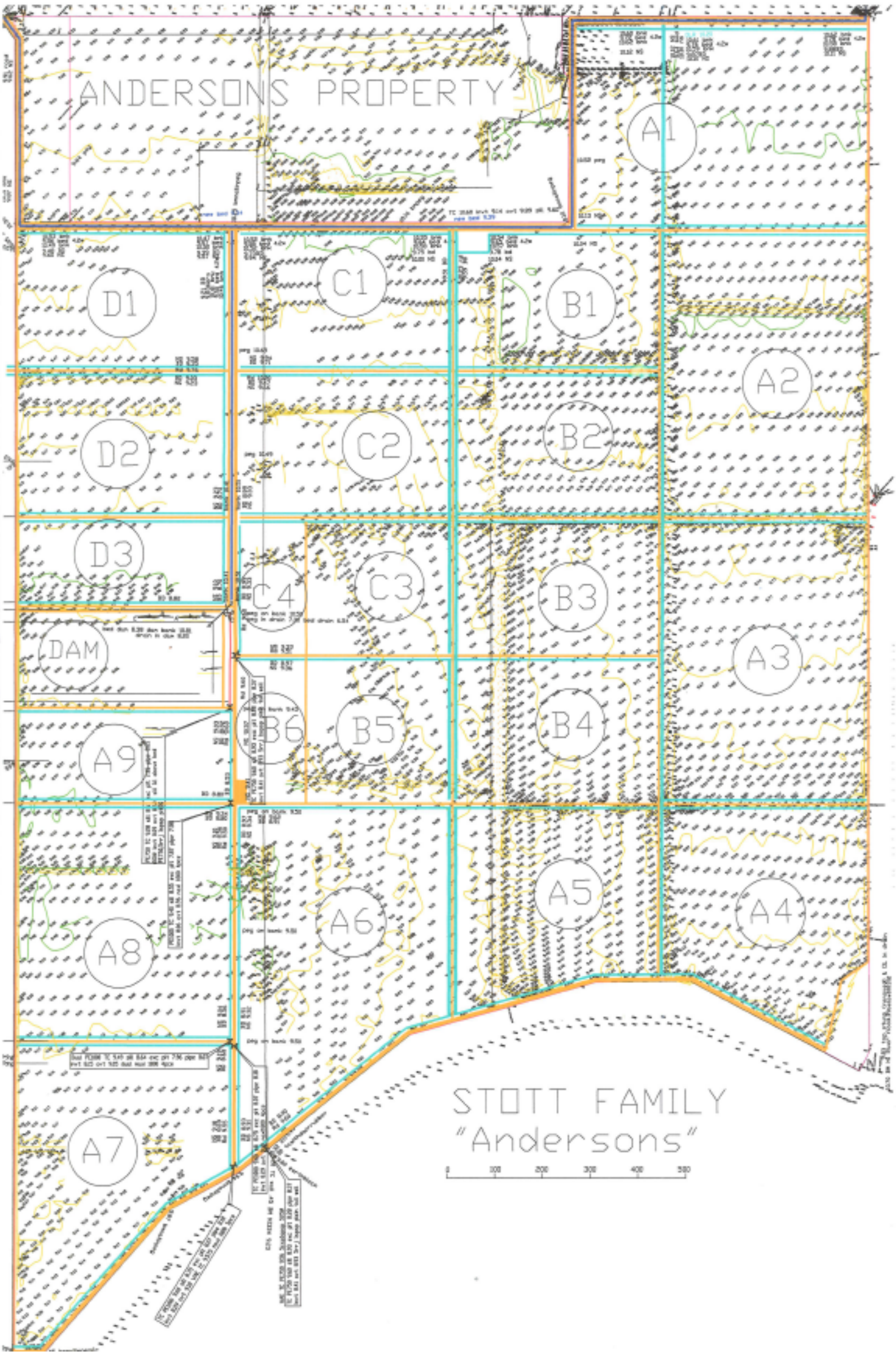


Figure 2b: Field design – Andersons



irrigation research:
smarter irrigation for profit projects

RESEARCH PROJECT: The impact of irrigation and N management on N uptake and yield in maize

What is the research?

The maximising on-farm irrigation profitability project has a site with Ray Thornton at Numurkah investigating the impact of irrigation and nitrogen (N) management on crop nitrogen uptake and grain yield in maize. Management of irrigation and N fertiliser in high input systems such as irrigated maize can have significant impact on yield. There needs to be a balance to ensure yields are not limited by water and N as well as to ensure there is not over application contributing to excessive production costs and reduced productivity from these significant resources.

The maize field experiment had two irrigation management and two N management strategies that were applied to whole bays within an automated border-check surface irrigation system.

The irrigation treatments began at crop establishment after the fourth irrigation and remained until the end of the irrigation season. The two strategies were : i) standard grower irrigation practice (average 45 kPa matric potential) and; ii) reduced irrigation deficit (average 30 kPa matric potential). Matric potential was monitored in each bay by installing two Watermark sensors at 5, 15, 30 and 45 cm depth. Average measurements at 15cm were used for scheduling the irrigations.

Nitrogen at the rate of 218 N kg/ha (470 kg urea/ha), calculated through a N budget for the site, was applied as urea using 'upfront' and 'split' application strategies. The 'upfront' strategy had 75% of the total rate applied prior to planting and the remainder was water-run in-crop during the third irrigation event (16 December). The split strategy had 40% of the total rate applied prior to planting and the remainder was water-run in-crop during the third and fourth irrigation events.

Remote sensors deployed on drones are also being tested to see if this method can be used to measure crop N uptake.

How will it benefit me?

The research is asking two critical question when it comes to productivity within a farming system. These are:

- For high yielding irrigated maize production what is the best way manage N inputs into this system to maximise the return from the crop but also from the investment in the fertiliser input? And secondly
- How then does my irrigation management influence the uptake of the N which flows through to final grain yield?

Remote sensing and the measurement of crop N uptake has the ability to highlight within field variability and potentially predict N requirements cheaply and earlier in the season allowing the fine-tuning of N requirements and applications.

Why is it important?

Nitrogen inputs and particularly irrigation water are significant costs to irrigated cropping and both have the capacity to significantly influence grain yield and profitability. Often only approximately half of the applied N gets into the crop to which it is applied with very little (less than 10%) of it then into subsequent crops. This indicates that a large amount of the applied N is lost from the system, effectively doubling the cost of the applied N to the crop. The average price for temporary water in the Murray Valley Irrigation area is $139.00/ML (ranging from ($16 - $680/ML) from the period 1998/99 – 2015/16 meaning water can quickly become a large cost to irrigated production when it is not used properly.

Key findings/results to date?

In the 2015/16 season crop N uptake and grain yield was increased by applying 75% of the predicted crop N requirement upfront and 25% in-crop compared to 40% upfront and 60% in-crop. This is different to current practice and will be investigated further.

Monitoring of soil moisture is critical to maximise production and productivity of key resources such as water and nitrogen. With the short opportunity times in Rays systems it appeared from the soil moisture sensors that the standard practice was not completely refilling the soil moisture profile from early January for the remainder of the season.

Strong relationships are developing between the indices through remote sensing and crop N uptake.

Who do I ask for more information?

- John Smith, Project Leader, NSW Department of Primary Industries, Phone: 02 6951 2503
- Wendy Quayle, Senior Research Fellow, Deakin University, Centre for Regional and Rural Futures, Phone: 02 6969 6904
- John Hornbuckle, Associated Professor (Research) Deakin University, Centre for Regional and Rural Futures, Phone: 02 6969 6903
- Rob Fisher, Irrigated Cropping Council, Phone: 0428 545 263
- Sam North, Research Hydrologist, NSW Department of Primary Industries, Phone: 03 5881 9926

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Irrigated Cropping Council Promoting irrigated agriculture

Irrigation Research & Extension Committee

Australian Government Department of Agriculture and Water Resources

Australian Government Cotton Research and Development Corporation

Australian Government Rural Industries Research and Development Corporation

RESEARCH PROJECT: The influence of nitrogen fertiliser rate and irrigation management on crop N uptake, lint yield and apparent fertiliser nitrogen recovery in subsurface drip irrigated cotton

What is the research?
Irrigated cotton field experiments have been established at Ben Witham, Matt Stott's and Dallas Stott's with collaboration between the maximising on-farm irrigation profitability and the impact of irrigation methods and management strategies on nitrogen fertiliser recovery in cotton projects.

A key component of both projects is gaining an understanding of the response of cotton to nitrogen (N) application and management and irrigation management in the southern NSW environment.

To investigate the influence of N and irrigation management N rate and irrigation deficit experiments have been established. At each of the farms N fertiliser has been applied at 6 rates (from 0 N/ha - 400 kg N/ha). At Matt's farm irrigation will be managed based on different deficits from the period from first flower to first cracked boll which represents the period of greatest water uptake. Each of the sites has a different irrigation system and measurements of crop N uptake and lint yield will be made to determine the influence of irrigation system on these factors.

Additional work will also be conducted to directly quantify the amount of N being lost as di-nitrogen (N2) as affected by moisture deficit, so that the N balance can be completed more accurately and enable water-nutrient management to be further understood and optimised. However, N2 is the most abundant gas in the atmosphere (approximately 78 per cent by volume) which poses significant challenges in its measurement to be only considering the additional N2 from management practices.

Finally remote sensing is being tested to determine indices that can be used to determine N uptake and lint yield in cotton.

How will it benefit me?
The research is asking two questions around the impact of irrigation on N uptake and lint yield in irrigated cotton in southern NSW. These are:

- What impact does the irrigation system have on nitrogen use efficiency and recovery and lint yield in irrigated cotton? And similarly around irrigation management
- What impact does the irrigation management have on nitrogen use efficiency and recovery and lint yield in irrigated cotton?

Why is it important?
In high yielding high input systems, such as irrigated cotton, it is important from an industry perspective to have Best Management Practices developed from broad ranging research and this research is the first of its kind, to this level of detail, in the southern NSW production area.

From a growers perspective it's important to have an understanding of how irrigation management impacts on other aspects of crop production that can impact on lint yield and profitability. When changes to irrigation systems or management of a current system potentially changes the dynamics of the soil water this can have significant impact on N availability and uptake into the crop both of which impact lint yield.

The use of remote sensing has the potential to better and predict crop N uptake and within field variability to fine-tune N management, it may also provide early predictions of lint yield that help guide management decisions through the season.

Key findings/results to date?

In the 2015/16 season results showed that lint yield was influenced by both the rate of applied N and by the irrigation schedule in a sub-surface drip irrigated block when water was applied every day compared to every second day. However, crop N uptake was only influenced by the rate of applied N.

Apparent N fertiliser recovery in the plant ranged from 60 per cent at 100 kg of applied N/ha to 48 per cent at 250 kg of applied N/ha and at the optimum rate of fertiliser (where the cost of N was $1.50/kg and the return from lint was $2.20/kg) the apparent fertiliser recovery was 46 per cent.

The use of remote sensing indices to identify differences in crop N status over time and spatially is showing some strong relationships (Figure 1). The use for the prediction of lint yield is also showing promise.

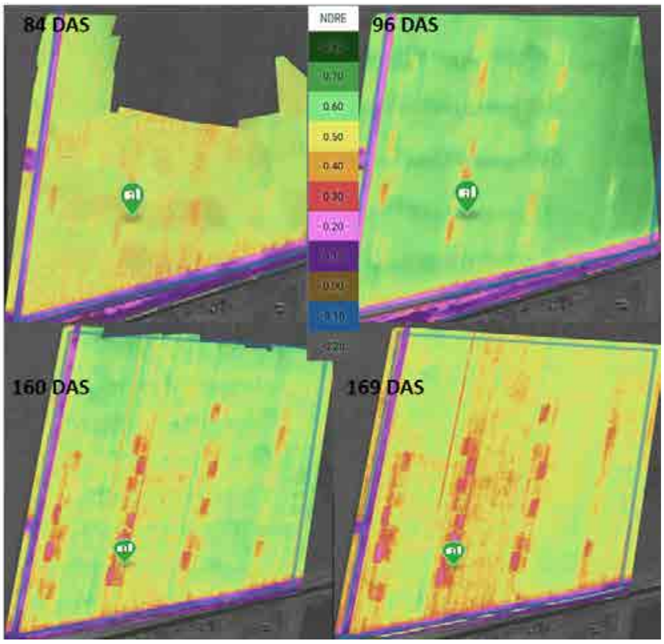

Figure 1: Normalised Difference Red Edge (NDRE) maps of the site at <10 cm pixel resolution showing the differences in crop nitrogen status between treatments across the season.

Who do I ask for more information?

- John Smith, Project Leader, NSW Department of Primary Industries, Phone: 02 6951 2503
- Wendy Quayle, Senior Research Fellow, Deakin University, Centre for Regional and Rural Futures, Phone: 02 6969 6904
- John Hornbuckle, Associated Professor (Research) Deakin University, Centre for Regional and Rural Futures, Phone: 02 6969 6903
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RESEARCH PROJECT: Developing design recommendations for basin surface irrigation systems

What is the research/technology?

Despite over 70 years of rice growing in southern NSW, there is still no evidence based criteria for designing basin layouts. In the main, layouts have been developed from personal experience and "rules of thumb". Whilst surface irrigation performance has improved, trial and error through constructing layouts is an expensive and inefficient way of finding optimal designs; improvements may not be disseminated widely; and where new ideas are picked up more broadly, they may be ill-informed and misapplied.

"Fast watering" and bankless channel systems are cases in point of inappropriate adoption of "new" developments. Investigations over the past 10 years have shown that in most basin layouts, overly long opportunity times (30 to 50 hours) are due to slow drainage, not slow watering. The principle cause of these long drainage times is the hydraulic connection between bays created by the bankless channel, with water in the filling bay rising to stop drainage from the upstream bay (see Figure 1 below).

Figure 1: Irrigation of a contour basin using a bankless channel. This photograph shows how water filling the basin being irrigated has backed up through the inlet structure (below frame) and stopped drainage from the upstream bay.

Research under the *'Maximising on-farm irrigation profitability'* project aims to develop design criteria for optimising basin surface irrigation systems used in the rice and cotton industry.

How will it benefit me?

Previous research has recommended that water should be on and off bays in under 10 hours to ensure waterlogging is minimised and cropping flexibility/water productivity maximised. We have evidence to show there is potential to increase yields from wheat in rice layouts by 50-100 per cent if the key constraint (i.e. waterlogging) can be overcome.

Additional benefits are possible with good design. For instance, operational savings in the order of 10-40 per cent are possible if machinery overlap is reduced by adopting GPS steering guidance and squaring up bays.

Why is it important?

Without evidence based design criteria, we will continue to see surface irrigation layouts built that will not be able to deliver the improvements in productivity, cropping flexibility and cost savings that are needed to meet the challenges facing irrigated croppers.

In addition, layouts will continue to be built to meet current needs only, and so will lack the capacity to incorporate new developments in automation and farm machinery without major reconstruction.

Key findings/results to date?

Data collection has only just commenced to determine typical infiltration rates and surface roughness coefficients needed to inform the design process. The key outcome of the data collection and design process over the next 12 months will be two key recommendations around the optimum basin size for a given soil type and inflow rate; and the minimum paddock slope for unobstructed drainage in bankless channel systems.

Who do I ask for more information?

- Sam North, Research Hydrologist, NSW DPI, Deniliquin, Phone 03 5881 9926.

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RESEARCH PROJECT: Modernisation of furrow irrigation in the sugar industry

What is the research/technology?

Furrow irrigation is the dominant form of irrigation in the Burdekin, Australia's largest sugar growing region. Farmers in the region are under increasing pressures to reduce environmental impacts while facing high pumping energy costs. The water and energy efficiency of furrow irrigation can be improved with careful management by the grower but this means a higher labour requirement. Automation of the irrigation systems offers the opportunity to reduce labour costs and ensure that management decisions are made in a timely manner.

After a review of technologies, a system was designed that was low cost and best suited to the existing infrastructure. The system is comprised of:

- WiSA radio communication system and Aqualink Software
- Pump control
- Linear actuators on butterfly valves for fluming (layflat gated pipe)
- Pressure/level sensors and flowmeters in supply lines
- Buried soil moisture sensors and/or drain probes to sense irrigation completion

Automated systems were installed at three typical sugar farms in the Burdekin region:

- Jordan Site - 5 irrigation sets (82 ha)
- Linton Site - 11 irrigation sets (51 ha) in addition to an existing 43 ha of drip
- Pozzebon Site - 6 irrigation sets (17 ha)

How will it benefit me?

The automation systems in the current trial allow the irrigator to:

- Control and schedule irrigations remotely from home office, tablet or smartphone
- Use end of row sensors to trigger switching irrigation sets
- Set up text message alarms or system shutdowns based on flow or pressure/level triggers
- Keep records of runtime or water use for each block.

Most importantly this system is now commercially available.

Why is it important?

Without evidence based design criteria, we will continue to see surface irrigation layouts built that will not be able to deliver the improvements in productivity, cropping flexibility and cost savings that are needed to meet the challenges facing irrigated croppers.

In addition, layouts will continue to be built to meet current needs only, and so will lack the capacity to incorporate new developments in automation and farm machinery without major reconstruction.

Key findings/results to date?

The control systems have been functioning well at all sites since the beginning of 2015 when they were installed. The farmers are already comfortable with scheduling and monitoring the irrigations without needing to visit the field. Work is now focusing on determining the economic costs and benefits of the system.

Next steps?

The Smart Irrigation Project is focussing on the Jordan Site, aiming to incorporate crop and soil sensing, weather measurement and modelling to transform this automated irrigation into a smart system which can also determine the best time to irrigate and how much to apply.

Who do I ask for more information?

- Malcolm Gillies, Project Leader, NCEA & USQ, gilliesm@usq.edu.au, Mobile: 0429 662 802
- Steven Attard, AgriTech Solutions, steve@agritechsolutions.com.au, Mobile: 0418 155 844
- Marian Davis, BPS, mdavis@bps.net.au, Mobile: 0418 155 844
- Andres Jaramilo, SRA, ajaramillo@sugarresearch.com.au, Mobile: 0475 973 282

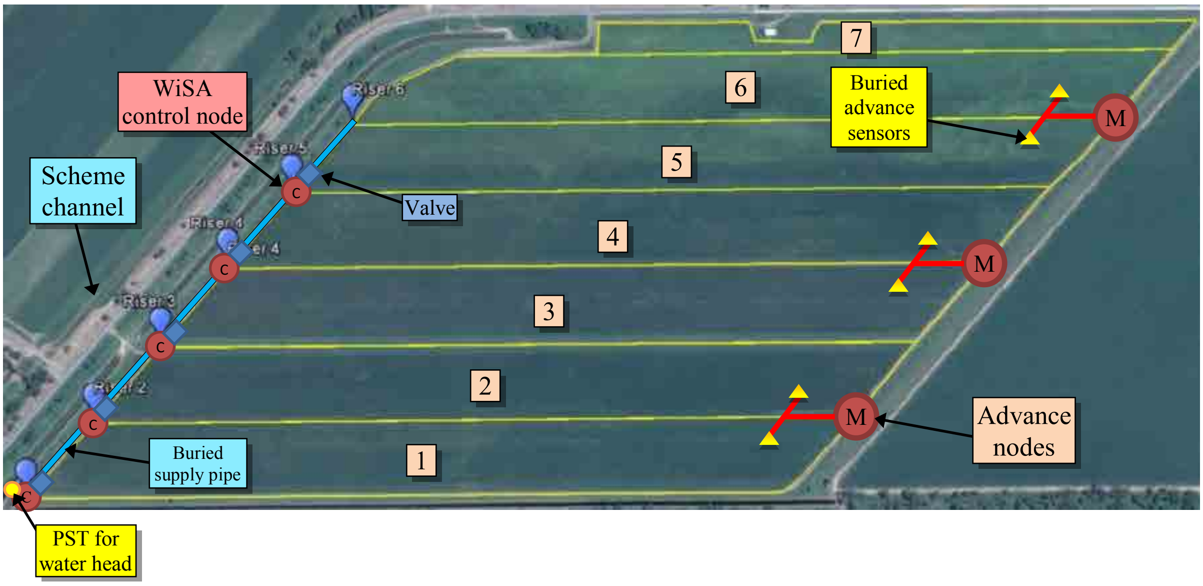

Figure 1: Trial layout for Jordan site.

Figure 2: Examples of actuated valves for layflat gated pipe built for the project.

Sugar Research Australia

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RESEARCH PROJECT: Towards autonomous furrow irrigation using small PTB's

What is the research/technology?

NCEA at USQ completed successful remote control furrow irrigation trials with Rubicon FarmConnect systems and structures from 2013 to 2015, and testing of a prototype blind head ditch and small Pipe Through the Bank (sPTB) layout at "Red Mill", Moree in 2014/15. In September 2015, the Carolan family at "Waverley", Wee Waa installed a 108 ha field of automated furrow irrigation. Following successful irrigations of cotton and faba bean crops, another 200+ hectares have been installed in October 2016, and plans for further expansion of this automated system have been completed.

The currently available commercial system installed at Waverley is comprised of:

- A secondary head-ditch supplied through a Rubicon BayDrive dropgate for each irrigation set;
- Small pipes through the bank (sPTB) for each rotobuck (2 m spacing)
- Water level sensors in the main supply channel to provide alarms
- Water level sensors in the secondary head-ditch to estimate flows through the sPTB's

Elements of the Autonomous Furrow Irrigation system to be implemented in the near future include:

- Farm level channel control, from the water storage dam to the field
- Integration of field sensors and software models to control the irrigation with the optimum shut-off time.

The current research focus at this site aims to improve the existing commercially available system by using plant, soil, weather and hydraulic measurements in combination to autonomously control furrow irrigation from water source to field.

How will it benefit me?

Automation of furrow irrigation using current commercial systems allows the grower to:

- Reduce labour requirements in starting siphons and monitoring water levels,
- Control furrow irrigations remotely from an office computer, smartphone or tablet,
- Remotely monitor water levels in channels and ditches and receive alerts based on level.

Future integration of the elements of Smarter Irrigation will enable the system to:

- Control all water flow from the water storage dam through to the irrigation furrows,
- Adapt irrigations to current plant water requirements in real time,
- Ensure irrigation management decisions are correctly made on-time, and are put into action.

Why is it important?

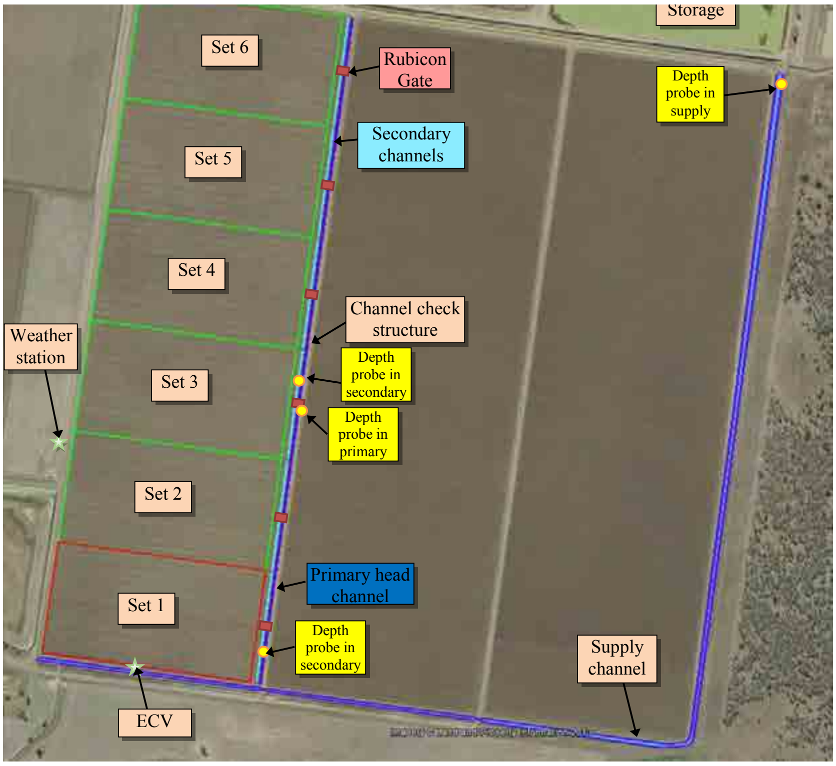
Rising labour costs, and a real difficulty in sourcing irrigation labour means that it is increasingly difficult for growers to make the right decisions, and to be able to put them into action on-time. This two staged approach of (a) implementing automation to reduce labour, and (b) implementation of smarter irrigation using novel sensing and modelling technologies, will ensure that furrow irrigated cotton remains profitable and sustainable into the future.

Key findings/results to date?

The automated sPTB system has functioned well in the 2015/16 cotton crop delivering uniform flowrates across each 310m wide irrigation set. The channel level sensors have proven to be very useful for the farm manager, saving many trips to the storage and supply channels to check and adjust water levels. These have given the confidence to know that the gates are opening and closing as scheduled, and irrigations have been completed remotely at the farm house. At this site it is estimated that the cost of implementing the automated layout will be recovered in three to four seasons.

Who do I ask for more information?

- Dr Joseph Foley, Project Leader, NCEA & USQ, Joseph.Foley@usq.edu.au, Ph: 07 4631 1559
- Malcolm Gillies, Project Leader, NCEA & USQ, gilliesm@usq.edu.au, Mobile: 0429 662 802
- Dr Jasim Uddin, NCEA & USQ, Jasim.Uddin@usq.edu.au, Mobile: 07 4687 3966



Top left: Layout of field for 2015/16 cotton season at Waverley Ag, Wee Waa

Bottom left: David Robson, Rubicon; Joe Foley, NCEA; Shawn Padman, Padman Stops; Steve Carolan and Andrew Greste, Waverley.

Top right: Rubicon BayDrive and gate controlling water flow from the primary head ditch on the right, into the blind secondary head ditch and sPTBs on the left.

Bottom right: Installation of sPTB's during construction of the secondary blind head ditch.

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RESEARCH PROJECT: Smarter irrigation using variable rate centre pivots

What is the research/technology?
Centre Pivot and Lateral move irrigation systems are generally known for their ability to apply uniform applications to a broadacre field with high efficiency. Recently developed variable rate technology (VRI) now allows farmers to apply a spatially variable pattern of irrigation to the field under these machines. These systems provide the potential of precisely applying the irrigation that will meet the specific requirements of the soil and crop at all locations in the field. The challenge is determining this spatially variable requirement for each irrigation.

The concept of Smarter Irrigation is where a combination of field sensors, models and control strategies can be used to allow the system to automatically determine the optimal way to irrigate the crop. The previous work by Alison McCarthy led to the development of the VARIwise software and plant based sensing technologies. VARIwise incorporates weather forecasts, soil moisture monitoring and crop growth monitoring and prediction to determine irrigation requirements over the forecast period. Low cost cameras in the field and on the irrigation machine track the crop's development by detecting cover and fruiting numbers.

Trials are being conducted in the 2015/2016 cotton and dairy pasture seasons to evaluate the software and hardware components of variable-rate centre pivot irrigation using VARIwise. Sites have been selected for the 2016/2017 season to evaluate the system at the commercial scale. The cotton site is situated at Yargullen, Queensland, and two dairy sites in Tasmania are TIA Dairy Research Facility and Montana.

How will it benefit me?
VARIwise is being used to generate a prescription map that is approved and/or modified by the farmer before being transferred to the irrigation system. This has potential to reduce labour, risk and human error in irrigation management decisions. Field trials have demonstrated 5-12 per cent yield improvements and 10-11 per cent water savings using adaptive irrigation control.

Why is it important?
Automated irrigation application systems can increase water use efficiency and crop productivity by automatically analysing historical, current and predicted weather, soil and plant measurements to identify spatial water requirements.

Who do I ask for more information?
- Dr Alison McCarthy, Principal Researcher, NCEA & USQ, Alison.McCarthy@usq.edu.au, Ph: 07 4631 2189
- Dr Joseph Foley, Project Leader, NCEA & USQ, Joseph.Foley@usq.edu.au, Ph: 07 4631 1559

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Dairy Australia Your Levy at Work

RESEARCH PROJECT: Optimised dairy irrigation farms

What is the research/technology?

Dairy Smarter Irrigation is trialling a range of irrigation optimisation technologies at 5 sites across Australia. The sites have been established in Warwick Queensland, Tamworth NSW, Macalister Demonstration Farm Gippsland, Mt Gambier South Australian and Benjer Western Australia. Each of the sites will quantify the expected water, energy and labour savings associated with adoption of innovative irrigation technologies over two irrigation seasons, as well as the associated management and skills requirements, maintenance costs and labour and lifestyle implications.

The technologies and management practices being assessed include system performance checks, soil moisture monitoring and scheduling tools, local weather stations, pump and meter performance evaluations, fertigation, solar pumping and variable rate irrigation control.

How will it benefit me?

Each site will develop locally relevant extension messages for irrigators. This means that case studies from the focus farms will be developed to include costs and benefits of each action. Field days, workshops and site information will be developed to assist farmers to learn how to apply the successful strategies used at the demonstration sites on their own farm.

Why is it important?

Irrigators aim to maximise returns per ML. Each Dairy Smarter Irrigation site will help irrigators to develop skills in using regionally relevant tools and technologies to apply the right amount of water at the right time, the sites will provide benchmarks and tools that farmers can use to check how their performance compares to the demonstration site.

Key findings/results to date?

'The simple things are often the best.' Ensuring regular maintenance and monitoring of your system is undertaken can often provide large efficiency gains. Conducting systems checks regularly can identify where efficiency losses are occurring enabling them to be addressed.

Who do I ask for more information?

- The Dairying for Tomorrow website is regularly updated with news from the project: www.dairyingfortomorrow.com.au/tackling-specific-issues/water/smarter-irrigation-for-profit/
- Monique White, Project Leader, Dairy Australia, Mobile: 0400 972 206
- David Hall, Queensland, Mobile: 0428 491091
- Marguerite White, NSW, Mobile: 0447 500 415
- Sarah Killury, Gippsland, Mobile: 0458 004 918
- Monique White, South Australia, Mobile: 0400 972 206
- Esther Price, Western Australia, Mobile: 0418 931 938




RESEARCH PROJECT: IrriSAT - Weather based irrigation scheduling and benchmarking technology

What is the research/technology?

IrriSAT is a weather based irrigation management and benchmarking technology that uses remote sensing to provide site specific crop water management information across large spatial scales (Hornbuckle et al. 2009). IrriSAT calculates crop coefficients (Kc) from relationships with satellite (Landsat and Sentinel) derived Normalised Difference Vegetation Index (NDVI) data. Daily crop water use (ETc) is determined by multiplying Kc and daily reference evapotranspiration (ETo) observations from a nearby weather station.

IrriSAT is moving weather-based scheduling into the future. The IrriSAT app (https://irrisat-cloud.appspot.com) automates satellite processing and information delivery of satellite data and provides water management information across a range of scales to irrigators to assist in irrigation scheduling and crop productivity benchmarking.

How will it benefit me?

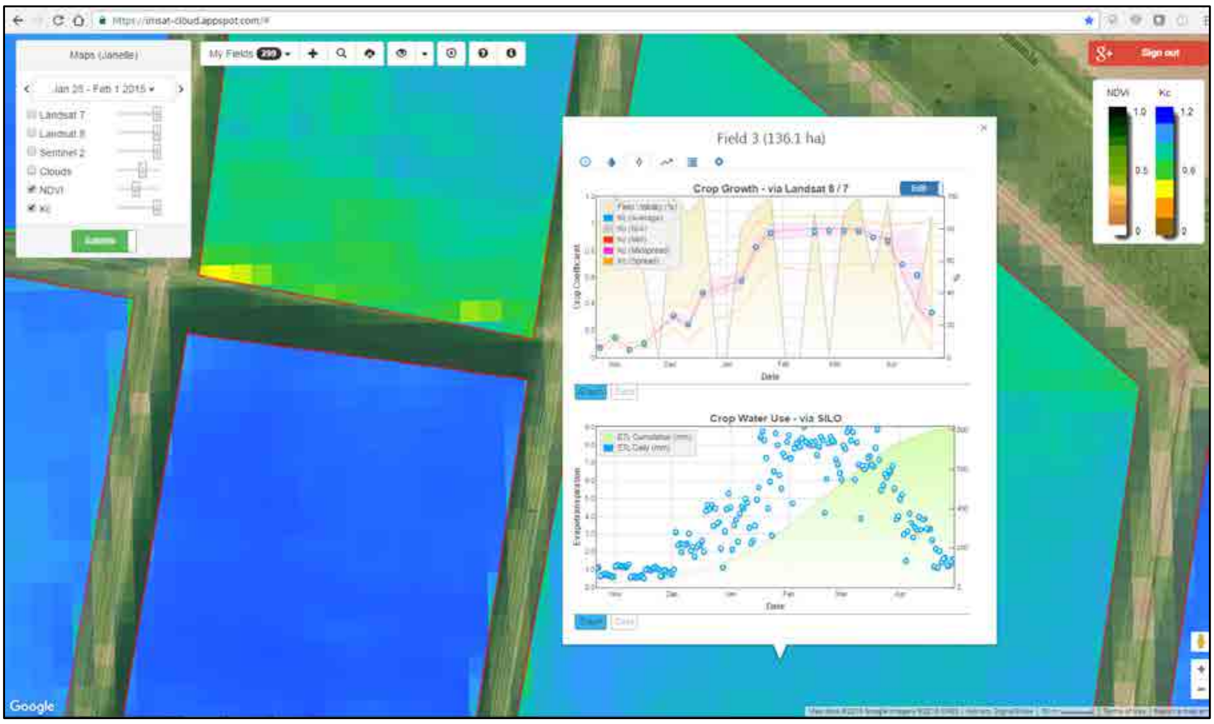
IrriSAT provides daily crop water use and a 7 day crop water use forecast at low cost and across a large spatial area. IrriSAT can also be used for benchmarking. When seasonal crop water use is combined with yield data it provides a measure of crop productivity (Crop water use index = total production (bales)/Crop Evapotranspiration (ML)). Variation in crop productivity can be examined within and between fields, farms and regions.

Why is it important?

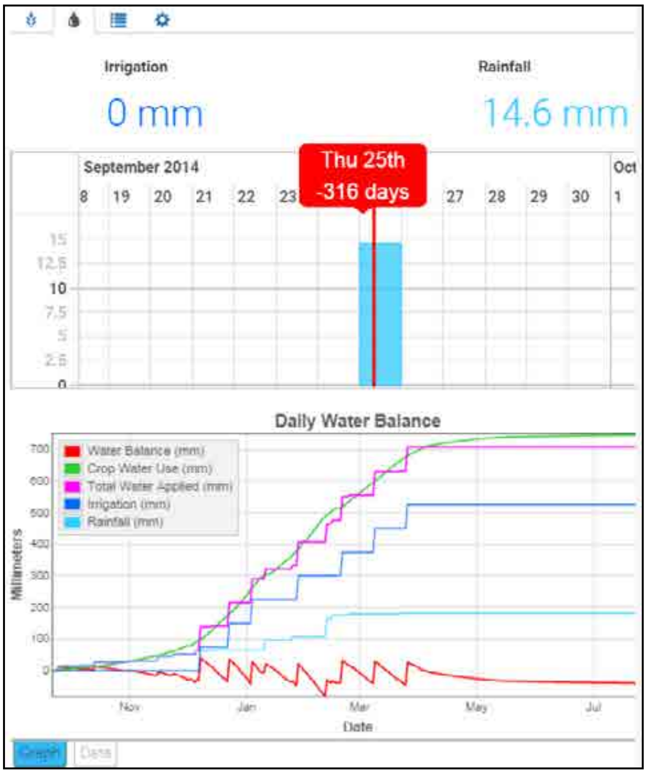
Irrigators aim to maximise returns per ML. IrriSAT will help irrigators apply the right amount of water at the right time, provide benchmarks and examine performance drivers to enable continuous improvement in crop productivity.

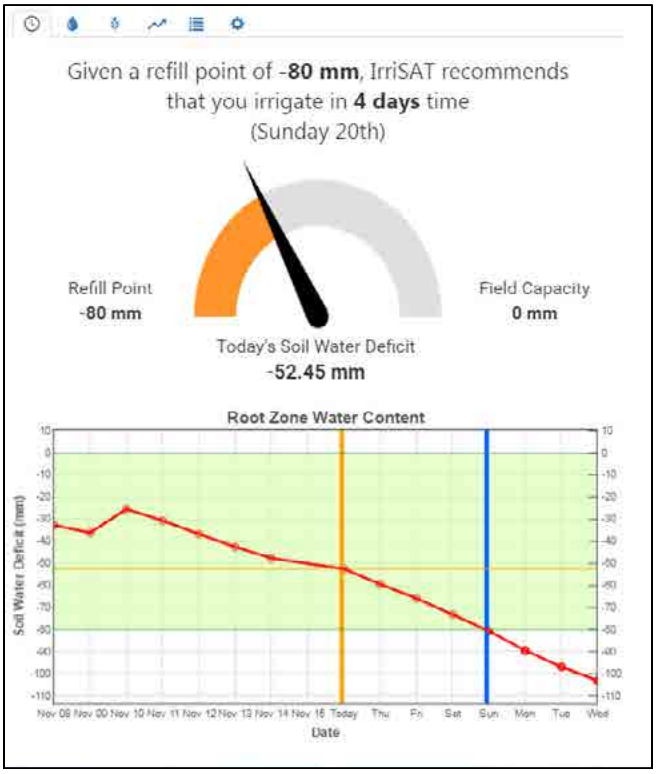
Key findings/results to date?

The cloud based IrriSAT app is freely available at https://irrisat-cloud.appspot.com. The current project is working with consultants and irrigators to further develop app functionality. Without any data input, you can click on a field and see your crops daily crop water use and track crop water use across the growing season.



You can also add irrigation and rainfall inputs to run a daily water balance and track soil moisture deficit to help with irrigation scheduling decisions.





Who do I ask for more information?

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Steve Carolan
Waverley, Wee Waa

May 2016

Location: 'Waverley', 30 km west of Wee Waa

Water sources: Surface water Pian Creek / Lower Namoi and groundwater

Soil type: Self mulching, grey clay

Enterprise: Cotton

Existing irrigation system: Furrow irrigation

Total area irrigated: 109 ha

Total savings: 163 ML with 58% returned to the environment.

With his farm manager, Andrew Greste, Steve Carolan wanted to steer away from siphons, so they decided to install automated, permanent through the bank pipes.

Mr Greste said that not only were they looking at increasing efficiencies and trying to reduce labour, but also at the way they irrigated.

Description of the project

Steve Carolan was successful in Round 4 of STBIFM.

His project involved converting existing syphon irrigation fields to pipes through the bank (PTB) irrigation and was designed to improve field application efficiency.

The PTB conversion involved:

- Develop a twin head ditch, where one supplies water to a secondary head ditch
- Automated structure feeding the secondary channel split into 300m sections
- 75mm buried PTBs on 2m spacing feeding semi-permanent rotabucks

"…without receiving funding from STBIFM, it would have been too financially risky to automate my irrigation infrastructure."

Permanent pipes through the bank (PTB) at Waverley, Wee Waa

The benefits of the project

The benefits associated with the automated system include massive labour savings, flexibility in irrigation run times and being able to adjust irrigation flow rates to dramatically improve water efficiency.

Mr Carolan also commented on how the automated system made cropping so much more flexible.

"If the rest of the farm was set-up like this, we would have every paddock 'turn-key' ready to irrigate at any time. We could decide in winter to irrigate grains, already be setup, not have to go and shift pipes, and have the flexibility of moving around the farm."

Automated PTBs at Waverley, Wee Waa

Will you be putting more in?

Mr Carolan would like to increase the scale of his farm modernisation, and said that due to the extent of subsidy offered by the STBIFM program, he would be financially confident to shift to automation on a larger scale.

The program has allowed him to modernise his system in a way that, prior to receiving the funding, was too financially risky to implement. Seeing the results of automation in research trials and on paper, Mr Carolan had been thinking about converting to an automated system for some time. All he needed was external funding, and that's where the STBIFM program was able to assist.

What are your thoughts on the Irrigated Farm Water Use Efficiency Assessment (IFWUEA) process?

Farm planning funded through the program has been a valuable tool for many irrigators, which is why financial assistance for the preparation of an IFWUEA has been expanded to all catchments in the program area.

IFWUEAs help irrigators locate and quantify on-farm water losses, and that information can then be used to look at options to improve on-farm efficiency.

Mr Carolan found the IFWUEA process extremely useful when planning for his infrastructure modernisation project. The assessment reinforced his thoughts about the anecdotal water losses on Waverley being correct.

Andrew Greste and Steve Carolan (Waverley) and Peter Verwey (project officer STBIFM) at Waverley, Wee Waa (image: M Jenson)

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