Smarter Irrigation for Profit PHASE II
FACT SHEET I COTTON

Gwydir Valley Irrigators Association Inc.

RRDP2004 Technical Research Final Report
May 2022
Smarter Irrigation Grower-led Cotton Optimisation and Performance Trial Results 2021-2022 season

Gwydir Valley Irrigators Association Inc

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making every drop count

Australian Government
Department of Agriculture, Water and the Environment

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Contents

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Executive Summary

Over the last 14 years the Gwydir Valley Irrigator Association (GVIA) in partnership with Sundown Pastoral Company have, with the support of the Cotton Research and Development Corporation (CRDC) and the Federal Department of Agriculture, Water and the Environment, co-ordinated the Keytah Grower-led irrigation efficiency project. This has incorporated Irrigation System Comparison, automation and most recently optimisation of surface irrigation.

The two surface irrigation systems; siphon and bankless channel, continue to be widely utilised in the cotton industry. Siphons may be manual or automated and backless channel comes in a large number of different forms. Bankless channel designs are increasing in popularity as growers strive to manage labour resourcing issues. These systems offer potential efficiency gains in energy and machinery. The Keytah system comparison results indicates that the water use efficiency of these systems is equivalent to other systems, but there is more to learn about automating and optimising the different design options.

The trial has done commercial research into alternative cotton irrigation systems including subsurface drip, lateral move, bankless channel and siphon. It has included the investigation of the practical constraints of installation, management, reliability, and suitability of components associated with automation of irrigation in siphon and bankless channel systems. There has been an assessment of the value of sensors in the automation of siphons and bankless channel. In 2021-2022 the RRDP2004 project expanded to include commercial assessments of optimised irrigation using SISCOweb. This focused on a manual siphon field near Moree. In addition, the project collaborated with CottonInfo under CRDC2201, to do an assessment of irrigation performance in a siphon-less tailwater backup systems.

These trials were designed to demonstrate to growers how they can potentially improve the performance of their irrigation management. The Keytah results indicate that irrigation performance is influenced more by seasonal conditions that by system, so growers can improve irrigation performance by striving to optimise the system they have. If they decide to change to a different type of system such as a siphon-less tailwater backup, they will have data to inform their design choices and information on options for automation. This work has included commercial partners, an important aspect for adoption irrigation technology, this with increase the confidence that growers have in the tools and technologies in use.

The trail continued to collect data on water use efficiency as measured using the Gross Production Water Use Index (GPWUI), a measure that enables comparison between seasons and systems, and will add to the Keytah information.

This is a unique project which has been driven by growers to collect relevant commercial data. This data is designed to provide cotton growers greater insight into irrigation systems, performance and new technologies, giving them the ability to make more informed infrastructure investment decisions.

Background

The GVIA in partnership with Sundown Pastoral Company initiated a grower led irrigation project in 2008. It was initially funded from 2008-2012 under the Raising National Water Standards Program by the National Water Commission. Extra funding from the CRDC enabled the project to continue from 2012-2022. Additionally, this project is supported by funding from the Australian Government Department of Agriculture, Water and the Environment as part of its Rural R&D for Profit program (2017-2022).

The Keytah system comparison trial RRDP2004 now has six years of data collected from 2009-2010 to 2020-2021. As a result, growers know that irrigation system performance is impacted more by seasonal conditions than by system choice. Growers are looking for means to optimise existing irrigation systems or automate operations to improve efficiencies. Importantly water will not be the only consideration, there are challenges associated with labour and energy. Additionally, soil type, slope and water availability will need to be factored into decision making.

The majority of the industry is looking primarily at surface irrigation either siphon or one of the many bankless channels designs available. Further information into automation and optimisation of surface irrigation has been collected in 2021-2022 to complement the Keytah automation and system comparison project. This will allow growers to compare different infrastructure and scheduling approaches which will enable them to look into alterative possibilities to optimise their existing surface irrigation systems or change to new systems.

The trials implemented in 2021-2022 were initiated following grower interaction at the RRDP2004 GVIA field day in 2021. There are two parts, one looking into optimising manual siphon irrigation, and one into irrigation performance in a siphon-less tailwater backup field. This extension of the Keytah research is aimed at assisting growers to improve their understanding of irrigation optimisation with regard existing irrigation systems and with newer designs and irrigation approaches.

The GVIA project is a grower-led initiative, focused on commercial reality. The ongoing support of the project from the CRDC and the Australian Government has enabled it to continue to collect relevant data and has enabled extensive collaboration with industry and research partners.

Methods

The 2021-2022 component of the RRDP 2004 project included:

1. An assessment of the practical constraints of installation, management, reliability and suitability of components associated with automation of irrigation in a Siphon-less Tailwater Backup System.
2. A demonstration of the application of SISCO to a manual siphon field.
3. An assessment of the performance of the Siphon-less Tailwater Backup System.

Comparative Data:

- Assess soil moisture prior to planting and post picking using soil cores.
- Record water applied and rainfall throughout the season.
- Collect yield results.

Demonstration of SISCOweb

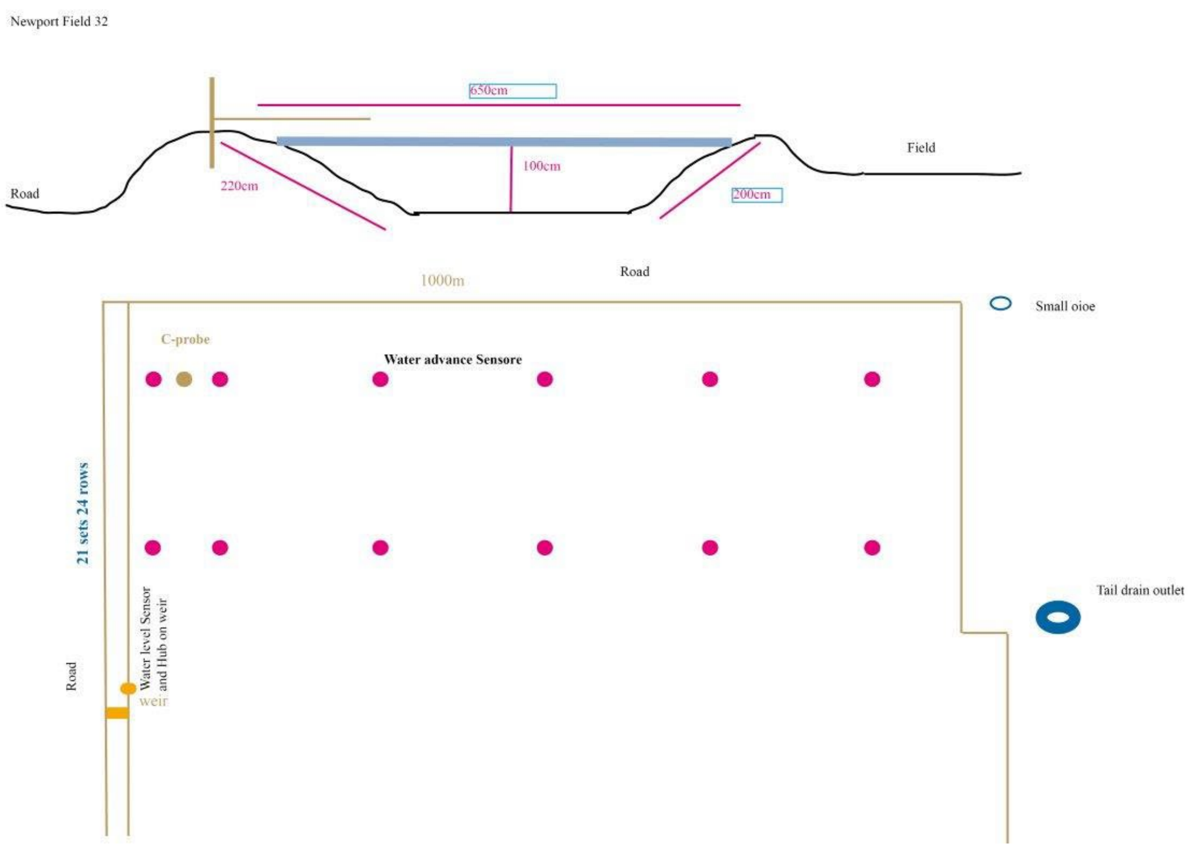
SISCOweb offers the potential to enhance irrigation performance by gaining a better understanding of water advance down the field and soil infiltration characteristics. This work was completed in partnership with the Centre for Agricultural Engineering at the University of Southern Qld, who provided technical advice, support, analysis of data and irrigation reports.

We utilised commercially available water advance sensors previously used at Keytah in a manual siphon field north of Moree. These were complemented by a new EnviroNode hub and an ultrasonic water level sensor (measurement range 20cm to 750cm, resolution of +/-1cm) directly wired to the Hub.

Six water advance sensors were placed in a single furrow for each of Set 10 and Set 19 of Field 32. The advance sensors were impedance sensors made by EnviroNode IoT and were designed so that the impedance measurement would drop when the sensor's prongs came into contact with the irrigation water. The sensor would measure and transmit the impedance value every five minutes and a history of these measurements can be viewed on the EnviroNode dashboard.

Data collected from these devices was analysed by the SISCO model. This analysis provided information on soil infiltration characteristics down the length of the measured furrows, application efficiency and distribution uniformity.

Figure 1: Newport Field 32 Layout

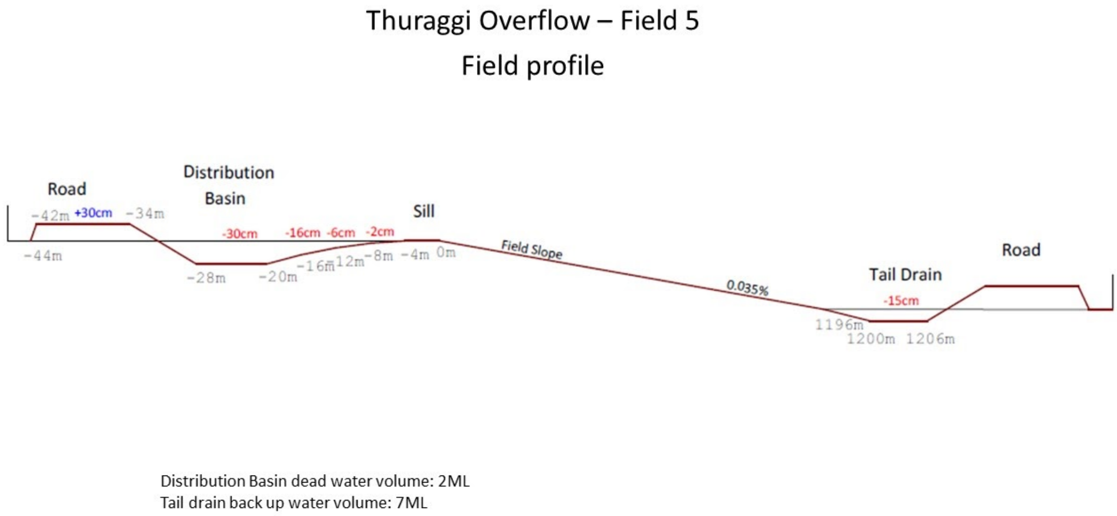


Assessment of Siphon-less Tailwater backup System

The objective was to collect detailed information on irrigation performance in the siphon-less tailwater backup design developed by Glenn Lyons and implemented in the St George region of Qld.

The siphon-less tailwater backup system is supplied by a head ditch fed directly from the storage. As each bay is irrigated a Padman stops bay outlet opens to allow water into the distribution bay. As the distribution bay fills, water flows over the sill and down the field length (refer figure 2). As water reaches the tail drain, it backs up the rows. Once all rows have been irrigated the Padman bay outlet in the next bay is opened to fill the distribution bay, and the gate in the tail drain is opened to allow water to flow to the next tail drain.

Figure 2: Thuraggi Overflow Profile



The field is split into management units of three bays using a common drainage point, assessment of irrigation performance focused on bays 7, 8 and 9. The intention was to measure and monitor water use and movement in one of these three bay management units. This was to entail measuring water into the head ditch (distribution basin) and water leaving tail drain after irrigating three consecutive, uniform bays within the field. In addition, the intention was to assess water advance, depth and infiltration characteristics in different rows over the three bays being monitored in the field. Figure 3 provides details of sensor placement.

The specific aims included the following;

1. Measure Irrigation Water Use (IWUI) efficiency and or Gross Production Water Use (GPWUI) efficiency.
2. Measure water infiltration rate from head ditch to tail train in the tailwater backup siphon-less design.
3. Estimate application and distribution uniformity in the tailwater backup siphon-less design.
4. Investigate potential to apply surface irrigation optimisation technologies such as SISCO to the tailwater backup siphon-less design.

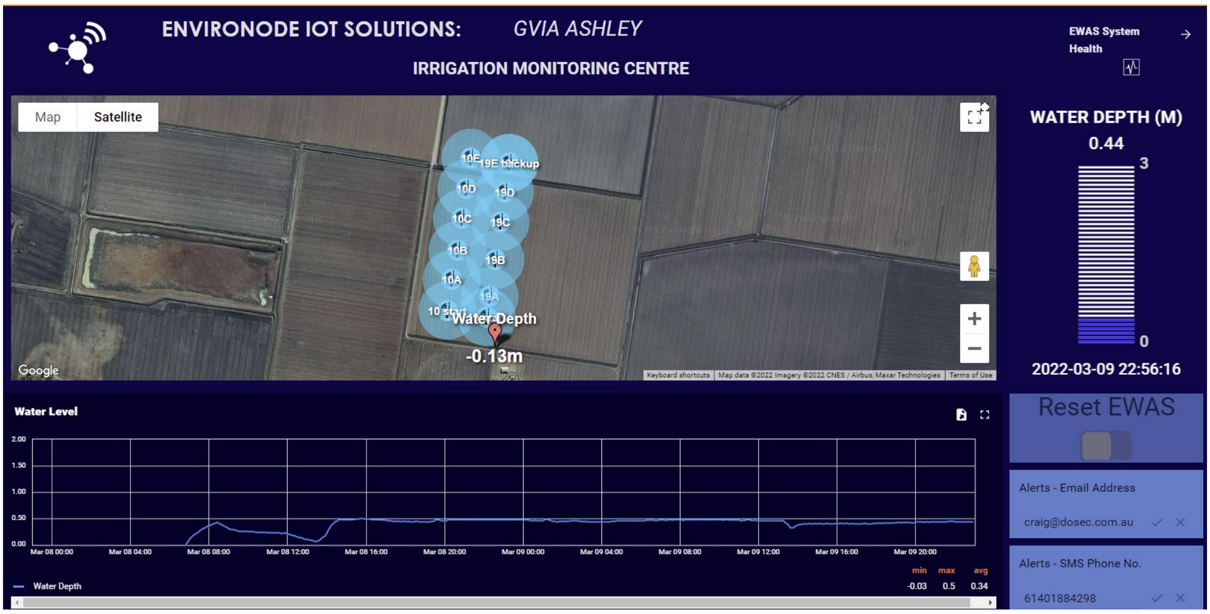
Figure 3: Thuraggi Overflow field 5 layout and sensors

Results

Demonstration of SISCOweb

In the 2021-2022 season the EnviroNode water advance sensors were re-deployed to field 32, a manual siphon field at Newport north of Moree. In addition, the field was fitted with an EnviroNode hub and water level sensor. The water level sensor was monitoring the head ditch water level as seen in figure 4.

Figure 4: Sensor placement and water level 8-9 Mar 2022

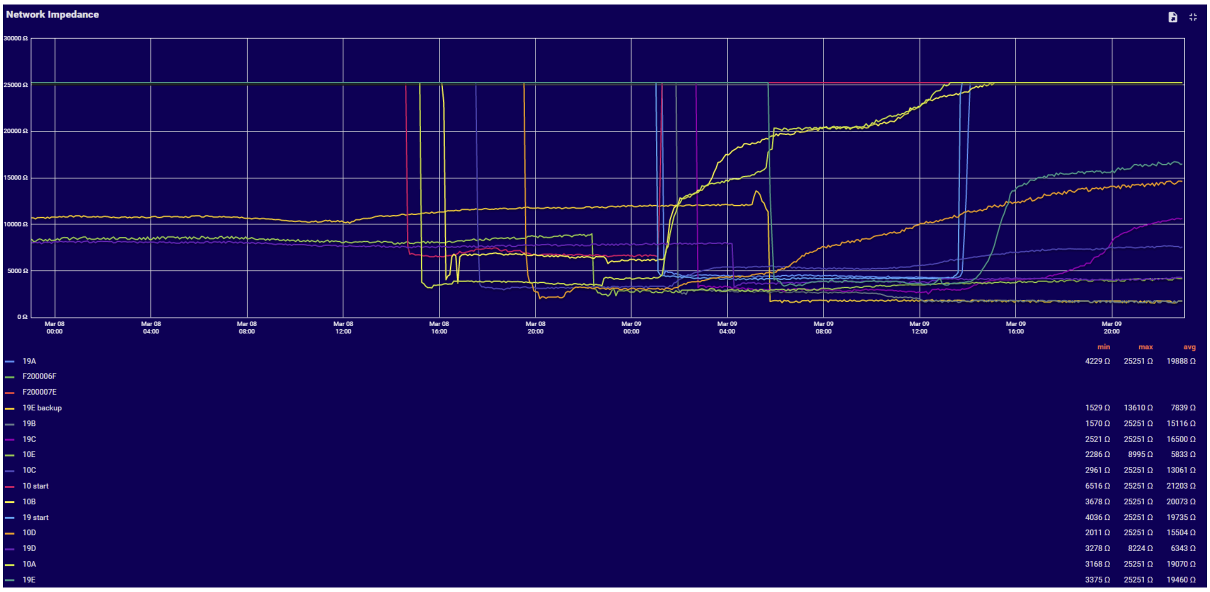


The sensors were initially positioned at regular distances down three rows in the field. Two of the sensors were not transmitting correctly so were removed. At this time, it was decided to adjust the sensor locations. The sensors were positioned down a row in set 10 and set 19. A sensor was placed at the start of the plant line in each row to identify the exact time each of the sets were irrigated. In a manual setup, different sets will be started at different time in a bid to maintain constant head heights.

A manual measure was made at several stages during the season to determine the head height (See Appendix 1: USQ SIP2 Newport Irrigation Analyses 2022 for details). This information was used to calculate the siphon flow rates; a critical metric required for the SISCOweb model.

As water advanced to, or left from each of the sensors the impedance changed (figure 5). During the season the data was uploading from the water advance sensors to the hub on five minute intervals. Data from the hub was available to input into the SISCO model from the dash online.

Figure 5: Network impedance 8-9 March 2022



As this was a pre-commercial demonstration data was not transmitted in real time to the irrigation team. Irrigation start and stop details were cross checked with manual on farm irrigation records. Draft reports were developed for each of the irrigation events. These reports included details of sensor placement, channel water level, measured furrow irrigation advance and irrigation analysis from the SISCO model such as siphon flow rates and infiltration characteristics (figure 6 and 7), which is the progressive infiltrated depth of water over time.

The SISCO software can produce a plot of the modelled depth of applied water at each point along the length of the furrow. Figure 7 provides an example of this plot from the irrigation on the 8th of March. The green line indicates the target soil moisture deficit. The example in figure 6 shows that the water in the furrow didn't make it completely to the tail drain, thus minimising excess tailwater, an objective of the farm, due to minimal tailwater capacity. There was an average infiltration depth for the whole length of the furrow of 76mm (0.76ML/ha), the infiltration at the head ditch was higher 95mm, while at the tail drain end it was between 25 and 60mm. The model also suggests that there were deep drainage losses of approximately 13mm, highlighting the challenge of balancing the aspects of irrigation optimisation.

Figure 6: Screenshot of SISCO output for infiltration characteristic, set 10 8 Mar 2022

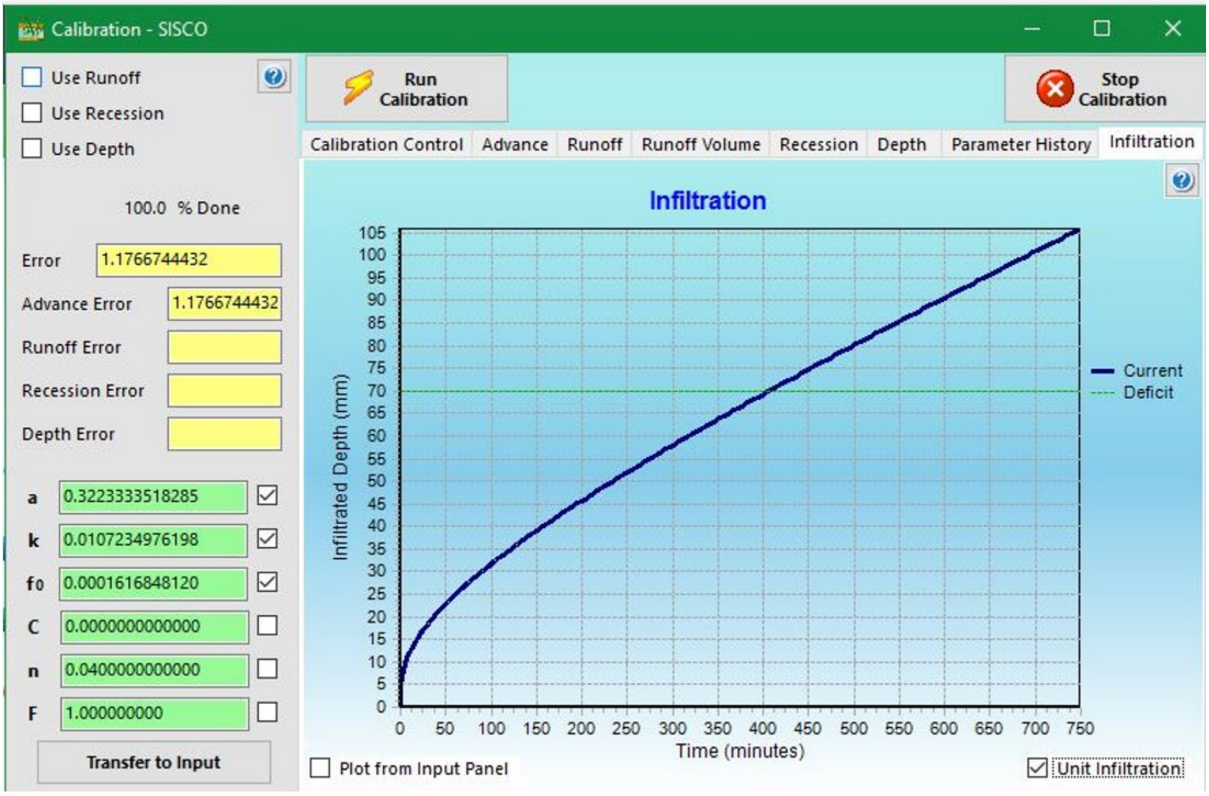
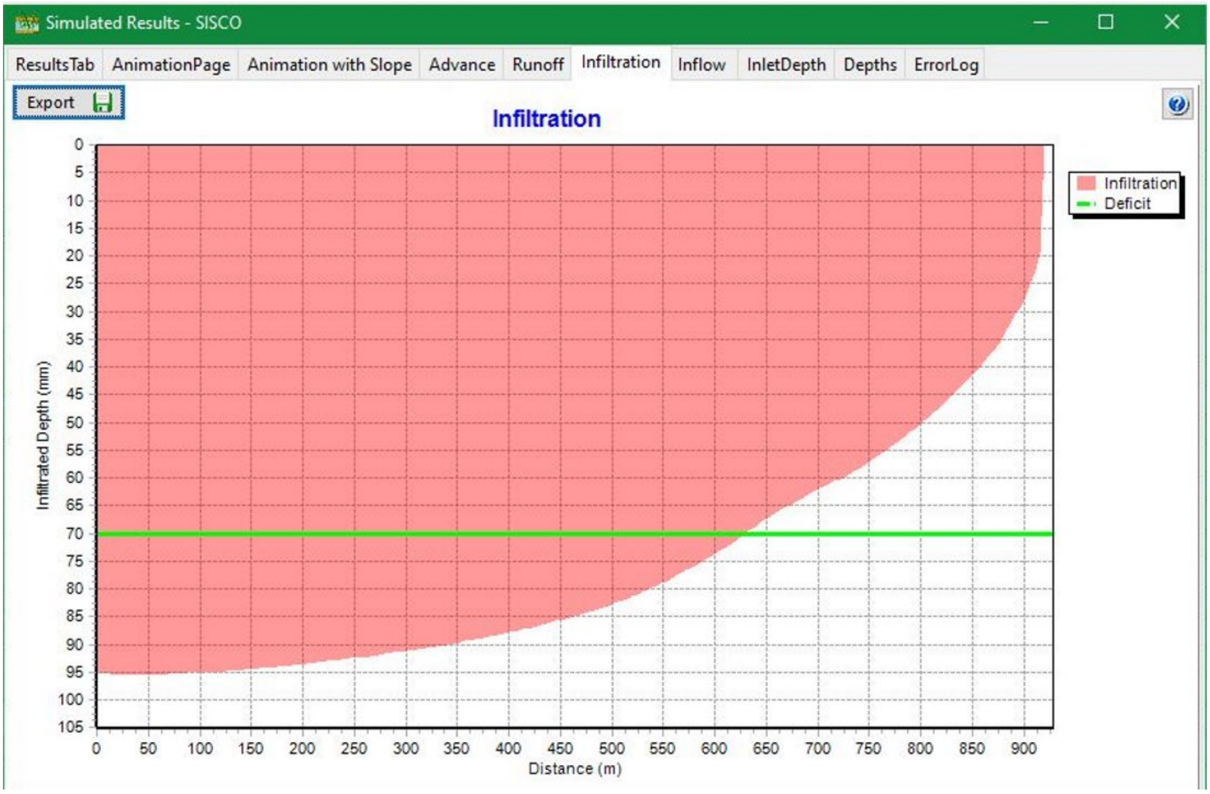


Figure 7: Simulated SISCO infiltration plot 8th Mar 2022



Information such as this was developed for six irrigation events during the season. This data is available in the USQ report Appendix 1. Data from the in field hub was uploaded to SISCO and reports developed following the irrigation events, it was not real time and could not be used to inform irrigation decisions. The information has been made available to the farm and a field discussion was held to talk about the model, and the possible fit of the tool in siphon systems. The data collected shows that irrigation performance varied during the season. This was impacted by flow rates and the time that the irrigation was run for. A challenge for many farms, including this one is they are limited in the amount of tailwater they can manage, this can mean that irrigation is stopped earlier than is ideal. In this demonstration the best performance was where slower flow rates and longer run combined.

The costs associated with the sensors was considered as part of the project. There are a number of different commercial providers who can supply sensors, and all are priced between $700 and $1,000 per unit. The hub used in this trial fitted with a water level sensor and with the capacity to manage sensors, collect and transmit data was valued between $5,000 and $6,000.

Assessment of Siphon-less Tailwater Backup

At the start of the 2021-2022 season field 5 at Thuraggi Overflow was fitted with a number of different sensors. A storage meter was in existence and monitored the water applied to the field. There was an additional channel level sensor in the supply channel. The field has been fitted with automation equipment providing opening and closing times for irrigation gates associated with the three bays being assessed in this trial. Details of these structures is available in the USQ report and in the CRDC2201 report.

All irrigation water applied to bays 7, 8 and 9 was measured, and all water off this set of three bays was also measured to inform the applied irrigation water. Padman advance sensors were installed at select locations in bays 7, 8 and 9. These were pressure transducers so record water depth over time, so can monitor the recession of water leaving the bay. The advance sensors were positioned downstream of the sill and upstream of the tailwater backup area. The segment of the field monitored resembles a normal furrow field. There were some early season issues with the LoraWAN system supporting the Padman instruments, so Taggle Advance Sensors were installed in duplicate in two furrows. The Padman sensors functioned correctly throughout the trial.

MaxiFlow Culvert Starflows were installed to provide data on velocity and depth through the inlets into bays 7, 8 and 9. To capture individual furrow inflows the USQ team tested Starflow sensors in the furrow at the sill (details are in the USQ report).

Observations and measurements during the season found that there were differences in furrow flow rates across the bays. This was a result of the sill level; flow rates were faster in furrows where the sill was lower. One set of water advance sensors was in one such row.

Once flow rates were established the SISCO model could be applied and water advance, infiltration characteristics could be modelled. Optimisation of the top section of the field was possible where the tailwater is not backing up. There is still work to be done to determine what contribution the tailwater backup water is having.

A field day was held at St George in March 2022. The field day provided an opportunity for irrigations to hear from those involved in the project. A panel session discussed the adoption of tailwater backup systems, automation of irrigation and optimisation of surface irrigation. This involved an irrigator, system designer, regional extension officer, commercial supplier and researcher.

Following the field day attendee were asked to complete a survey (Appendix 2). A number of the questions looked to see how irrigators felt about losses, optimisation and adoption of technology.

Figure 8: Optimisation and performance feedback St George field day.

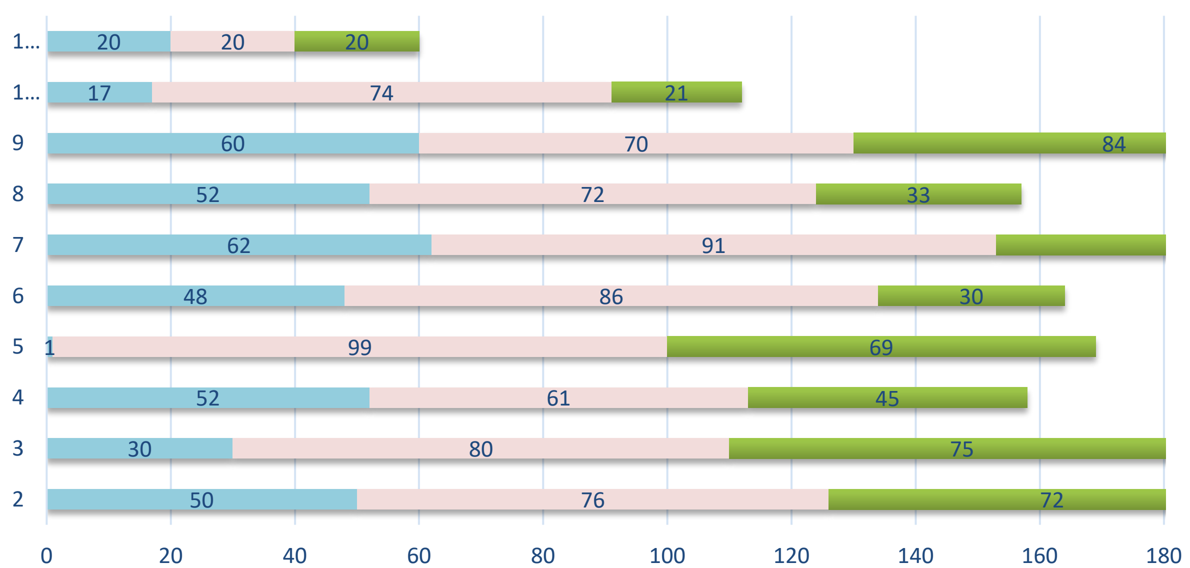


Figure 9: Likelihood to optimise Irrigation efficiency

	YES	NO	UNSURE
changing flow rates into fields	44.44% 4	11.11% 1	44.44% 4
adjusting irrigation run times	44.44% 4	33.33% 3	22.22% 2
adjusting field length	33.33% 3	66.67% 6	0.00% 0

Figure 9: Likelihood of you making changes or adopting the following technology into operations

	EXTREMELY LIKELY	VERY LIKELY	NOT SURE	SOMEWHAT UNLIKELY	UNLIKELY
Automated gates (eg Padman stops)	10.00% 1	30.00% 3	40.00% 4	10.00% 1	10.00% 1
Transitioning fields to siphon-less designs	30.00% 3	40.00% 4	20.00% 2	0.00% 0	10.00% 1
SISCOweb irrigation optimisation	0.00% 0	20.00% 2	60.00% 6	10.00% 1	10.00% 1
Channel level sensors	20.00% 2	50.00% 5	20.00% 2	0.00% 0	10.00% 1
Improved monitoring of water in fields	40.00% 4	40.00% 4	10.00% 1	0.00% 0	10.00% 1

Figure 10: With regard technology and automation what do you see as barriers to adoption?

	EXTREME BARRIER	MAJOR BARRIER	SOMEWHAT OF A BARRIER	NOT A BARRIER
Reliability of technology	33.33% 3	11.11% 1	44.44% 4	11.11% 1
Cost	37.50% 3	12.50% 1	37.50% 3	12.50% 1
Service provider support	20.00% 2	30.00% 3	40.00% 4	10.00% 1
Understanding the value of the technology	0.00% 0	12.50% 1	75.00% 6	12.50% 1
Understanding what the technology does	0.00% 0	12.50% 1	62.50% 5	25.00% 2

Discussion

The demonstration of SISCO in a manual siphon field was able to confirm that the commercial provider associated with the trial (EnviroNode IoT) could readily collect the necessary data and transmit it to the SISCO server.

Real time water advance information and analysis through SISCOweb would enable the optimisation of irrigation events through the transmission of SMS notifications informing when siphons should be stopped. The real time data was not available during this demonstration but as a result of the demonstration it can easily be made available in the future.

The plot of the modelled depth of applied water (infiltration) as displayed in figure 7, provides an easily understood snapshot of irrigations. It is however important to note as was found with this demonstration, that there will be differences between irrigation events through the season. This trial showed that siphon flow rates differed from 3.6L/sec to 4.4L/sec. This may have been influenced by the soil deficit at the start of irrigation, the head height during irrigation or by siphon placement. Run times for irrigations were also variable ranging from 6 hours 45 minutes to 10 hours 45 minutes. Run times are usually determined by the time water reaches the tail drain, this can vary throughout the season. The water advance sensors and SISCO modelling can help inform irrigators about what is happening in the field, how fast the water is moving down the row and modelling the depth that it is infiltrating into the soil, information that can help improve irrigation performance. Following the demonstration and discussions of the capabilities of the SISCO model the irrigation and management teams showed interest is its ability to aid irrigation performance. This is especially important in situations where the irrigators are new to the farm or the industry.

The upload of data from the hub to the SISCO server was every five minutes, and the upload from the sensors to the hub, was also every five minutes. Ideally, to ensure that the SISCO model has the right information as soon as practical, this time should be shortened to two minutes during irrigation events. This can be easily adjusted by EnviroNode IoT and was actioned during the season. Updates to the hub could be done either remotely or in some cases with a sim card loaded with the necessary information.

Sensor reliability has been identified as a barrier to adoption by irrigators (figure 10). The demonstration did find that even high quality robust sensors can have issues. Two of the 15 sensors had software update issues, these were easily rectified, but the sensors had to be sent away for this to happen.

This trial positioned six water advance sensors in each of two rows. Although the individual sensors are small and compact, they are cumbersome to position evenly down the row. The sensors used in this trial had solar panels, and posts so they could be found if there was an issue in season and retrieved at the end of the season. The post can create issues if there are in crop passes with either cultivation or spray applications. The placement of sensor is a limitation associated with this optimisation approach.

Assessment of Siphon-less Tailwater backup System

The siphon-less tailwater backup field 5 at Thuraggi Overflow was fitted with a number of different sensors to monitor irrigation water applied, rainfall and irrigation performance during the season. The field was fitted with Padman automation equipment linked to the Padman Webapp Portal.

All irrigation water applied to bays 7, 8 and 9 was measured, and all water off this set of three bays was also measured to inform the applied irrigation water. The Padman water advance sensors were linked to this portal. The Padman sensors functioned correctly throughout the trial. There were however some early season issues with the LoraWAN system supporting the Padman instruments. This is an example of the importance of reliability of technology – that reliability, as was the case here, is often associated with connectivity not the device.

Observations and measurements during the season found that there were differences in furrow flow rates across bay 7. This was a result of the level of the sill across the width of the bay. This highlights the importance of land development. There will always be some variability as it is difficult to achieve uniform grade with earth moving equipment, however developing and maintaining irrigation bays that are as even as possible will improve the uniformity of flow rates across the bay. In this design the evenness of the sill level across the bay is important, as the distribution bay fills, water is dispersed across the bay, a level sill will help ensure evenness of flow down all the rows in the bay reducing the impact off furrow shape and elevation in comparison to other furrows.

Once flow rates were established the SISCO model could be applied, water advance, opportunity time and infiltration characteristics could be modelled for the first part of the bays. (refer USQ report Thuraggi Overflow)

Where the tailwater is backing up it was not possible to determine the opportunity time for water in the rows, the backup into rows is not consistent, and it was not possible to determine which rows backed up and how far they backed up. There is still work to be done to determine what contribution the tailwater backup water is having.

Despite not being able to model the backup sections of the field, the trial was able to determine that the use of the tailwater in this way was valuable. As irrigation transitioned from bay 7 to 8 and then to 9 the volume applied to each bay reduced, the use of tailwater from bay 7 and then bay 8 reduced application volumes into the subsequent bays. This design also reduced the total tailwater volume (estimated to be approximately 5 to 10% of inflow) compared to other designs.

Feedback from the St George field day in March 2022 indicated that there was interest in and increasing understanding of losses and techniques which can improve performance. 44% of respondents indicated a willingness to adjust flow rates and run times to optimise irrigation efficiency. 80% indicated that they were extremely or very likely to improve monitoring of water in fields and

70% were extremely likely or very likely to adopt channel level sensors. Respondents indicated that 70% were extremely or very likely to transition fields to siphon-less designs.

With regard SISCOweb irrigation optimisation only 20% indicated they were very likely to adopt the technology, 60% were unsure. This may be in part due to the need for additional sensors to monitor water infields, or it may be that they feel that they can make the improvements they are targeting with other tools and or technologies.

Conclusions

The SISCO demonstration on a manual siphon field showed that the software does provide useful information on irrigation performance. In the future when this information is available in real time, it will be useful to assist irrigators to optimise irrigation events throughout the season.

Working with commercial sensors and hub from EnviroNode IoT demonstrated that the software could easily interact and that in the future this may provide a commercial option for producers.

The majority of the cotton industry is surface irrigated, and there is an increasing trend for more to be developed as producers work to efficiently balance water, labour and energy resourcing. The system comparison yield results show the bankless channel system has performed very strongly over the last three seasons.

The initial assessment of the siphon-less tailwater backup design suggests that the performance of the top section of the field can be monitored. Observations indicate that land development needs to be as precise as possible as this will improve application uniformity and irrigation performance. There is still work to be done to monitor the performance of the whole field including the area where tailwater backs up.

The SISCO model has provided valuable information for irrigators, however it still faces barriers to adoption. The need for infield sensors and measures of furrow flow rates will limit adoption until the installation can be simplified.

The demonstrations in 2021-2022 have provided more information associated irrigation assessments and will be useful for Growers looking to make changes to their irrigation systems. They will be balancing a range of factors including soil type, topography or existing land use, water reliability, crop type and financial capital as they consider the tools and technologies that they may adopt.

Indications are that growers are intending to make changes to improve their irrigation efficiency through adoption of automation tools, monitoring equipment and adjustment to flow rates or run times.

Reliability of technology is a consideration for producers, this trial found that this can be related to connectivity or software issues more than the device itself.

SISCO model provides useful, actionable and valuable information. This project that it can readily be applied to manual siphon field to assist irrigators to optimise irrigation events. The application of the model to siphon-less tailwater backup designs is not yet possible, although irrigation performance in field segments where there is no tailwater backing up is possible. The adoption of the model will be impacted by the need to install sensors in the field, and to measure furrow flow rates.

Appendix 1

USQ
Centre for Agricultural Engineering

SIP2 Report 2019-22

May 2022

Newport Irrigation Analyses

Dr Simon Kelderman

A/Prof Joseph Foley

Dr Malcolm Gillies

Dr Jochen Eberhard

Appendix 2

Smarter Irrigation Siphon-less Field day Evaluation 2022

Q1 Where are you from

Answered: 10 Skipped: 0

ANSWER CHOICES	RESPONSES	
Gwydir Valley	0.00%	0
St George	100.00%	10
Border Rivers	0.00%	0
Other (please specify)	0.00%	0
TOTAL		10

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q2 What is your Occupation

Answered: 10 Skipped: 0

ANSWER CHOICES	RESPONSES	
Farm Manager/Owner	60.00%	6
Farm Employee	0.00%	0
Researcher	0.00%	0
Other (please specify)	40.00%	4
TOTAL		10

#	OTHER (PLEASE SPECIFY)	DATE
1	contractor	3/11/2022 11:26 AM
2	Agronomist	3/8/2022 4:52 PM
3	Agronomist	3/8/2022 12:50 PM
4	Agronomist	3/8/2022 12:48 PM

Q3 Thinking about Water Productivity, do you see value in

Answered: 10 Skipped: 0

	YES	NO	TOTAL
measuring water productivity	100.00% 10	0.00% 0	10
participating in the benchmarking project	50.00% 4	50.00% 4	8

Q4 How effectively do you feel you manage field losses across your farm? (zero is not effectively and 100 is extremely effectively)

Answered: 10 Skipped: 0

ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	39	392	10
Total Respondents: 10			

#		DATE
1	50	3/14/2022 3:51 PM
2	30	3/11/2022 11:33 AM
3	52	3/11/2022 11:31 AM
4	1	3/11/2022 11:28 AM
5	48	3/11/2022 11:26 AM
6	62	3/11/2022 11:23 AM
7	52	3/8/2022 4:52 PM
8	60	3/8/2022 2:35 PM
9	17	3/8/2022 12:50 PM
10	20	3/8/2022 12:48 PM

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GVIA making every drop count

Q5 How important do you think flow rate is to improve irrigation optimisation and efficiency? (zero is not important and 100 is extremely important)

Answered: 10 Skipped: 0

ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	73	729	10
Total Respondents: 10			

#		DATE
1	76	3/14/2022 3:51 PM
2	80	3/11/2022 11:33 AM
3	61	3/11/2022 11:31 AM
4	99	3/11/2022 11:28 AM
5	86	3/11/2022 11:26 AM
6	91	3/11/2022 11:23 AM
7	72	3/8/2022 4:52 PM
8	70	3/8/2022 2:35 PM
9	74	3/8/2022 12:50 PM
10	20	3/8/2022 12:48 PM

Q6 How well do you think you manage your irrigation start times and end times? (zero is not well and 100 is extremely well)

Answered: 10 Skipped: 0

ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	53	530	10
Total Respondents: 10			

#		DATE
1	72	3/14/2022 3:51 PM
2	75	3/11/2022 11:33 AM
3	45	3/11/2022 11:31 AM
4	69	3/11/2022 11:28 AM
5	30	3/11/2022 11:26 AM
6	81	3/11/2022 11:23 AM
7	33	3/8/2022 4:52 PM
8	84	3/8/2022 2:35 PM
9	21	3/8/2022 12:50 PM
10	20	3/8/2022 12:48 PM

Q7 Following the presentations today, are you likely to work to optimise your irrigation efficiency by

Answered: 9 Skipped: 1

	YES	NO	UNSURE	TOTAL
changing flow rates into fields	44.44% 4	11.11% 1	44.44% 4	9
adjusting irrigation run times	44.44% 4	33.33% 3	22.22% 2	9
adjusting field length	33.33% 3	66.67% 6	0.00% 0	9

Q8 Thinking about the Thuraggi Overflow siphon-less trial. How would you rate the value of commercial scale research? (zero is not valuable and 100 is extremely valuable)

Answered: 10 Skipped: 0

ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	89	888	10
Total Respondents: 10			

#		DATE
1	99	3/14/2022 3:51 PM
2	80	3/11/2022 11:33 AM
3	80	3/11/2022 11:31 AM
4	99	3/11/2022 11:28 AM
5	75	3/11/2022 11:26 AM
6	98	3/11/2022 11:23 AM
7	58	3/8/2022 4:52 PM
8	100	3/8/2022 2:35 PM
9	99	3/8/2022 12:50 PM
10	100	3/8/2022 12:48 PM

Q9 Thinking about the information presented: Please rate the likelihood of you making changes or adopting the following technology into your operations.

Answered: 10 Skipped: 0

	EXTREMELY LIKELY	VERY LIKELY	NOT SURE	SOMEWHAT UNLIKELY	UNLIKELY	TOTAL
Automated gates (eg Padman stops)	10.00% 1	30.00% 3	40.00% 4	10.00% 1	10.00% 1	10
Transitioning fields to siphon-less designs	30.00% 3	40.00% 4	20.00% 2	0.00% 0	10.00% 1	10
SISCOweb irrigation optimisation	0.00% 0	20.00% 2	60.00% 6	10.00% 1	10.00% 1	10
Channel level sensors	20.00% 2	50.00% 5	20.00% 2	0.00% 0	10.00% 1	10
Improved monitoring of water in fields	40.00% 4	40.00% 4	10.00% 1	0.00% 0	10.00% 1	10

Q10 With regard technology and automation what do you see as barriers to adoption

Answered: 10 Skipped: 0

	EXTREME BARRIER	MAJOR BARRIER	SOMEWHAT OF A BARRIER	NOT A BARRIER	TOTAL	WEIGHTED AVERAGE
Reliability of technology	33.33% 3	11.11% 1	44.44% 4	11.11% 1	9	5.44
Cost	37.50% 3	12.50% 1	37.50% 3	12.50% 1	8	5.75
Service provider support	20.00% 2	30.00% 3	40.00% 4	10.00% 1	10	5.30
Understanding the value of the technology	0.00% 0	12.50% 1	75.00% 6	12.50% 1	8	3.13
Understanding what the technology does	0.00% 0	12.50% 1	62.50% 5	25.00% 2	8	2.75

Q11 How would you rate the value of the CottonInfo SIP2 field day; Optimisation and automation of siphon-less irrigation? (zero is no value and 100 is excellent value)

Answered: 9 Skipped: 1

ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	84	757	9
Total Respondents: 9			

#		DATE
1	87	3/14/2022 3:51 PM
2	80	3/11/2022 11:33 AM
3	78	3/11/2022 11:31 AM
4	99	3/11/2022 11:28 AM
5	79	3/11/2022 11:26 AM
6	92	3/11/2022 11:23 AM
7	70	3/8/2022 4:52 PM
8	72	3/8/2022 2:35 PM
9	100	3/8/2022 12:48 PM

Appendix 3

USQ Thuraggi Overflow report

Appendix 4:

2021 GVIA Field day feedback

1. Where are you from?

ANSWER CHOICES	RESPONSES	
Gwydir Valley	4.08%	2
Griffith	10.20%	5
Namoi Valley	14.29%	7
Border Rivers	8.16%	4
Macquarie Valley	2.04%	1
Burdekin or North Qld	2.04%	1
Darling Downs	14.29%	7
Other (please specify)	44.90%	22
TOTAL		49

2. What is your occupation?

ANSWER CHOICES	RESPONSES	
Farm Manager/Owner	34.69%	17
Farm Employee	8.16%	4
Researcher	16.33%	8
Other (please specify)	40.82%	20
TOTAL		49

3. Thinking about the Keytah Irrigation Efficiency research. How would you rate the value of Grower led commercial scale research?

ANSWER CHOICES	RESPONSES	
Extremely useful	53.06%	26
Very useful	42.86%	21
Somewhat useful	4.08%	2
Not so useful	0.00%	0
Not at all useful	0.00%	0
TOTAL		49

4. Which irrigation systems would you like more commercial data on?

Australian Government
Department of Agriculture, Water and the Environment

This project is supported by funding from the Australian Government Department of Agriculture, Water and the Environment as part of its Rural R&D for Profit program.

CRDC

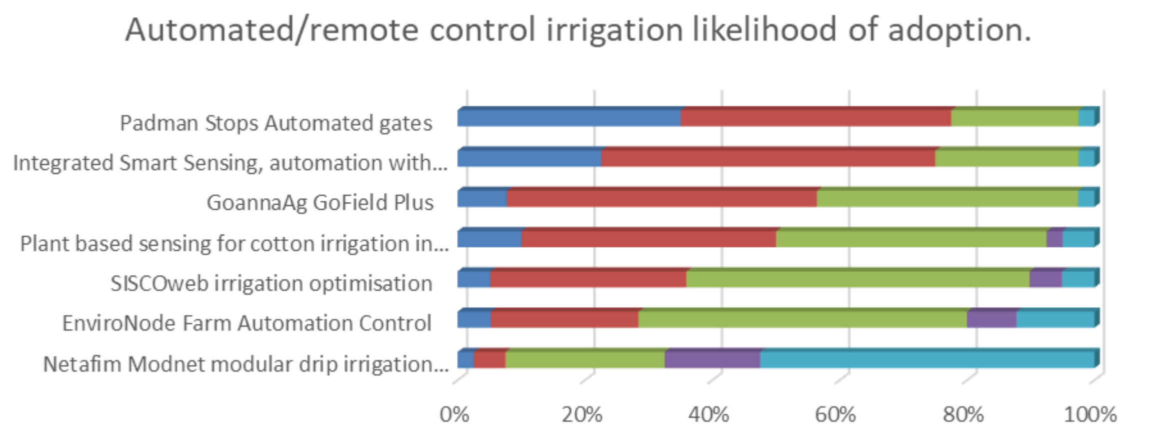
GVIA making every drop count

ANSWER CHOICES	RESPONSES	
Automated siphons	8.70%	4
Automated bankless channel	78.26%	36
Modular surface drip irrigation	8.70%	4
Overhead irrigation	4.35%	2
TOTAL		46

5. As a grower how useful was the Keytah presentation on their field experience with automation of bankless channel?

ANSWER CHOICES	RESPONSES	
Extremely useful	36.17%	17
Very useful	55.32%	26
Somewhat useful	8.51%	4
Not so useful	0.00%	0
Not at all useful	0.00%	0
TOTAL		47

6. Thinking about the automated/remote control irrigation information presented: Please rate the likelihood of you adopting the following technology into your operations.



	Netafim Modnet modular drip irrigation system	EnviroNode Farm Automation Control	SISCOweb irrigation optimisation	Plant based sensing for cotton irrigation in limited water	GoannaAg GoField Plus	Integrated Smart Sensing, automation with Padman gates	Padman Stops Automated gates
Extremely likely	2.5	5.13	5.1	10	7.7	22.5	35
Very likley	5	23.1	30.8	40	48.7	52.5	42.5
Not Sure	25	51.3	53.9	42.5	41	22.5	20
Somewhat likely	15	7.7	5.1	2.5	0	0	0
Inlikely	52.5	12.2	5.1	5	2.6	2.5	2.5

7. How would you rate the value of the GVIA field day; Application of digital technologies for automated irrigation?

ANSWER CHOICES	RESPONSES	
Excellent value	63.27%	31
Good value	34.69%	17
Some value	2.04%	1
Not of value	0.00%	0
TOTAL		49