GRASSROOTS GRANT FINAL REPORT

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: **CGA2002**

CGA: **Macquarie CGA**

Project Title: **On-farm Evaluation of pumping telemetry - Macquarie CGA**

Project Commencement Date: 01/09/2019 **Project Completion Date: 31/08/2021**

Recognition of support: The Research Provider Tim Gainsford and the MCGA acknowledges the financial assistance of the Cotton Research and Development Corporation in order to undertake this project.

Part 2 – Contact Details

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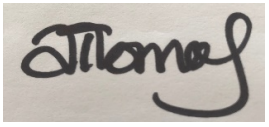


Date submitted: 30/9/21

Part 3 – Final Report

(The points below are to be used as a guideline when completing your final report.)

Background

1. Outline the background to the project.

The new non-urban water metering framework began in December 2018 with the goal of ensuring that the vast majority of licensed water take is measured by accurate, auditable and tamper evident meters. The new metering rules are prescribed in the Water Management Act 2000 and the Water Management (General) Regulation 2018 and outlined in the NSW Non-urban Water Metering Policy. In the Macquarie Valley Under NSW's metering rules, meters and telemetry need to be installed by 1 December 2019 for surface irrigators and 1 December 2020 for groundwater users (no telemetry required). With zero irrigation allocation in the Macquarie valley at present for the 2019/20, the Macquarie Cotton Grower Association (MCGA) wanted to take the opportunity to participate in an on-farm evaluation of telemetry infrastructure compatible with the non-urban water metering framework that is coming into legislation in the next two seasons, (Currently Dec 2020). With the current demand for growers to be compliant in the non-urban metering requirements, there is unprecedented demand for information on metering telemetry technology. This project aims to educate growers and share real life experience of this by sharing a practical on-farm demonstration using groundwater, that will be open to all growers. Given that growers are facing a low/zero water allocation for the 2019/20 season it will provide them with an opportunity to see the technology in action they otherwise may not have had.

Objectives

2. List the project objectives (from the application) and the extent to which these have been achieved.

- Select an appropriate trialist. - The project objective was to select a grower who has access to groundwater in the 2019/20 season to trial and identify some robust and reliable telemetry infrastructure. The grower identified was planning on updating his pumping metering equipment to meet the legal requirements. He planned to install water meters, engine monitoring, however due to the ongoing drought he was going to delay the installation of the telemetry units and meters. The MCGA supported the grower to go ahead and install this tech using grassroots grant funding, to allow him to showcase the technology to other growers and meet the identified information gap that exists in this area.

  Due to unforeseen circumstances beyond the control of the grower, installation of the telemetry equipment was delayed, and an extension was agreed to. Unfortunately, this slight delay has meant that although the installation and use of the telemetry technology is now successfully installed and working, many of the activities set out in the application Outcomes we

were hoping to achieve, have been delayed or had to be demonstrated virtually because of COVID restrictions.
Growers in the region have been able to see, virtually, how this technology looks and feels in a real farm situation. The grower agreed to the following contributions:

- ❖ Host an on-farm demonstration of the technology in action during the season: Achieved a modified version due to COVID restrictions. The grower was the main speaker at the MCGA AGM Sept 2020. Tim Gainsford presented a well designed slide show with many photos of the equipment in use at his farm. He presented data they had collected although with the delay it meant it was still limited data that he was dealing with at that time. Tim talked through the complications and challenges they faced with installation and use of the technology. There were many questions asked at the Q&A section and the audience seemed genuinely keen to go and see the on-farm technology in use once restrictions were lifted.
- ❖ Create a case study after the season to showcase the benefits and limitations: This has now been completed and is now going to be used for wider circulation.
- ❖ Updates in-season via the MCGA networks (website, social media, and grower updates): Completed via the MCGA networks.
- ❖ Create in-season video content to be shared with growers during the season: In progress
- ❖ Work closely with MRFF to extend key messages: Completed
- ❖ Promote using the cotton industry extension tools such as Spotlight Magazine: In progress

Methods

3. Detail the methodology and justify the methodology used. Include any discoveries in methods that may benefit other related projects.

- Identification of a grower who has a Bore water licence and is located central to Narromine. To ensure the grower is willing to participate in an on-farm trial that will showcase remote pump and meter monitoring equipment throughout the season and willing to assist with achieving the other outcomes identified in sharing this knowledge.
- Selection of the appropriate equipment & Installation of the equipment on-farm (grower will fund 60% of the project – infrastructure and metering costs and the project would fund the telemetry costs) See Appendix 1 for details of Telemetry costs:

Scope of Work

Description of existing infrastructure:

- Caterpillar C15 electronic diesel engine.
- Shaft driven Amarillo angle drive with 3 stage turbine pumps.
- Mace turbine flow meter.
- 60,000L fuel tank.

Scope of work – AE Gainsford:

- New pattern approved flow meter with data-logging.
- Electronic engine control unit. This unit will allow the potential for remote monitoring and control of the engine when connected to a telemetry interface.
    - Ability to monitor the following engine performance measures:

- Engine RPM
- Engine hours.
- Engine oil pressure.
- Fuel Rate.
- Coolant temperature.
- Engine load %.
- Air filter blockage.

Scope of work – Grant Funds:

- Telemetry (interface to be capable of logging data and generating reports), including telemetry unit and all connections, hardware and software required for operation:
    - Engine performance and control.
    - Fuel tank level: Electronic sensor.
    - Additional temperature sensor for angle drive.
    - Pumping rate (link to flow meter).
    - Shaft lubrication automation (drip control)

From the scope of work identified, research was conducted as to suppliers who could provide the products and services required under the following criteria:

- Be an approved supplier and installer of the new pattern approved meters.
- Supply, install and service a solution for engine control elements required.
- Provide a telemetry solution to link all components and compile them on one display.
- Provide remote access to the data (dashboard).
- Provide scope for expansion of the system into other relevant areas (e.g., weather monitoring, soil moisture monitoring, irrigation automation etc)
- Provide ongoing service and support.

Solution

After reviewing potential suppliers Tim chose to engage Darling Irrigation to provide their solution due to their ability to meet the project requirements, and due to their proximity for future product support and expansion. The following system was hence installed:

- MAIT Industries radio communications network consisting of a base station located at the farm homestead, and a remote system located at the pumping site.
- Kensho K27 electronic engine control unit to operate and manage the engine, as well as collect and transmit the required information through the MAIT network.
- Aquamonix Pattern Approved water meter with telemetry capability able to transmit through the MAIT network.

Outcomes

4. Describe how the project's outputs will contribute to the planned outcomes identified in the project application. Describe the planned outcomes achieved to date.

- Host an on-farm demonstration of the technology in action during the season: A modified version due to COVID restrictions was achieved. The grower was the main speaker at the MCGA AGM Sept 2020. Tim Gainsford presented a well-designed Slide show with many photos of the equipment in use at his farm (also attached). He presented data they had

collected although with the delay it meant it was still limited data that he was dealing with at that time. Tim talked through the complications and challenges they faced with installation and use of the technology. There were many questions asked at the Q&A section and the audience seemed genuinely keen to go and see the on farm technology in use once restrictions were lifted.

- Create a case study after the season to showcase the benefits and limitations: This has now been completed and is now going to be used for wider circulation amongst growers within the Valley.
- Updates in-season via the MCGA networks (website, social media, and grower updates): Completed via the MCGA networks.
- Create in-season video content to be shared with growers during the season: In progress
- Work closely with MRFF to extend key messages: Completed
- Promote using the cotton industry extension tools such as Spotlight Magazine: In progress

Conclusion

5. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. What are the take home messages?

It was expected that the chosen supplier would have proficient knowledge in the technology utilised, however, it was found that experience with these technologies was still developing, and so additional time and assistance was required during setup. It was found that this was a challenge during the supplier selection stage as there is not a single developed system that could meet the requirements, and so different technology had to be utilised to bring together the end solution. It was not possible to find a supplier that was adequately versed for this to be a simple process.

The technology utilised has met all requirements, and it is believed that as this technology has been specifically developed for the applications required it was able to meet our expectations.

The installation of the technology has been a success as it has been able to meet all of our requirements resulting in reduced expense of man hours, increased worker safety and our ability to monitor performance in real time. Collection of performance data now also allows us to conduct reviews and make decisions to further improve operational efficiency. The ability of real time monitoring has significantly reduced the amount of concern and worry by management around the potential for something to be going wrong without our knowing.

The limitation of this system is that it utilises radio communication which limits the size of transferable data which may mean it cannot expand into such things as cameras for real time visual monitoring, or two way communication, for real-time on demand automation/control.

Conclusions

Every operator has a slightly different requirement from technology due to their location, size, setup, and types of equipment being used all impact the type of systems that can be utilised. Another factor is the existing telecommunications network if there is adequate 4G signal for example then the options are much broader. Therefore this study has found, there is no off-the-shelf solution that will suit everyone and there is a need for a reliable supplier to be able to piece together a sufficient solution.

When developing a scope of work it is important to be clear and concise about the specific requirements of your operation, and to keep a long-term view regarding desired future expansions and how and when you might want to upscale the telemetry or technology towards automation. This is mainly due to such systems being pieced together and the installer not having advanced experience and proficiency with some third-party technology suppliers.

A further consideration is the type of connectivity available on the farm to enable these digital technologies now and building in the future.

This project has demonstrated that the Cotton Industry can take advantage of technology to reduce man hours, minimising personal risk, while improving efficiencies to benefit the environment as well as the operation financially.

Extension Opportunities

6. Detail a plan for the activities or other steps that may be taken:

Since the commencement of the project AE Gainsford have already expanded the network into weather stations, soil moisture monitoring, and small submersible pump control. They have discovered that the system has the ability to accommodate numerous devices to allow expansion of the reach whilst still having a single point of access.

Expanding into programmable irrigation automation will be investigated as AE Gainsford next step.

The MCGA have shared the concept and have identified that connectivity on farms in the region do not always support the technology available. Therefore, the next project will explore what other connectivity solutions are available to support this type of technology in other locations/farms.

Budget

7. Describe how the project's budget was spent in comparison with the application budget. Outline any changes and provide justification.

The budget was as per our application. For the identified scope of work the project closely met the estimated spend. There were some minor increases in costs seen due to some additional setup time spent given this is a bespoke system, (AE Gainsford provided funds). There were no changes to the scope of work made throughout the process.

MACQUARIE VALLEY "SMART FARM SHOWCASE" 21ST FEB 2019.

The field day was attended by 112 participants, 68% were current/potential growers or consultants. We got 52 evaluations completed and returned to us at the end of the day. The field day was hosted by the Macquarie Cotton Growers Association at "Karamea" the home of the Denston and Richardson Families.

Here is a summary of the evaluation sheets we received back from those who went along.

Q: Did the event meet your expectations

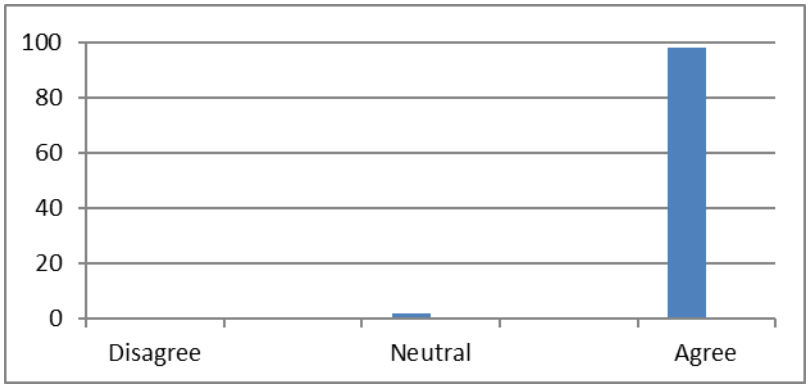


Fig 1. Q: Did the event meet your expectations (%)

Q: Was the event presented at the level you could understand.

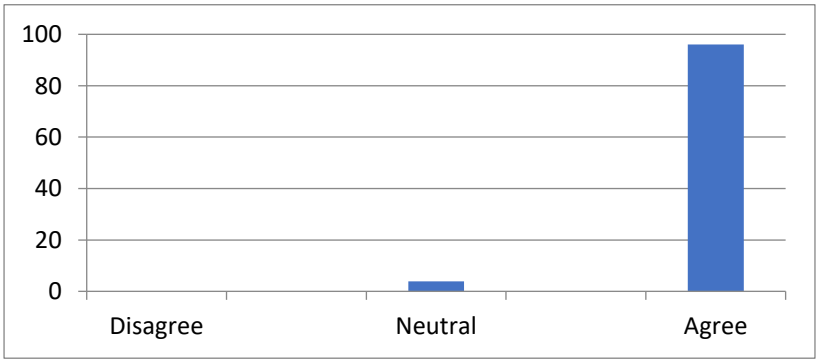


Fig 2: Q. Was the event presented at a level you could understand (%)

Q: How could we improve the event to be more useful for you?

Most participants left this blank, however, we did get a few answers.

“Very well done”

“Raining”

“The balance was great, loved the strong farmer-focused presenters”

“Louder Microphone”

“Really well done “

“Nothing”

“Explain more on local service/install options, local dealers/ other brands available”

“Excellent information could have had more smart farm devises in used in fields”

“More loudspeakers sometimes difficult in the field to hear presenters”

“Was looking for more technical info on the telemetry”

Q: With regard to smart farm technology please rate your level of understanding before and after the event.

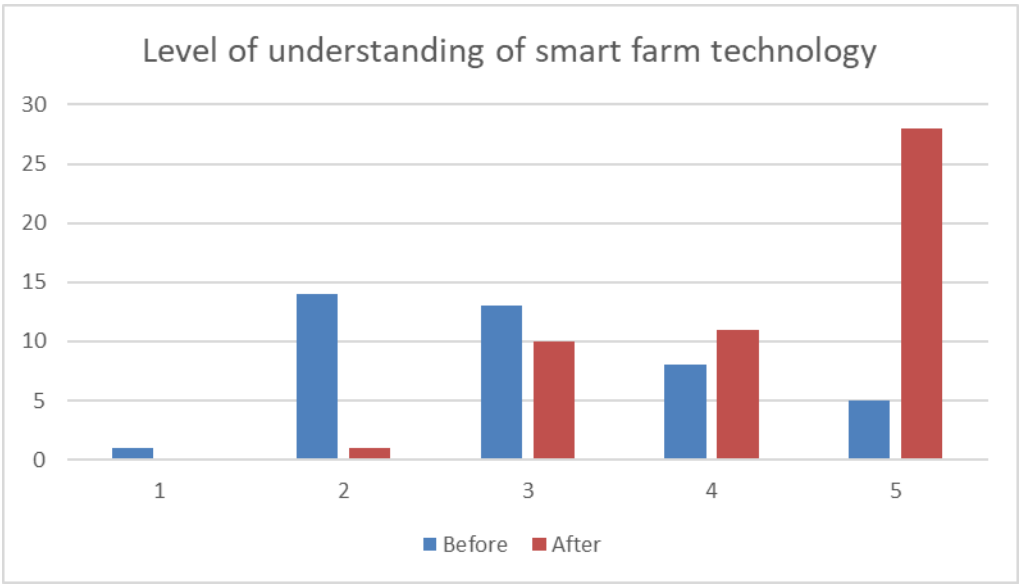


Fig 3: Level of understanding of smart farm technology before and after the event (participant numbers on x-axis).

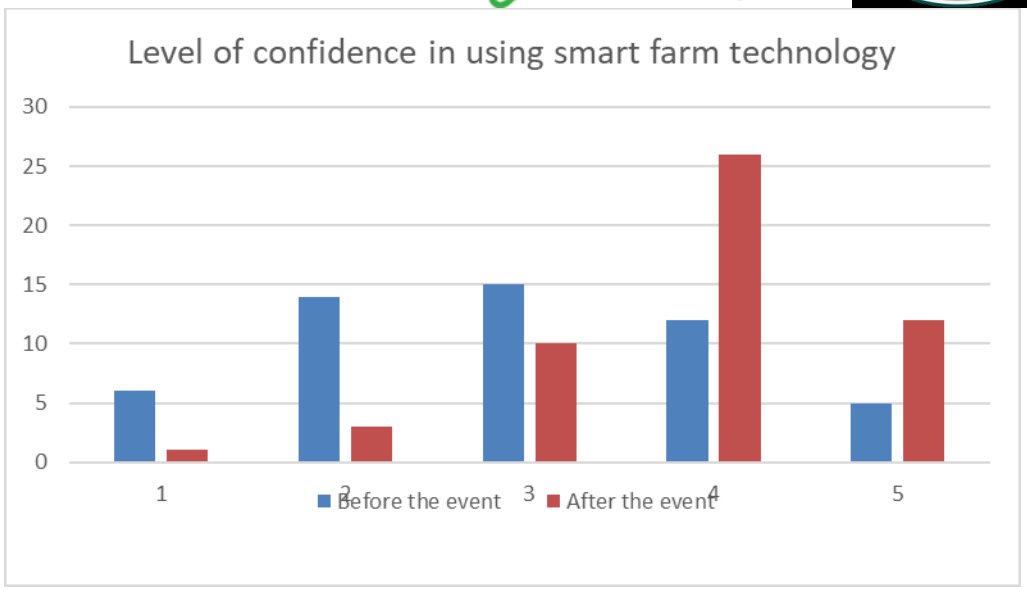


Fig 4. Level of confidence in using smart farm technology before and after the event (1 is basic and 5 is very good) Participant numbers on x-axis.

Q: As a result of this event are you more likely to adopt the smart farm technology on your farm or in your consultancy; or if you are currently using it, to use it more effectively?

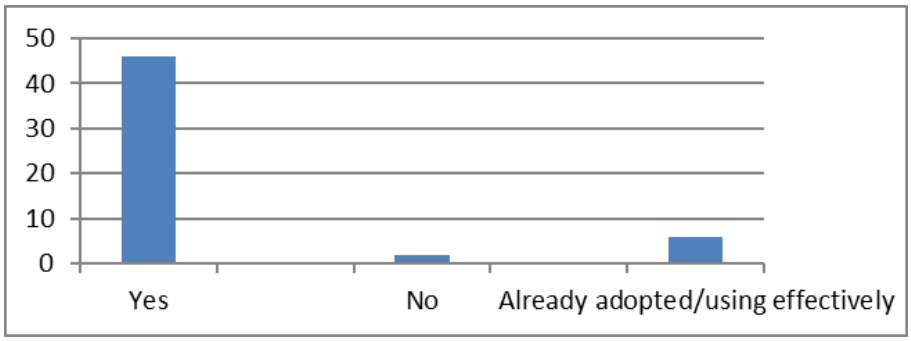


Fig 5: More likely to adopt smart farm technology as a result of the field day.

Q: If you do plan on making changes, in what time frame might that happen

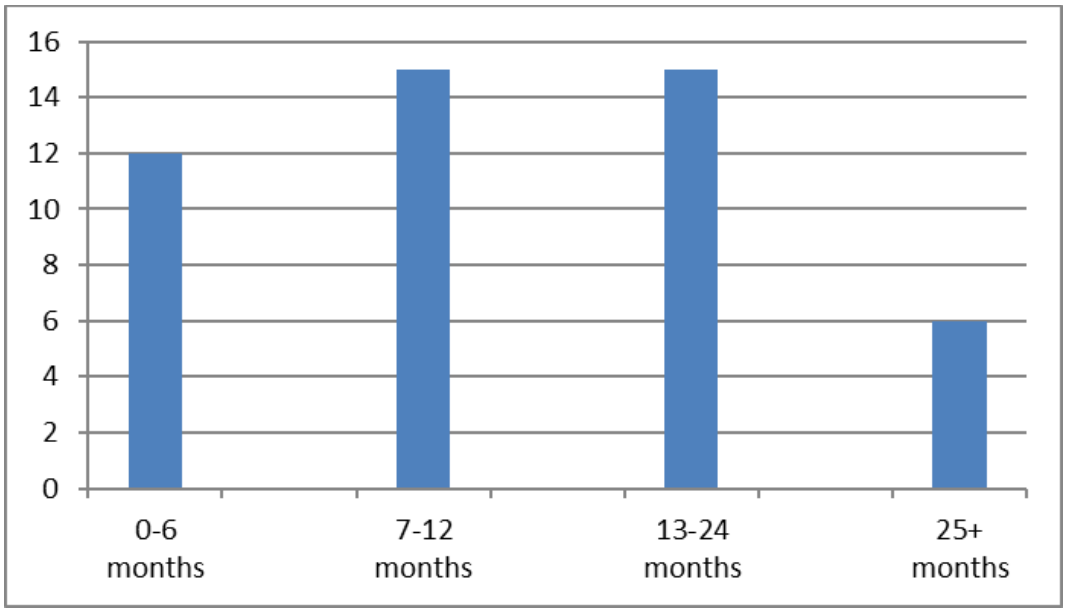


Fig 6: Timeframe on making changes (participant numbers on the x-axis).

Q: What would prevent you from using smart farm technology in your business; and or what else do you need to assist you in using it? The following responses were received

Cost (x10)	Nothing
$$$ and network establishment	No irrigation water (x6)
Reliability (x2)	Access to lending
Still developing tech	Interest rates
Upgradability	Maturity of technology
Network Coverage	

Fig 7: Comments from participants

Q: Did you find the firsthand grower experience a good way to present information?

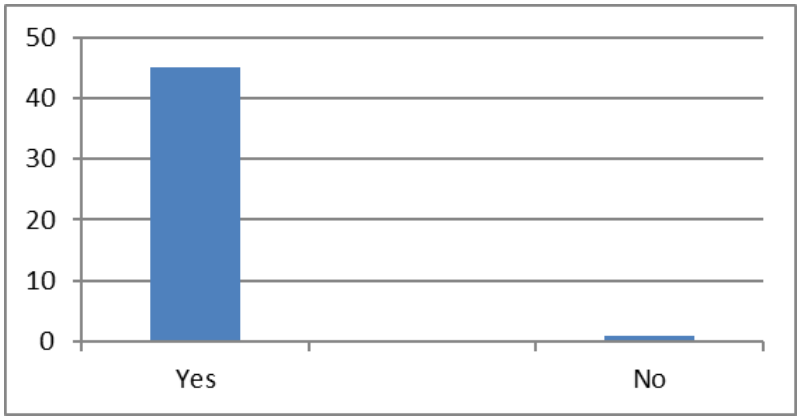


Fig 7: Participant responses.

Further comments :

“Excellent – real issues “	“Stew is very easy to listen to”
“Stew was terrific”	“Very good practical advice”
“Perfect”	“Great Presso’s”
“Excellent and practical”	“Good communicators”
“Loved it”	“The best way to showcase tech”

Fig 8: Comments from participants

Q: Would you be interested to hear more about Automation in the future?

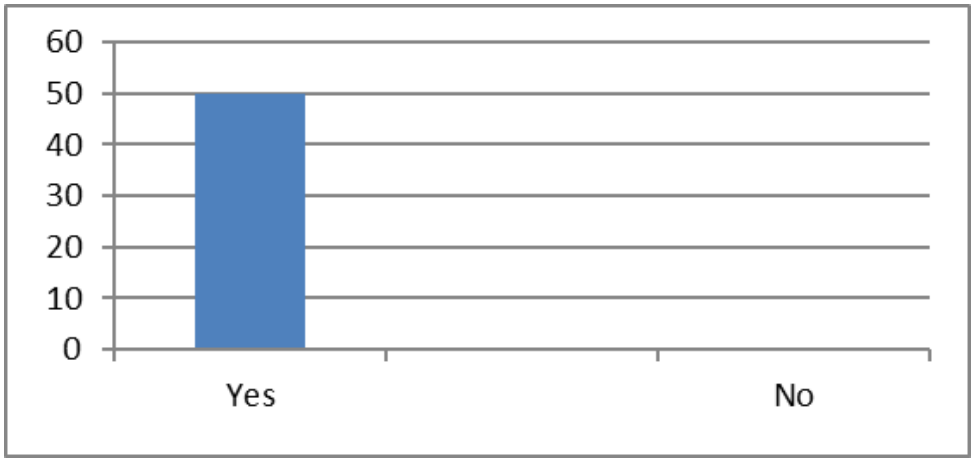


Fig 9 : 100% of Participants are keen to find out more on Automation

Q**: How did you hear about this event?**

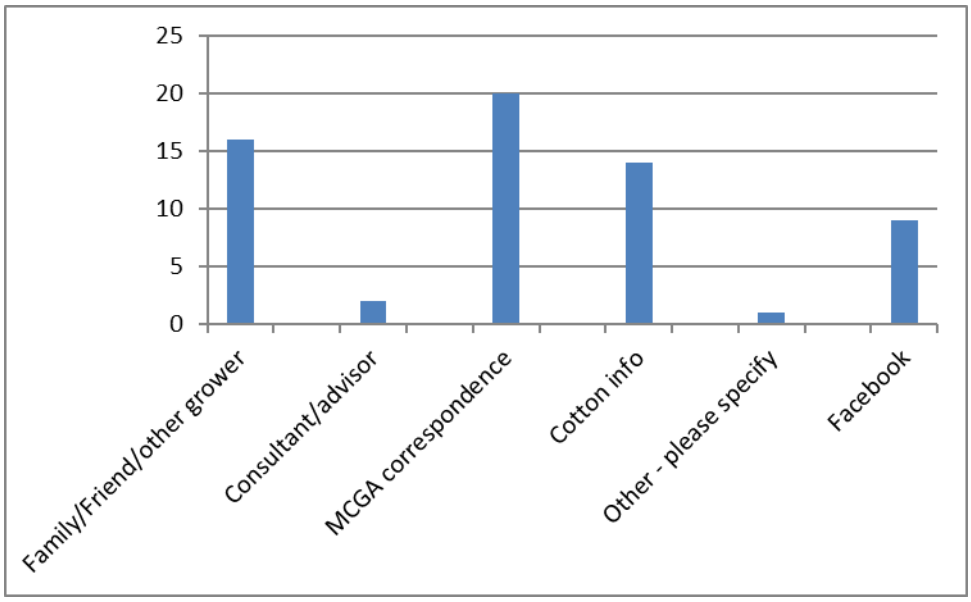


Figure 10. Event promotion.

Q: How do you classify yourself?

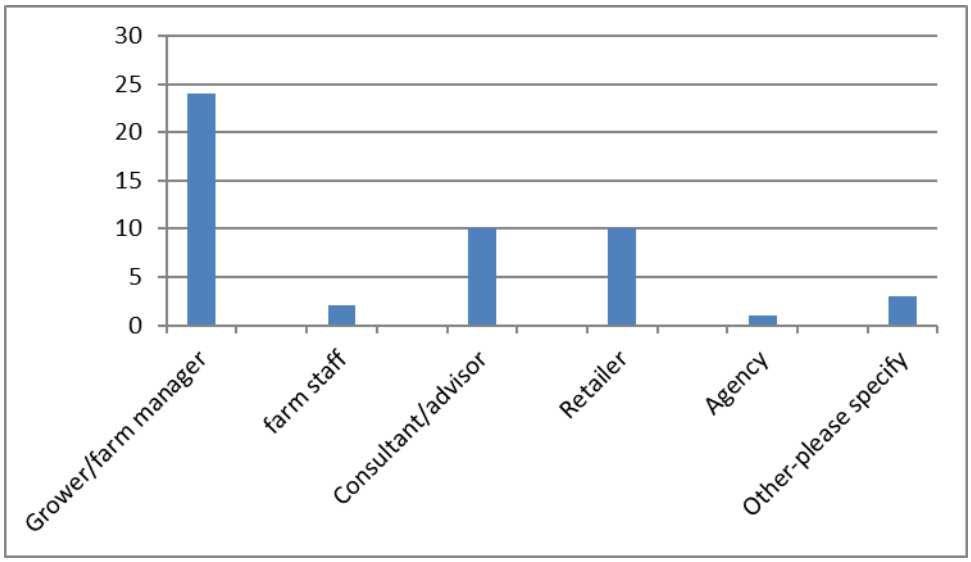


Fig 11. Participant classifications.

Q: Do you have any further feedback?

MCGA did a great job	Great timing for field day	Great day, thanks (x 5)
Good day	Need a bigger Microphone	Awesome day cheers
Well done, a new focus for field days, hit the nail on the head		
Great venue and lunch	More seats on the bus	

AE Gainsford - Bore Site Upgrade Breakdown

Water Meter		
Poly pipe 355mm per M	$1,512.00	
Flanges 355mm	$206.40	
gaskets	$48.00	
Backing rings	$117.00	
Weld labour	$897.60	
pulse switch (3 way switch)	$300.00	
Meter install labour	$897.60	
350mm water meter	$7,620.00	**$11,598.60**
Engine Monitoring/Control		
Kensho K27 and wiring loom	$2,220.00	
Fuel level transducer	$528.68	
Temp sensor	$313.95	
Engine control labour	$1,188.00	
Consumables	$360.00	**$4,610.63**
Drip Doser for oil lubricated shaft		
drip doser	$2,990.00	
Dripper labour	$660.00	
Consumables	$240.00	**$3,890.00**
		$20,099.23

Telemetry - Line of sight radio		
Bore Site		
Radio mait ic12R	$1,935.15	
Sensor input board	$553.61	
relay and bases	$335.16	
RS485 link for engine comms	$69.83	
Mait labour	$1,320.00	
Consumables	$360.00	
rs485 card for meter to mait	$480.00	
Consumables	$240.00	**$5,293.75**
Base (homestead)		
Mait. Prog, graph, Radio, SMS, high gain antenna	$4,606.19	
labour	$1,706.00	**$6,312.19**
		$11,605.94

2020 Grass Roots Grant Project

Digitally Enabled Cotton Farms

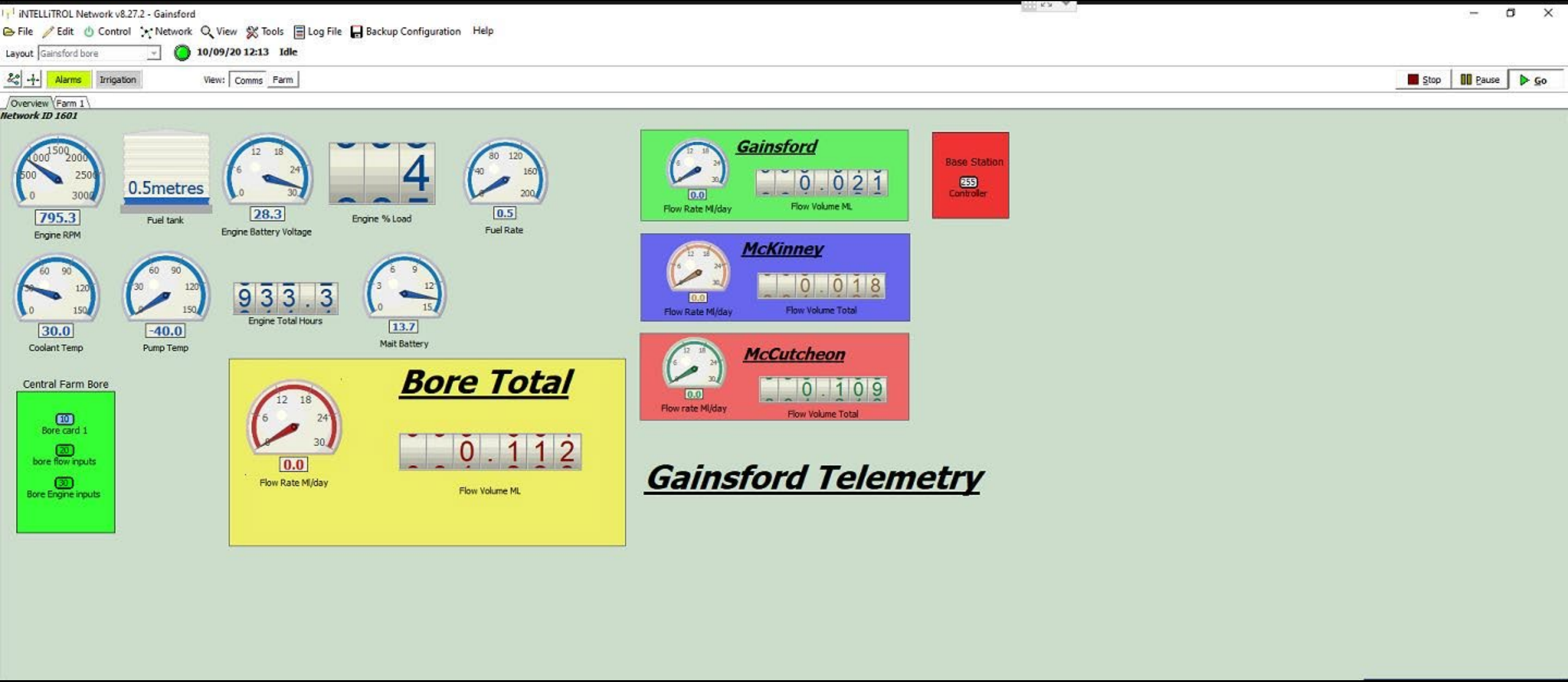
3 Phase project : Don’t rush in approach

- Survey our members to find out what issues they have with connectivity
- What do they think could solve these issues
- Who should we be lobbying to solve the problems
- Identify areas to research
- Find out who is already doing it and go and see them and find out the warts and all view
- Implement stragies that will lead to better connected farms

19 20 GRG Project – Pump Monitoring

Inside view


WARNING: DISCONNECT POWER PRIOR TO ENGINE MAINTENANCE
WARNING: DISCONNECT POWER PRIOR TO ENGINE MAINTENANCE
POWER ON
OFF
RP
MENU
UP
DOWN
ENTER
0 RPM
22.7 VDC
MOD CAN
933.3 HRS
0 PSI
16 °C
Load 0%
Rate 0 L/Hr
Status: Ready-Manual
START
AUTO
STOP
SOOT
Telemetry READY
K27
CB15
CB3
EMERGENCY


iNTELLiTROL Network v8.27.2 - Gainsford
File
Edit
Control
Network
View
Tools
Log File
Backup Configuration
Help
Layout
Gainsford bore
10/09/20 12:13
Idle
Alarms
Irrigation
View:
Comms
Farm
Stop
Pause
Go
Overview
Farm 1
Network ID 1601
795.3
Engine RPM
0.5metres
Fuel tank
28.3
Engine Battery Voltage
4
Engine % Load
0.5
Fuel Rate
30.0
Coolant Temp
-40.0
Pump Temp
933.3
Engine Total Hours
13.7
Mait Battery
Central Farm Bore
10
Bore card 1
20
bore flow inputs
30
Bore Engine inputs
Bore Total
0.0
Flow Rate Ml/day
0.112
Flow Volume ML
Gainsford
0.0
Flow Rate Ml/day
0.021
Flow Volume ML
McKinney
0.0
Flow Rate Ml/day
0.018
Flow Volume Total
McCutcheon
0.0
Flow rate Ml/day
0.109
Flow Volume Total
Base Station
255
Controller
Gainsford Telemetry


AQUAMONIX
Measure. Monitor. Master.
FLOW RATE
+0.00000
VEL
+0.00000
EMFLUX
i500
46826
Electronics
Φ 1 2 3
OFF
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Industries
A Better Crop Per Drop
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