CottonInfo

Australian Government
Cotton Research and Development Corporation

2018

Optimising irrigation & nitrogen research tour

2018 optimising irrigation & nitrogen research tour

INTRODUCTION:

CottonInfo's annual researchers tour in 2018 will focus on optimising irrigation and nitrogen.

CottonInfo, with support from the Cotton Research and Development Corporation (CRDC) will host irrigation and nitrogen researchers on-farm across six valleys in February 2018 to discuss the impact of irrigation management on N efficiency in the crop.

The tour will cover four key things:

- **Benchmarking to quantify irrigation losses on-farm**: featuring Ali Chaffey, CottonInfo/NSW DPI.
- **Where do N losses occur and what can be done?** featuring John Smith, CottonInfo/ NSW DPI; Ben Macdonald, CSIRO; Graeme Schwenke, NSW DPI; and Peter Grace, QUT.
- **How does irrigation management influence losses in crop N uptake?** featuring Jon Baird, NSW DPI; Wendy Quayle, Deakin University; Dio Antille, NCEA-USQ; and James Latimer, ANU/ CSIRO.
- **How to maximise irrigation system performance?** featuring Joseph Foley, NCEA-USQ; and Gwydir Valley Irrigators' Association (GVIA).

The CottonInfo regional extension officers (REOs) will also provide the initial findings from this season's in-field experiments, which are investigating the potential for N-loss during the first two irrigation events after its application.

FOR MORE INFORMATION:

Contact CottonInfo's technical leads for irrigation, Ali Chaffey (0439 326 601, ali.chaffey@dpi.nsw.gov.au) and nutrition and water, John Smith (0427 060 597, john.smith@dpi.nsw.gov.au).

The cotton industry has many resources to assist with irrigation and nitrogen. To access these, please visit www.cottoninfo.com.au or www.mybmp.com.au.

TOUR DATES:

DARLINGTON POINT - TUES 6 FEB
Point Farms, Darlington Point
8am-11:30am

WARREN - WED 7 FEB
'Strathern,' Warren
8am-11:30am

MOREE - THURS 8 FEB
Part of the Gwydir Valley Irrigators Association (GVIA) irrigation field day.
'Keytah', Moree
8am-2pm

WEE WAA - FRI 9 FEB
'Waverley' Wee Waa
9am-12:30pm

BOGGABILLA - TUES 13 FEB
'Mundine' Boggabilla
8am-11:30am (QLD time)

BROOKSTEAD - WED 14 FEB
'Melrose' Brookstead
8am-11:30am

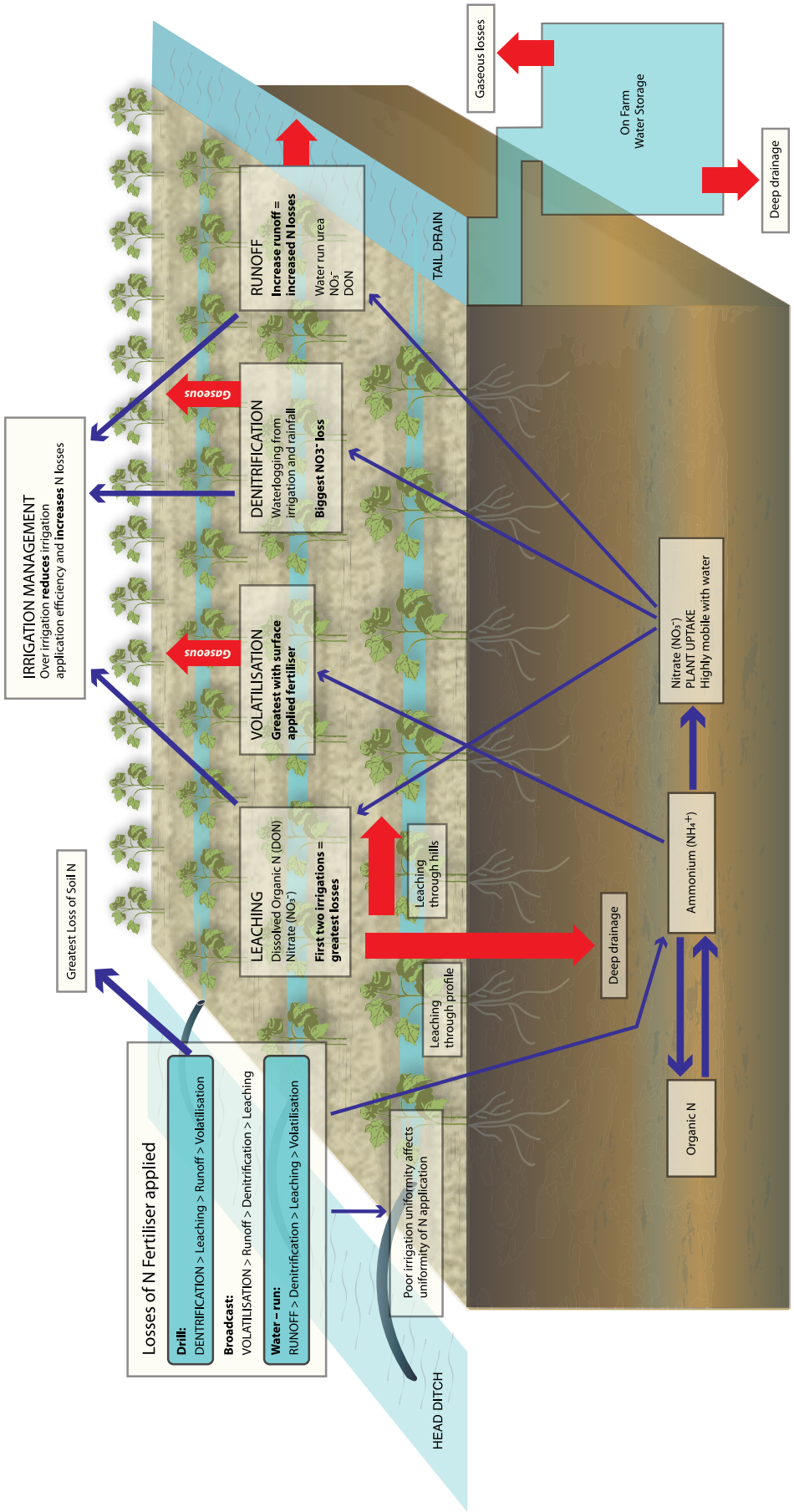
Australian Government
Department of Agriculture and Water Resources

The 2018 research tour is delivered by the industry's extension program, CottonInfo, with support from CottonInfo partner CRDC, researchers and their research organisations. The tour is also supported by funding from the Department of Agriculture and Water Resources through the Rural R&D for Profit program.

The research presented on the tour has been funded by CRDC in partnership with research organisations NSW DPI, CSIRO, QUT, ANU Deakin University, NCEA-USQ & GVIA. It has also been funded through the Rural R&D for Profit program projects *Smarter Irrigation for Profit*, and *More Profit from Nitrogen*.

Best Practice

The irrigation & nitrogen cycle



Benchmarking to quantify irrigation losses on-farm

Ali Chaffey, CottonInfo/NSW DPI

What is the research?
The Australian cotton industry is the most water efficient of the major cotton producing countries, and uses water productivity benchmarks to monitor performance over time.

With support from CRDC, NSW Department of Primary Industries (NSW DPI) has undertaken industry-wide benchmarking surveys across previous seasons (2006-07, 2008-09 and 2012-13). Another round of water productivity benchmarking is scheduled for this 2017-18 season.

Why do I need to be aware of this research?
Water productivity relates the amount of water used to the amount of cotton produced , in a bales per megalitre approach. Benchmarking water productivity involves calculating water use indices from farm data, and evaluating these relevant to established performance indicators.

Benchmarking surveys provide a snapshot of current water productivity performance for fields and farms at a point in time; for comparison across seasons and against regional and industry averages. More broadly, cotton-growing valley and industry scale data can be used to identify trends and drivers of top water productivity outcomes.

Benchmarking is also used to quantify on-farm water losses, including via evaporation and seepage from storages, channels and drains. This information can be useful in highlighting where water productivity improvements can be made across irrigation systems and operations. This can also be useful in better understanding pathways for N loss within the system.

How will it benefit my operation?
Irrigation management and nitrogen use efficiency are intrinsically linked, with water losses in irrigated systems representing a key potential pathway for N losses at the field level. This is shown in the irrigation and nitrogen cycle schematic on the previous page.

Plant uptake of N available from both the soil and from fertiliser is critical to maximising cotton yield, and effective irrigation management is an important influence on the rate and amount of loss of both of these sources of nutrition available to the crop. As such, improved understanding of where water losses are occurring is essential to informing management decisions to optimise productivity from both water and N used on-farm.

What are the current barriers to adoption?
- **Accurate measurement of water use**: knowing what and how to measure
- **Time**: to collect and consolidate information.

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NSW GOVERNMENT Department of Primary Industries

Where do N losses occur, and what can be done?

John Smith, CottonInfo/NSW DPI

What is the research?
Irrigation management and nitrogen (N) use efficiency are intrinsically linked within an irrigated cotton system. Cotton gets the majority of its N from soil N, however, the application of fertiliser N is critical to maximising lint yield.

Significant losses of both soil and fertiliser N through denitrification (waterlogging), surface run-off and deep drainage can result because of how irrigation is managed. Matching irrigation deficit to soil influences how much N is taken up by the plant which can also influence lint yield.

Not all irrigation systems are suitable for all soil types or field topography and must be considered in the layout of new fields or the redevelopment of old layouts. Overhead systems generally suit soils with higher infiltration rates. It can be too flat for bankless channel systems which rely on a step between bays to get drainage water away from the upstream bays while still allowing filling of the downstream bays.

Why do I need to be aware of this research?
The development of irrigation systems is a significant capital investment while irrigation water and fertiliser are significant annual investments in an irrigated cotton system.

Characteristics of each irrigation system mean they are better matched to certain soil types and field conditions. The suitability of irrigation systems to soil type and conditions impacts on irrigation management which influences the return from your fertiliser investment each year.

How will it benefit my operation?
Nitrogen is a key driver of lint yield within the irrigated cotton system but its influence is complex.

Improving the returns from the key investments of nitrogen and water is reliant on understanding the interactions between irrigation systems, soil type and irrigation management on key loss pathways and crop uptake of nitrogen.

What are the current barriers to adoption?
- **Complexity:** of the relationship between irrigation systems, water and nitrogen.
- **Time:** improving management around these factors requires time to understand field level constraints.
- **Technology:** improving management is likely to require the ability to apply water and nitrogen at less than a field scale level.

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Definitions of commonly used words:
- **Denitrification:** The loss of N through the conversion of nitrate to gaseous forms of N, such as nitrous oxide and di-nitrogen
- **Labile:** Easily broken down
- **Mineralisation:** Decomposition by microbes of organic N from organic matter and crop residues to ammonium.
- **Nitrification:** The process by which microbes convert ammonium to nitrate
- **Volatilisation:** The loss of N from the conversion of ammonium to ammonia gas released to the atmosphere.

Where do N losses occur, and what can be done?

Dr Ben Macdonald, CSIRO

What is the research?

- Nitrogen (N) fertiliser losses from irrigated cotton production systems can occur due to water movement via deep drainage and surface run-off.
- Nitrogen can be lost as organic N, urea, nitrate/nitrite and ammonia. N fertiliser can also be transformed into different gases, ammonia, nitrous oxides and nitrogen, and lost directly from the soil and water surfaces. All of these losses lower on farm nitrogen use efficiency and yield.
- The soil N pool is a large store of N and important plant nutrition source.

Why do I need to be aware of this research?

- Excessive fertilisation increases the potential organic and inorganic N losses.
- The bulk of the water and atmospheric N losses occurred early in the irrigation season when the cotton plant was small. At this stage there is a large pool of organic and inorganic N in the soil which can be actively transported by water or transformed into N and nitrous oxide gases. Later in the season the labile organic and inorganic N pool has been taken up by the plant which reduces the N losses.
- Early in the season dissolved organic N and urea as well as nitrate are important components of the total N flux.
- N is leached out of the hill early in the season and thus water management during this time is critical.
- Deep drainage losses in the order of 10-20 kg N ha-1 yr-1 are small but the cumulative amount over a longer time frame is of significance.
- N present in the storages will be transformed from urea and nitrate to organic nitrogen and some will be potentially lost as nitrous oxide and nitrogen gas. Nitrous oxide is a powerful greenhouse gas and contributes to global warming. Many consumers purchase goods based on a preference for low emission production and therefore it is important to reduce the emission footprint of the industry.
- Nitrate test strips can be used to measure nitrate concentration in the tail water to help determine the success of fertiliser and water management strategies.
- Of the applied fertiliser on average 30-40 per cent is taken up by the plant, 30-40 per cent remains in the soil N pool, 20-40 per cent is lost from the field. This means that the cotton plant sources 60-70 per cent of its required N from the soil. Work by the late Ian Rochester clearly shows that incorporating legumes and cover crops into the cotton rotation increases yield but also soil carbon and N.

How will it benefit my operation?

- Improving N use efficiency thorough improved water and fertiliser management will reduce costs.
- When considering using water run urea beware that in warm weather N gas emissions could be large.
- Managing nitrogen use efficiency is not about fertiliser nitrogen but really the management of the soil carbon and nitrogen pools to improve fertiliser N use efficiency (FNUE).
- Reducing nitrous oxide emissions could earn carbon credits and provide a new income stream through participation in the Emissions Reduction Fund.
- The cotton industry has a Carbon Credits Methodology Determination 2015 which can be used to develop practices to achieve nitrous oxide emission reductions. This method is called the *Emissions Reduction Fund — Reducing Greenhouse Gas Emissions from Fertiliser in Irrigated Cotton*.

What are the current barriers to adoption?

- **Price.** The relatively affordable price of nitrogenous fertiliser does not create sufficient disincentives to over apply product.
- **Time and capital.** It takes time and capital to change rotations and for the soil system to respond.

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What can growers do to improve fertiliser NUE?

Dr Graeme Schwenke, NSW DPI & Dr Peter Grace, QUT

What is the research?

Reducing the losses of N from applied fertiliser is key to improving NUE. The major pathway of N loss from applied N fertiliser is via denitrification of nitrate in irrigated cotton. Losses may be up to half of the N applied. Denitrification occurs where there is (1) lots of soil nitrate, (2) a source of labile carbon, eg. crop residues, (3) and a lack of aeration.

Losses may exceed over half of the N applied as evidenced by a range of treatments examined on four typical farms over two seasons (Figure 1). Interestingly in all cases, there was no significant difference in lint yield between the three treatments and plots that had received zero nitrogen. Abundant nitrogen was already available and deep soil testing would have signalled the fact that minimal N was required.

lead to over-application of N fertiliser that will not be used by the crop and will be at risk of significant losses (as shown in Figure 1).

Nitrate produced from pre-season fertiliser application can be mobile in the soil, moving with irrigation water and/or heavy rainfall. During irrigations, particularly the first irrigation after N fertiliser application (often pre-sowing), nitrate may move through the plant bed and into the "skip" furrow where some may be lost as runoff from the paddock.

Nitrification Inhibitors (NI) applied with, or as a coating on, the N fertiliser keeps it in the ammonium form by preventing the formation of nitrate in the soil. Ammonium is not lost under anaerobic conditions

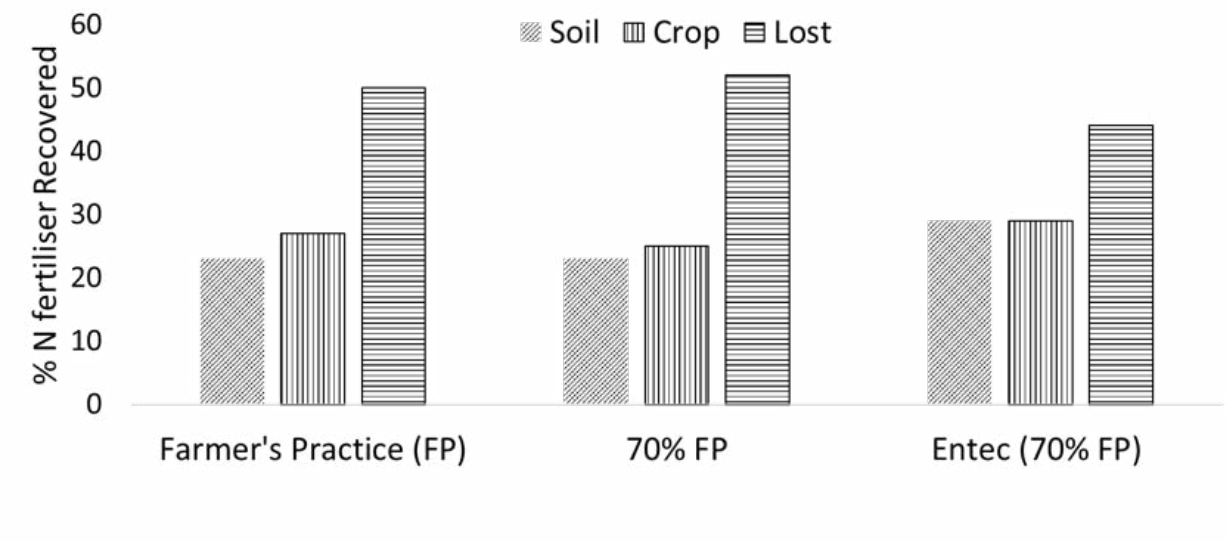

Figure 1. Fate of urea nitrogen applied at sowing to cotton on the Darling Downs in 2015-16 and 2016-17 (Average of eight farms in total).

Why do I need to be aware of this research?

High-yielding irrigated cotton uses N both from the soil and from fertiliser. Soil mineral N is mineralised from soil organic matter (humus, microbes and crop residues) to ammonium then nitrate. Soils higher in organic matter will mineralise more mineral N than those with low organic matter.

Not accounting for what is already in the soil and what will be generated by the soil during the season can

(waterlogging), and, once the crop is established, the ammonium can be taken up directly by the plant. The improvement of fertiliser N use efficiency (NUE) when using NI relies on a reduced N fertiliser rate, with reduced N loss still giving the maximum yield.

Polymer-coated urea releases the encapsulated urea into the soil over several months, thus slowing the accumulation of nitrate in the soil and reducing losses through denitrification. Getting a product with a release pattern that matches the establishing crop's N demand is important for this to be of benefit.

There are a range of in-season N fertiliser application methods and products used, and therefore different N loss processes may be involved, depending on which combination of methods/products are used.

- Side-dressed urea, anhydrous ammonia or other N products will have similar potential loss pathways to that applied pre-season, i.e. denitrification under waterlogging, and runoff loss of mobilised nitrate during irrigation
- Broadcasting urea ahead of an irrigation or forecast rainfall event brings another potential N loss mechanism into play: ammonia volatilisation. Urea must be converted to ammonia before volatilisation loss will occur—a process that may take 1-2 days. Applying water soon after broadcasting dissolves the urea and moves it into the soil where the ammonia /ammonium that develops from the urea is held against loss on soil particles.
- Water-running urea in irrigation water should prevent ammonia volatilisation losses as the urea moves into the soil and the ammonia /ammonium that develops is held on the soil particles. However, up to 36% of the N applied in this way may be lost from the paddock in runoff.

How will it benefit my operation?

Understanding the potential loss pathways and how fertiliser management influences the risks associated with each one enables potential reduction of the loss of fertiliser N by minimising:

- Denitrification before the cropping season.
- Runoff and leaching before the cropping season
- Losses from in-crop fertiliser
- Unused N remaining the soil post-crop

What are the current barriers to adoption?

- Fertiliser application is often done at the same time as other field operations and there is limited information that compares the opportunity cost of applying fertiliser when there is greater risk of loss compared to applying to reduce the risk of loss but requiring additional field operations.
- The premium of Nitrification Inhibitors and Polymer Coated products relative to standard N fertilisers.

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QUT

How does irrigation management influence crop N losses?

Jon Baird, NSW DPI; Dr Dio Antille, NCEA; Dr Wendy Quayle, Deakin University

What is the research?

The research included a number of on farm experiments situated throughout the cotton growing regions of Australia. The experiments are based on commercial cotton farming systems, evaluating various management strategies to optimise plant nutrition and water uptake, identify major loss pathways and soil nitrogen supply from soil organic matter, with the goal to achieve better farming sustainability while improving productivity.

The research is more accurately defining the interaction of nitrogen and water use by cotton plants. Multiple management strategies are established to evaluate the impact nitrogen and water have on growth responses at critical growth stages to assist growth regulation, control maturity and yield and lint quality benefits.

Why do I need to be aware of this research?

The research provides data that will assist in running automated and surface irrigation systems as efficiently as possible for labour, water and nitrogen according to weather conditions, plant development and soil type. This research also aims to inform on soil/fertiliser nitrogen supply rates over the growing season to assist nitrogen decisions.

Key findings will illustrate quantified impacts management options have on productivity and gross margins within various farming systems. Optimising the inputs into the farming system will lead to greater nitrogen use efficiency and water use efficiency, and ensure high sustainable productivity. A number of trials have found that reducing certain inputs will actually improve the final yield, so not only are growers saving money on lower input costs but they are achieving greater gross margins due to the higher productivity.

It is providing case studies of offsets between yield maximum compared with profit maximum in some of the challenging shorter growing season conditions that southern growers sometimes have to deal with.

How will it benefit my operation?

Quantified recommendations will be developed on the best way to drive management systems according to growing season conditions, crop development and the cost of water and fertilizer so that risk is reduced and profit maximised. Trial results over the last three seasons validate the optimal nitrogen rate can improve gross margins by $500/ha (equivalent to 1 bale /ha). While growers who are focused on water efficiency could improve returns by over 10 per cent on a dollar per megalitre ratio.

Depending on different soil types accurate application of water according to the weather and your crop should improve water use and nitrogen use efficiency so that you may potentially use the savings to increase your productive area, or elsewhere.

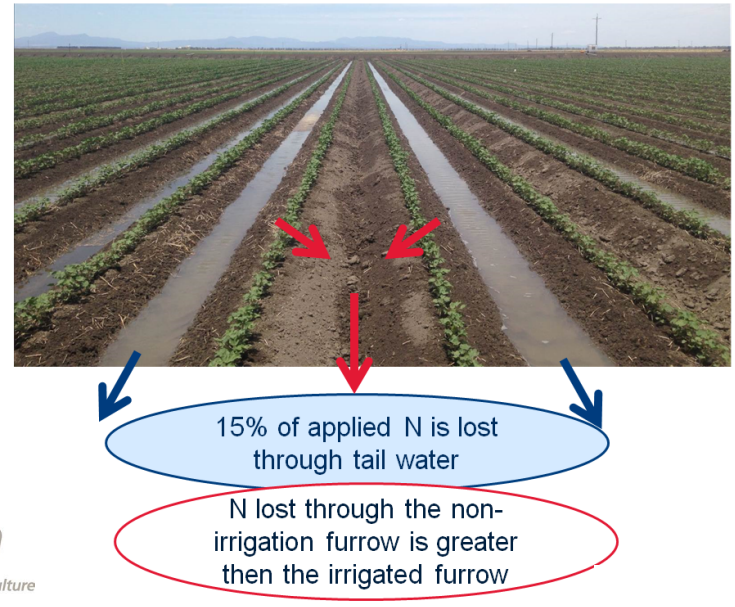

Figure 1. Nitrogen loss out the tail water during an irrigation event.

What are the current barriers to adoption/ commercialisation?
Ability to logistically run irrigation systems within the specifications or recommendations determined. For example, in some cases, short deficits with watering approximately every 7 days may be optimal but the farm irrigation system and layout cannot accommodate this level of intensity.

Background farm investigations are important to evaluate the optimal management system for your farm. It is imperative to investigate the mineral nitrogen available from your soils and understand the loss pathways attributed with an irrigation system. The socio-economic response of farmers to over supply inputs to their farming system as an "insurance" for crop production, rather than improving farming efficiencies to increase crop gross margins.

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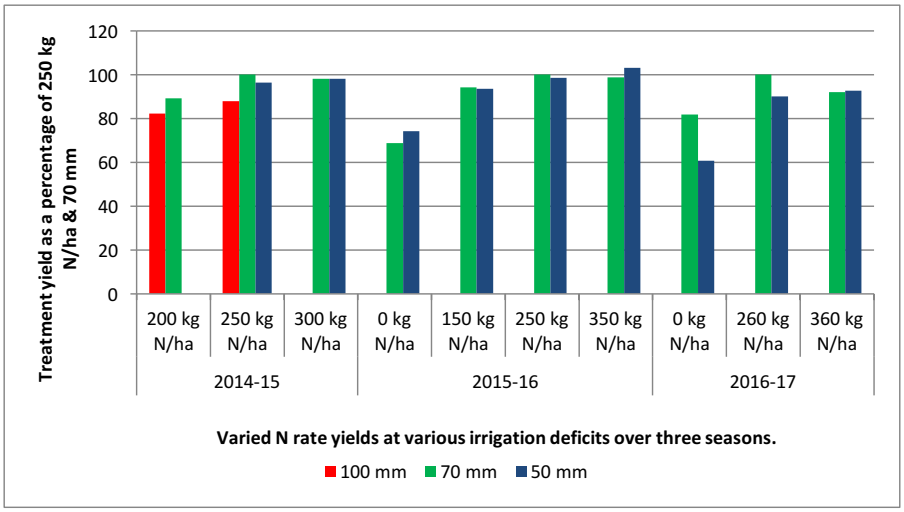

Chart 1. Varied nitrogen and irrigation rate trial yields, Northern NSW.

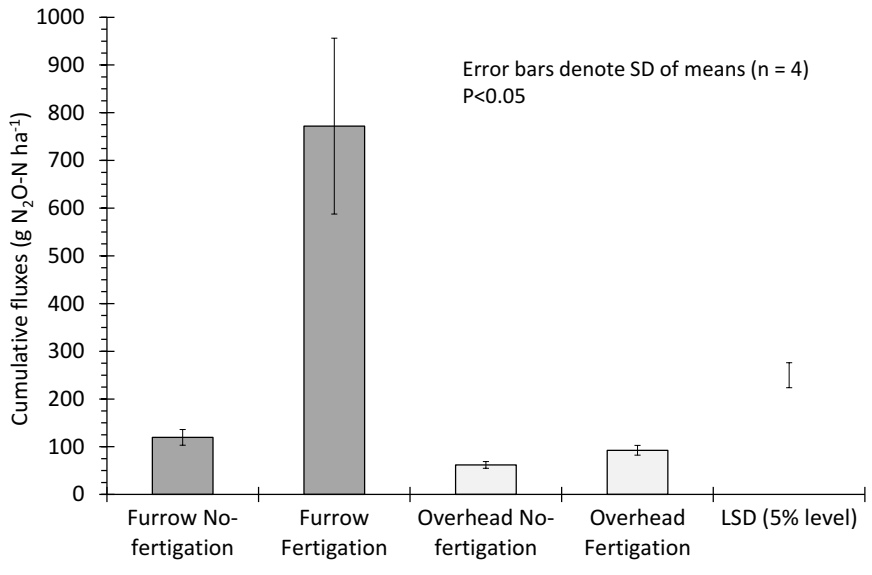

Chart 2. Short-term (30-day cumulative) nitrous oxide (N2O) emissions recorded in fertigated & non-fertigated cotton under furrow and overhead irrigation (season: 2014-2015).

Pitfalls in Water-Running Urea

James Latimer, ANU/CSIRO

What is the research?
Water-running urea is a popular method of nitrogen addition, with 46 per cent of Australian irrigated cotton growers opting to use this method in the 2016-17 growing season.

Commonly this involves mixing a few tonnes of granular urea in a 20kL rainwater tank, and then slowly releasing the concentrated mixture into the main water supply channel over the course of the irrigation.

This method of nitrogen addition can be cost and labour efficient, however, it can create inconsistent applications if not managed effectively. This research aims to identify pitfalls in water-running urea to inform improved management.

Why do I need to be aware of this research?
Water-run urea application can be cheap and requires minimal labour, however, if not managed carefully it can deliver inconsistent results in N distribution in the field.

Figure 1 (below) shows the nitrogen delivery from a single urea tank to five bays in a bankless channel layout.

In this example, the amount of nitrogen delivered to each of the fives bays varies dramatically, with Bay 1 receiving 1023 kg Urea, and Bay 5 receiving just 130 kg, a difference of almost eight times. Compounded over a whole season this could have serious effects on crop yield.

How will it benefit my operation?
In order to make the most of water-running urea, three aspects of your urea tank need to be well managed; tank concentration, outflow rate and discharge duration.

In addition to managing the outflow of your urea tank, it is also important to manage the flows in your irrigation channel network. If there are competing flow directions in the supply channels then the dissolved urea might not distribute evenly. This could leave some sections of crop receiving more nitrogen than you thought, while others can receive none.

Figure 2 (overleaf) hows the nitrogen concentration in a standard irrigation supply channel network. In this example, because of competing flow directions in the supply channel, urea is not being evenly mixed through the supply water.

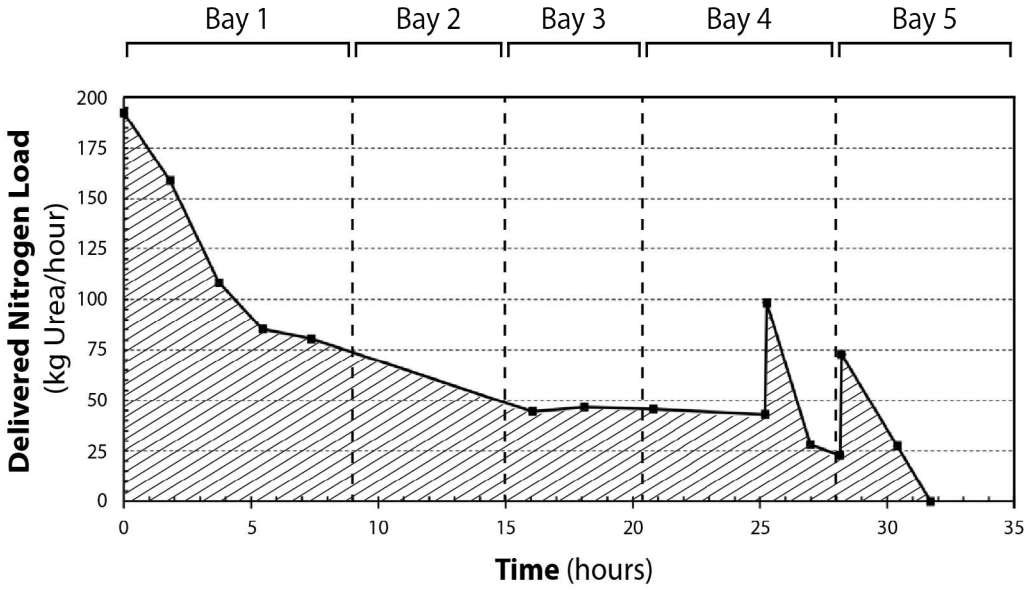

Figure 1. Nitrogen delivery from a single urea tank to five bays in series in a bankless channel layout.

When water-running urea, understanding the movement of N from the input source, through the channel network, into the field and through the tail water, allows growers to identify areas of loss or inefficiencies, and make improvements for optimised application.

What are the current barriers to adoption?
Barriers to adoption can include: unease at not being able to physically see the N go out onto the field; limitations on how much nitrogen you can apply at once due to urea solubility restrictions; missing N top ups if it rains and irrigations get pushed back; inconsistent results.

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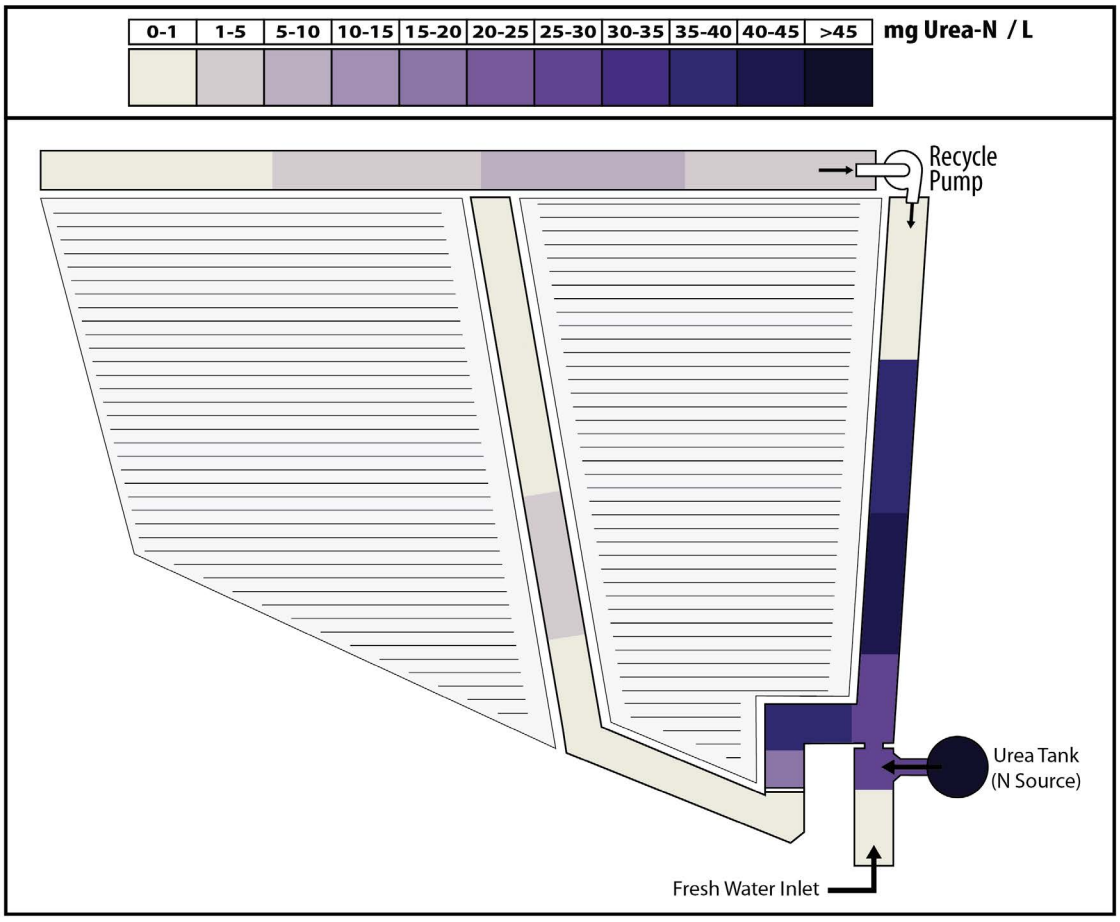
Figure 2. Urea (nitrogen) concentration in an irrigation supply channel network during a water-run urea irrigation event. .



Knowledge of furrow irrigation infiltration characteristic is key

Dr Joseph Foley, NCEA-USQ

What is the research?
Knowledge of furrow irrigation infiltration characteristic is key to understanding fertiliser movement with water. All growers want the fertiliser to be applied uniformly across the field and be available within the crop root zone. Growers must realise that when applying water-run fertiliser that the amount and uniformity is directly linked to the hydraulic performance of the surface irrigation system. Providing the fertiliser is well mixed it will travel wherever the applied water goes.

Why do I need to be aware of this research?
It is important for growers to understand the infiltration characteristic of their soil to determine whether furrow irrigation water ends up in the root zone (desirable), in runoff (recycled w/ small loss), or as drainage below the root zone (unwanted).

Figure 1 shows two example infiltration characteristics, one with a high final infiltration rate (lighter soil) and one with a low final infiltration rate (i.e. heavy clay soils in the mid and later parts of the season). Both soils have the same completion time on a typical cotton field but have significantly different outcomes in terms of water and fertiliser distribution (figures 2 and 3).

The high infiltration soil has poor uniformity and high drainage losses. The low infiltration soil has better uniformity and greater potential for loss of water-run fertiliser in the tail water.

How will it benefit my operation?
Growers and consultants have an inherent understanding of infiltration processes, that reduce soil waterlogging (yellow colouring of plants), or under-irrigation (early wilting of cotton) across parts of the field from their experiences. These irrigation effects are often apparent in yield maps.

Today, it is common practice for growers to furrow irrigate fields with higher flowrates so that the slowest couple of furrows are completed in 6 to 8 hours or less, regardless of the soil infiltration characteristic, with the aim of reducing any chance of waterlogging. These high flowrates and shorter times may result in an inability to fully replenish soil moisture deficits, which can be addressed by more frequent irrigations. Growers must also consider the impact of such management on the volume and distribution of the water-run fertiliser.

If fertiliser is mixed just upstream of the set of siphons that are running, it should be possible to optimise dosing timing to ensure fertiliser is placed in the root zone and losses are minimised.

Figure 1.

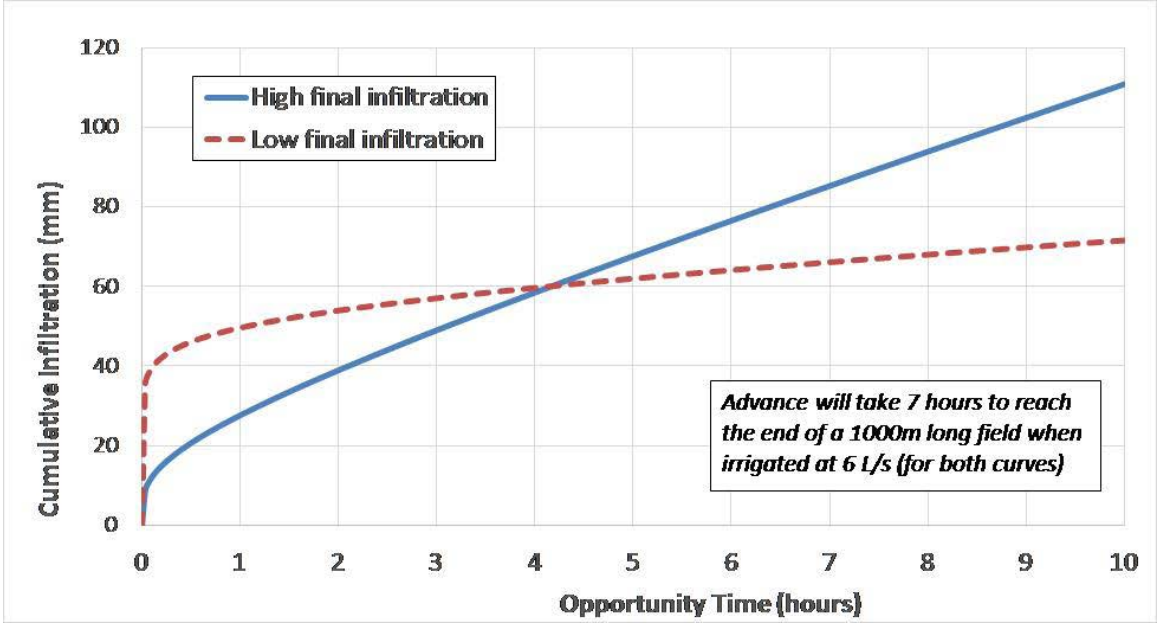


Figure 2..

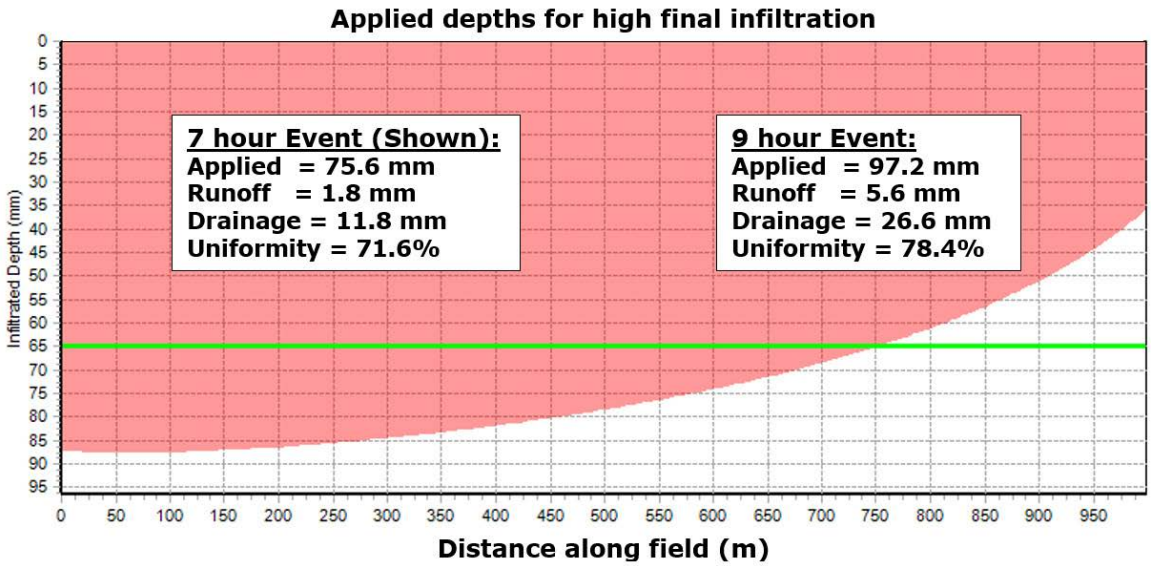
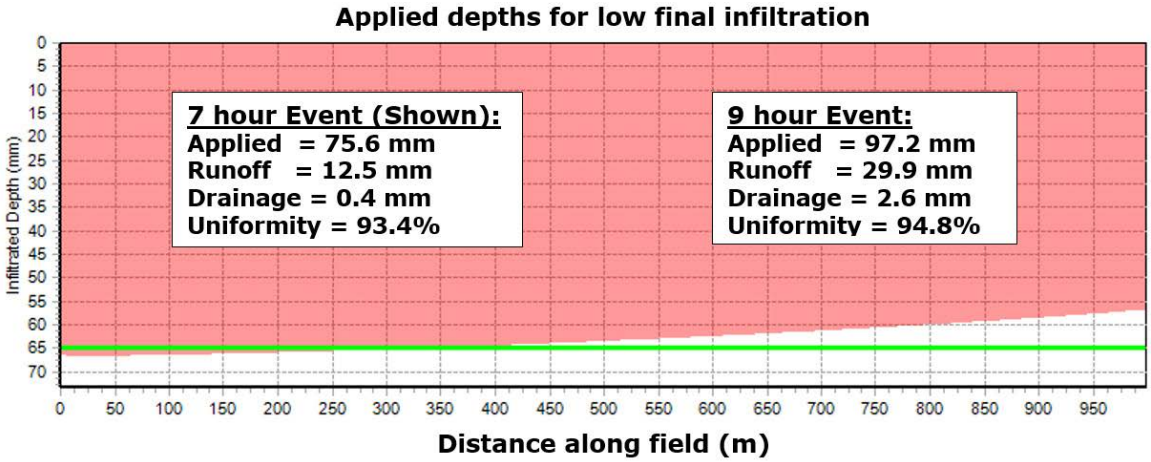


Figure 3.



Practical tips:

- The first irrigation set may not receive the desired quantity of fertiliser as the head ditch is already full of water before the irrigation starts.
- Water remaining in the head ditch and supply channels at the end of the irrigation will contain fertiliser which will be lost.
- Growers wishing to run long irrigation times should consider switching off the fertiliser early to minimise fertiliser losses.

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Irrigation System Design, Performance and Automation

Louise Gall, Gwydir Valley Irrigators Association

What is the research?
Previous GVIA grower-led irrigation research into siphon, subsurface drip, lateral move and bankless channel systems has found that there are minimal differences in water use efficiency over time, as each season is different and the advantages of each of the systems varies with the season.

It is anticipated that the two flood irrigations systems - siphon and bankless channels - will remain important. The question is: how does the industry enhance these two systems from labour resourcing and water use efficiency perspectives?

This project - the Smarter Irrigation Grower-led Cotton Automation Integration Trial - is evaluating the suitability of flood irrigation automation concepts in a largescale grower-led trial at Keytah in the Gwydir Valley. The flood irrigation automation comparison is being run in conjunction with the lateral and drip systems. A critical component of the project is access to reliable high speed internet connection with the ability to handle data transfer associated with automation and in-field water management.

Why do I need to be aware of this research?
The project is investigating the automation of siphon and bankless channel irrigation to address the challenges of labour, water availability, water use efficiency and the suitability of technology to provide economic returns:

- Growers are struggling with labour resourcing, identifying efficient automation systems would help to alleviate this.
- Automated irrigation must strive to produce water use efficiency standards at least equal, if not better to those achieved in the optimised siphon systems.
- Advancements in irrigation technology must be cost effective on a large scale but should also consider the frequency of use and the reliability of irrigation water.

How will it benefit my operation?
The project is designed to address four key issues being faced by irrigators:

- Maintaining and possibly improving the water use efficiency of flood irrigation;
- Addressing the labour resourcing challenge being faced by growers;
- Developing an automated system which is cost effective for large irrigation farms;
- Determining benefits of access to reliable high speed internet connectivity to enable data transfer.

The ultimate goal is to identify the key components necessary for irrigators to adopt automated flood irrigation and ultimately advanced irrigation scheduling.

What are the current barriers to adoption?
There are several barriers to the adoption of automated flood irrigation:

- The automation of siphon and bankless channel irrigation must fit within a capital cost structure which would enable large growers to carry the fixed costs of the system within their rotations or in seasons when irrigation water is limited.
- There are minimal commercial assessments of the installation, performance and cost effectiveness of flood irrigation automation options. This project is designed to provide growers interested in the automation of flood irrigation systems a greater understanding of commercially suitable alternatives and more insight into the pros and cons of the various options.
- It is currently difficult to easily link the necessary agronomic and water management components into a centralised location which will enable growers to remotely and confidently manage irrigations.
- Access to reliable high speed data transfer is a potential barrier to adoption.

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Gwydir Valley Irrigators Association Inc.

Measuring nitrogen loss during early season irrigation: trials

CottonInfo Regional Extension Officers

What is the research?
CottonInfo's team of Regional Extension Officers are running trials across the cotton growing valleys during the 2017-18 season to quantify the runoff component of the nitrogen loss pathway, and to highlight the relationship between irrigation and nitrogen management.

The trials have been established to provide a local perspective on the issues of deep drainage and runoff, which - when combined with poor nitrogen fertiliser placement – can result in significant nitrogen losses.

The trials are specifically addressing the following research questions:

1. What quantity of dissolved nitrogen moves out of the field with irrigation tail water under normal irrigation practice (treatment 1)?
2. Does irrigation management technique impact on the amount of this loss? What is the impact on nitrogen loss in irrigation tail water with an increased flow rate (treatment 2)?

Why do I need to be aware of this research?
Boosting the nitrogen use efficiency of cotton farms within Australia is a key objective of the Australian cotton industry. Research by Baird (2016) and McDonald (2017) has identified up to 10 per cent fertiliser N losses in the first two irrigations, influenced by pre-season fertiliser placement, deep drainage and runoff.

The extent of nitrogen movement in early season irrigation water appears to be influenced by:

- The pre-season nitrogen fertiliser application placement (depth and position in relation to the hill)
- Any events that could remove pre-season nitrogen fertiliser from the soil profile, such as heavy rain events resulting in run-off and waterlogging
- Early season irrigation management, with flow rate and duration impacting runoff, deep drainage and uniformity.

These trials will also provide an indication of the potential of variable rate fertiliser application as a tool to manage nutrient movement caused by water moving down the field.

How will it benefit my operation?
Poor fertiliser placement and early season irrigation management can result in removal of N from the system with potential to impact on lint yield through the reduction of available N. Quantifying the nitrogen movement under two irrigation treatments will provide regional data on potential nitrogen movement and options for minimising that movement.

What are the current barriers to adoption?
Current barriers to minimising nitrogen loss in early season irrigation include:

- The challenge of accurately assessing irrigation application and efficiency
- Monitoring the movement of nitrogen in irrigation water to identify the significance of the issue

These trials aim to address these barriers and inform management options of fertiliser placement, variable rate application and early irrigation management.

Contact:
Your local CottonInfo REO (see contact details on page 2 of this booklet).

CottonInfo

Australian Government
Cotton Research and Development Corporation

Notes

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Meet our team

Led by CottonInfo Program Manager Warwick Waters (0437 937 074, warwick.waters@crdc.com.au), and supported by Communications Manager Ruth Redfern (0408 476 341, ruth.redfern@crdc.com.au) the CottonInfo team of Regional Extension Officers, Technical Leads & *my*BMP experts are all here to help!

Regional Extension Officers

Regional Extension Officers provide cotton research outcomes and information directly to growers, agronomists, consultants and agribusinesses in each region. Contact your local Regional Extension Officer for the latest research, trials and events in your area.

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Technical Leads

Technical leads are experts in their fields and provide in-depth analysis, information and research to the industry, for the benefit of all growers. Contact the technical leads to learn more about water use efficiency, nutrition, soil health and much, much more.

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*my*BMP team

The *my*BMP team run the industry's best management practice program, *my*BMP. Contact the *my*BMP team to learn more about - or to participate in - *my*BMP.

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CottonInfo is a joint initiative of Australian Government Cotton Research and Development Corporation, CSD Cotton Seed Distributors, Cotton Australia

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