IREC Field Day

Irrigation Research & Extension Committee

Thursday 21 January 2021 — 7.30 to 12 noon

An update on the trials being held at the IREC Field Station

IREC Field Station — Stott Road, Whitton NSW

CSD Cotton Seed Distributors · NSW Government Department of Primary Industries · MI Murrumbidgee Irrigation Ltd · SunRice · Summit Ag Agricultural Consulting · Deakin University · Padman Stops The Farmers Friend

Irrigation Research & Extension Committee

2021 Field Day Program

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Kate Daly	Nth Qld	0427 799 891

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Granulock Z and Entec®

Granulock Z

Granulock® Z fertilisers help deliver a carefully balanced combination of nutrients in each granule to address the nutritional requirements of growing crops.

Granulock® Z helps crops take up applied nutrients more evenly. Growers can precisely provide newly sown crops with the right combination of nutrients for strong early root growth, healthy emergence and even growth. Granulock® Z fertilisers are compound fertilisers containing each nutrient in every granule.

Every Granulock® Z granule produced at Incitec Pivot Fertilisers manufacturing plant at Phosphate Hill in north west Queensland contains nitrogen, phosphorus, sulphur and zinc in every granule.

It is particularly important to supply germinating seeds and developing root systems with adequate points of contact when immobile micronutrients such as zinc are applied in the drill row at planting.

Depending on rate of application and row spacing, Granulock® Z is best applied in a band with the seed at planting. Each Granulock® Z granule contains water soluble zinc which is immediately plant available.

Granulock ® Z analysis

	Nitrogen (%)	Phosphorus (%)	Sulphur (%)	Zinc (%)
Granulock ® Z	11	21.8	4	1.0

Source: Incitec Pivot Fertilisers, 2020

Entec® an Enhanced Efficiency Fertiliser

New generations of nitrification inhibitors or ammonium stabilisers have been and are continuing to be assessed in Australian farming systems.

DMPP (Entec®) is one of the new generation of enhanced efficiency fertilisers. DMPP (3,4-dimethyl pyrazole phosphate) acts as a bacteriostat on Nitrosomonas spp, bacteria resulting in suppression of nitrification and retention of nitrogen in the stable ammonium form. Retention of the N component as ammonium potentially reduces losses associated with denitrification and leaching.

Denitrification is a bacterial process in which nitrate (NO_3) is used to metabolize organic molecules when atmospheric oxygen (O_2) is not available. The nitrate is converted to unreactive nitrogen (N_2, N_2O) gases that are lost from the pool of plant available nitrogen as soon as they are formed irrespective of the source of nitrogen (fertiliser or organic source).

Being a bacteriostat Entec® inhibits growth and reproduction of the bacteria without permanent harm. After the effects of Entec® have worn off, expect to see a recovery in nitrification in the soil. The effect of Entec® is very much soil temperature and soil moisture dependant.

For the majority of the time, losses of soil nitrogen are quite small, however when soils are greater than 60% water filled pore space for >72hrs and soil temperatures are >28C denitrification losses as N_2 and N_2O can be extremely high (Suter, 2007)

A newly-developed formulation based on DMPP, 3,4-dimethyl pyrazole tetra-methylene sulfone (DMPS), can be direct-injected with anhydrous ammonia. Schwenke and McPherson compared N_2O emissions from DMPS and nitrapyrin treated anhydrous ammonia from two Vertosols used for irrigated cotton.

At Emerald (Queensland), both inhibitors reduced N_2O emitted by 77% over 2 months. At Gunnedah (New South Wales), DMPS was active in the soil for 3 months, reducing N_2O by 86%, whereas nitrapyrin activity lasted for 2 months and reduced N_2O by 65%.

Realising the potential for improved environmental benefits from directly injecting DMPS with anhydrous ammonia requires an agronomic benefit justifying its additional cost to the farmer. Future research needs to investigate the potential for reduced N rates when using these inhibitors – without compromising high yields. (Schwenke and McPherson, 2018)

Contact

Jim Laycock — 0427 006 047
Incitec Pivot Fertilisers

C. N Walker and H. Suter. Keeping nitrogen under control. Healthy Soils Symposium July 2007
Schwenke A, B and McPherson A., (2018) Mitigation of nitrous oxide emissions from furrow-irrigated Vertosols by 3,4-dimethyl pyrazole tetra-methylene sulfone, an alternative nitrification inhibitor to nitrapyrin for direct injection with anhydrous ammonia, Soil Research, 56, 752–763

Viand Rice Crop

Can a decreased flood period growing rice minimise P tie up, decrease Black Root Rot spore load and weed seed bank, while maintaining an acceptable rice yield?

Crop details: 14ha Viand Rice sown 2 November @ 130kg/ha on 1 meter hills (sprayed out barley crop).
Flushed November 3 and four additional flushes November 16, December 2, 16 and 26 with permanent water January 1.

The aim of this rice crop is to:

- Demonstrate a more stable production system with integrated disease and weed management
- Maintain high cotton yields through Black Root Rot (BRR) control
- Increase profitability through increased system yield and system water use efficiency.

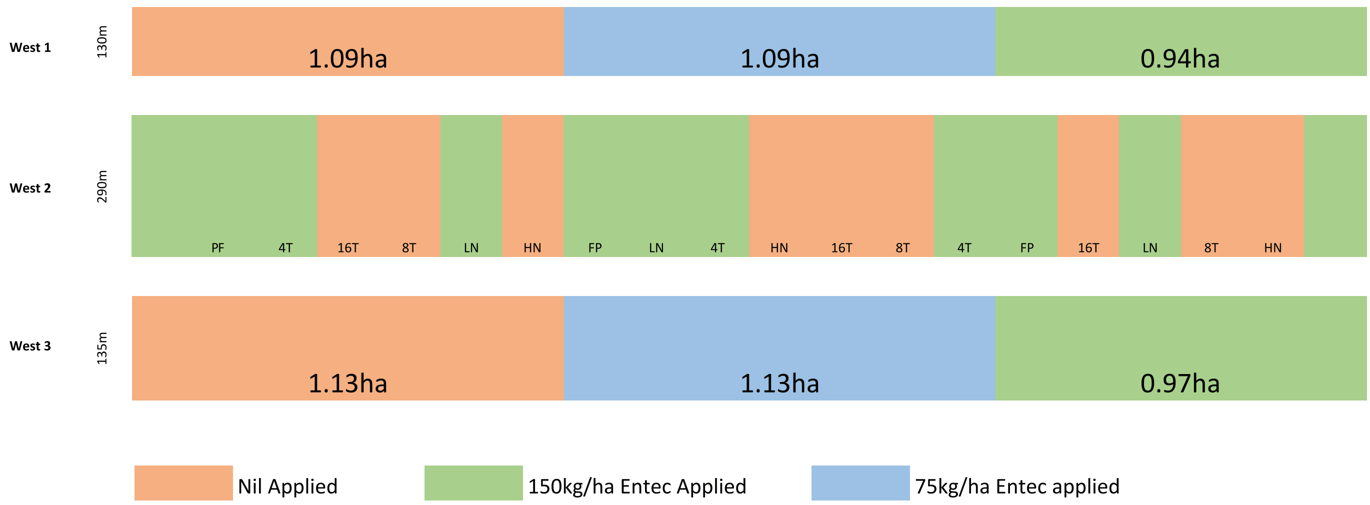
Cotton has been the summer crop grown at the IREC field station for a number of years because it is on a prior stream with high water use soil type. There is a reluctance by the cotton industry to have rice in rotation due to documented phosphorus tie up which limits cotton yields after rice but problems arise without a diverse rotation, particularly build-up of disease and problematic weeds.

Black root rot is a 'sleeping giant' disease that is already showing yield loss in the area. In the late 1990's research to reduce BRR spore load was conducted under a 150 day flood regime with aerial sown rice. However, more recent research has found that flooding fields for a minimum of 30 days has significantly reduced BRR spore load.

Growing rice using the drill and delayed permanent water method means that there is a shorter inundation period (30 to 60 days). This trial wants to investigate if a decreased flood period minimises P tie up, decreasing BRR spore load and weed seed bank while delivering profitable T/ML.

Other aims are;

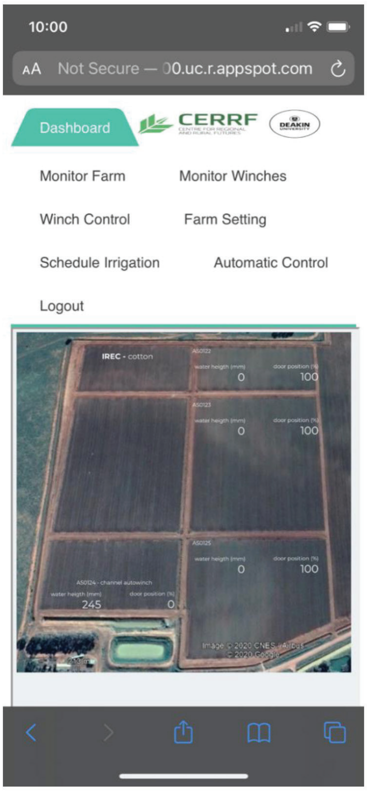
- N management of rice under an alternate wet dry system using slow release N
- A minimum flood period to maximise Water Use Efficiency (WUE) in rice
- Monitor following cotton crop for yield (impact of P tie up), disease (BRR) and weeds (control of hard to kill cotton weeds such as fleabane, silver leaf nightshade and roundup resistant ryegrass)
- Demonstrate automation for ease of irrigation management.



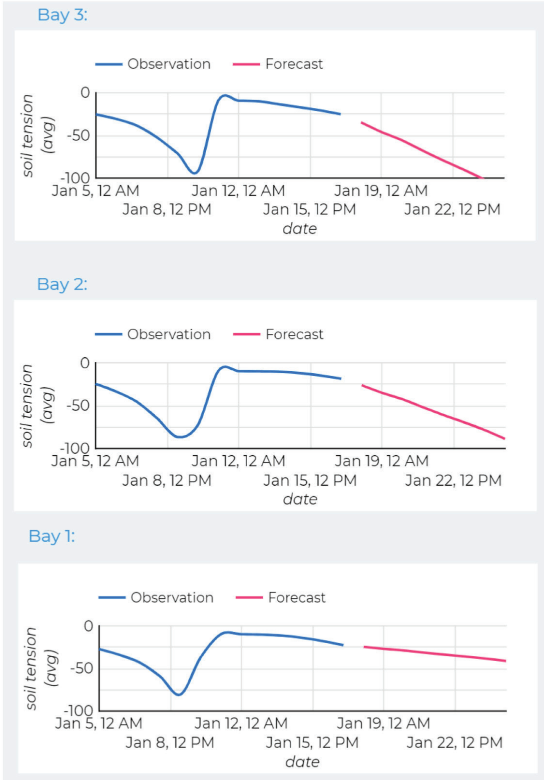
Residual Nitrogen from previous manure trial

Farmer Practice (FP)	76	kgN/ha
4t	78	kgN/ha
16t	141	kgN/ha
8t	147	kgN/ha
low N	94	kgN/ha
high N	157	kgN/ha

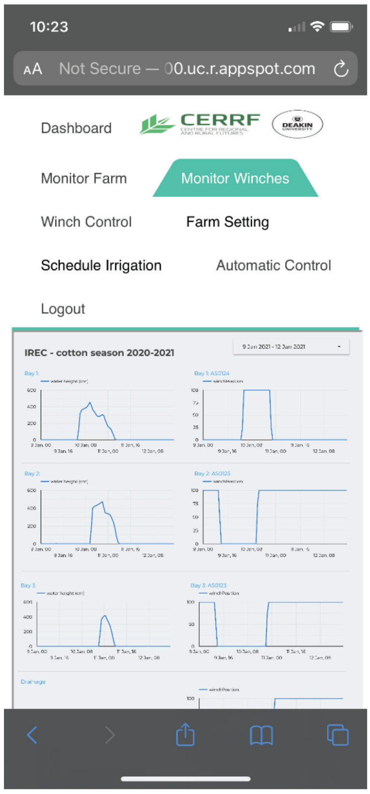
Smart Sensing and Automation



Soil tension forecasted 7 days in advance with weather and satellite data — determines when to next irrigate.



Irrigation events controlled by sensed bay water heights — doors drop automatically once heights are reached based on soil infiltration/dryness.



Levels of automation are determined by the user. Text messages can be configured for any stage to allow users to be comfortable with decisions until 'trust' built.

Project Team

John Hornbuckle, Rodrigo Filev Maia, Carlos Ballester-Lurbe, Matt Champness

Further Details

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Australian Government
Department of Agriculture

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

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Update on *Unlocking the true value of organic soil amendments* project

The effect of chicken litter on urea-N uptake and soil nutrient supply in irrigated cotton

Jackie R. Webb*, Rakesh Awale, Wendy Quayle *j.webb@deakin.edu.au

RATIONALE

•Determine improvements in NFUE when urea is integrated with chicken litter (CL) for cotton crop N budgets.

•Determine the quantities of plant available nutrients and release rates from CL following field application.

INTRODUCTION

Chicken litter boosts soil microbial health and can provide a supplemental crop nutrient source.

However, there is a lack of specific knowledge on the amount of plant available nutrients that a rate of litter application releases and if litter nutrient release rates are synchronised with plant demand.

In this study, we use a combination of techniques to determine the effect of CL on the fate of urea fertilizer (^{15}N isotope tracer) and soil N release (ion exchange membranes) in irrigated cotton. Here, we present some early results of soil N release rates taken within 2 weeks after CL application in two different months, and 2 months after application.

TREATMENTS & METHODS

- The treatments consist of a control, CL only (15t/ha), and urea-N applied at rates equivalent to 50, 150 and 300 kg N ha^{-1} with and without the equivalent of 15 t/ha of composted CL.
- Urea is labelled with the ^{15}N isotope, which enables us to directly track and calculate the portions of urea taken up by the plant and soil.
- Soil N release rates were measured with plant root simulator (PRS®) buried in microplots, with and without CL, in different months.
- PRS® probes absorb NO_3, NH_4 , and many other nutrients, as they become available in the soil, providing a true measure of 'what the plants sees'.

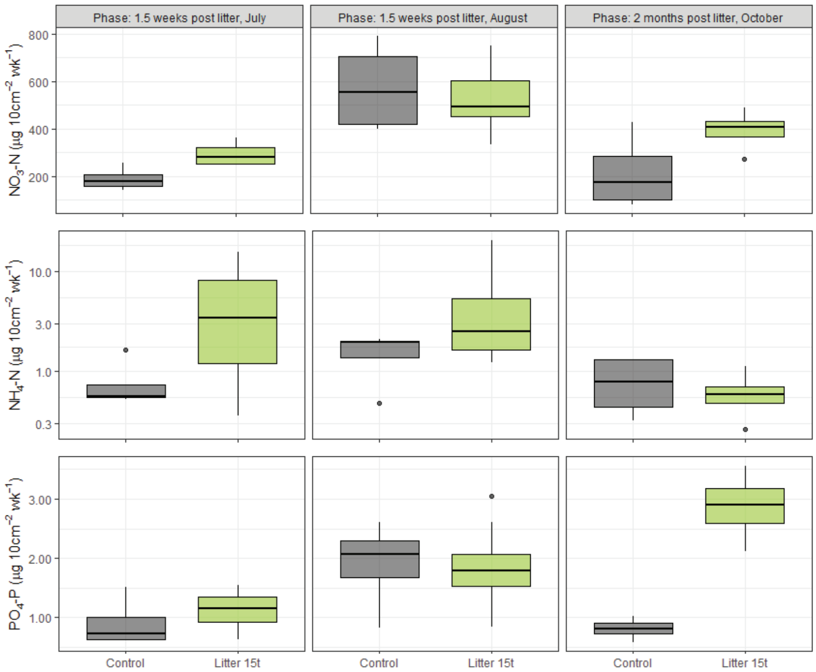


Figure 2: Rates of soil NO_3, NH_4 , and PO_4 release between CL and control treatments across different months

KEY FINDINGS SO FAR

Does application timing matter?

- Laboratory studies show that up to 50% of N released from the organic fraction of litter occurs during the first two weeks once applied to soil.
- Our results show evidence that NH_4 release is higher immediately after litter application compared to 14 days post planting, yet NO_3 results are unclear (Fig. 2).
- In contrast, soil PO_4 release was higher at establishment, which is promising for synchronising with plant P uptake and avoiding pre-plant losses from the soil.

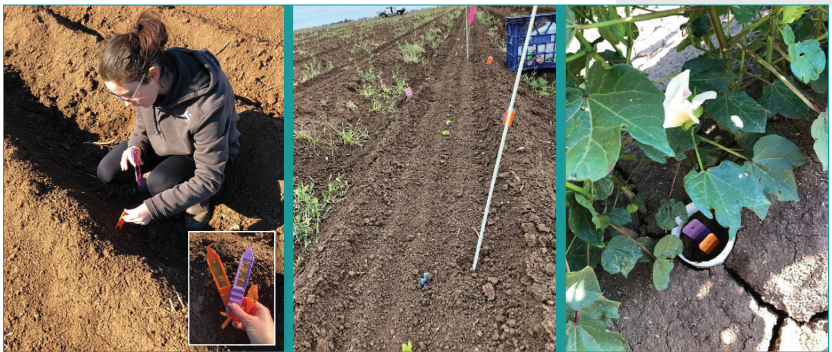


Figure 1: Plant Root Simulator probes (PRS® probes) were deployed across pre- and post-plant stages to measure soil NO_3, NH_4, and PO_4 release rates.

Litter sustains nutrient supply at establishment

- Chicken litter sustains higher soil NO_3 and PO_4 supply rates early in the growing season, measured here at 14 days post plant (Fig. 2)
- If cotton plants had fully grown roots at this time, this would be equivalent to supplying:
  - ~9 kg N/ha/wk compared to ~4.5 kg N/ha/wk with no litter (top 15 cm soil).
  - ~0.1 kg P/ha/wk compared to ~0.02 kg P/ha/wk with no litter
- We will continue monitoring nutrient release rates over the rest of the growing season.

ACKNOWLEDGEMENTS This work is funded by Deakin University, CRDC, and National Landcare Smart Farming Partnerships Program. We thank Darrel Fiddler for providing access to the farm site, Kieran O'Keefe for initial site discussions, and John Hornbuckle, Rodrigo Maia, Arbind Banija, and Matt Champness for fieldwork assistance

CeRRF CENTRE FOR REGIONAL + RURAL FUTURES

DEAKIN UNIVERSITY

Can poultry litter supply adequate P nutrition to irrigated cotton in an alkaline Vertosol?

Rakesh Awale, John Hornbuckle, & Wendy Quayle

Centre for Regional and Rural Futures, Deakin University, PO Box 562, Hanwood, NSW 2680

Objectives:

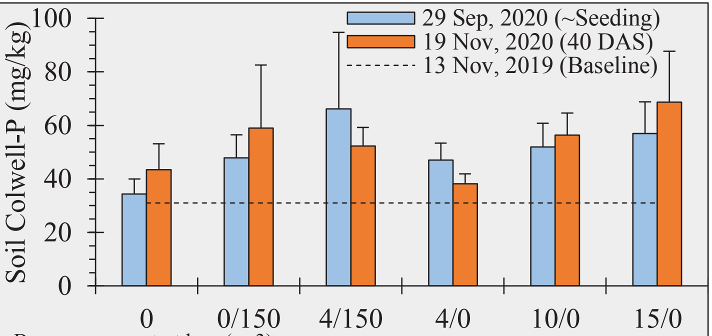
1. Assess the use of poultry litter as a starter P fertiliser by comparing soil P availability, cotton P uptake and growth and productivity when amending litter alone and integrated with mono-ammonium phosphate (MAP) application.
2. Determine P release mechanisms (desorption, dissolution, or mineralisation) from poultry litter amendments.

Treatments:

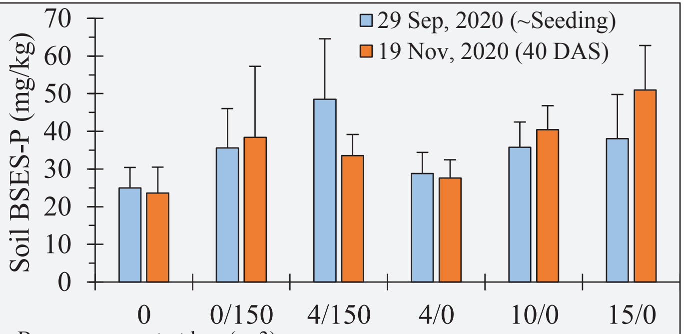
1) Control or no fertiliser added (0)
2) 150 kg/ha MAP (0/150)
3) 4 ton/ha chicken litter + 150 kg/ha MAP (4/150)
4) 4 ton/ha chicken litter (4/0)
5) 10 ton/ha chicken litter (10/0)
6) 15 ton/ha chicken litter (15/0)

Experimental:

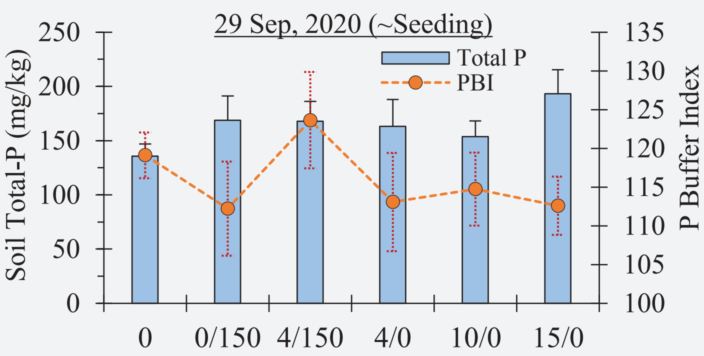
- *Location*: Carrathool, NSW
- *Litter comp*: 79.0 % dry matter, 40.1% C, 4.8% N, 1.1% P, & 3.1% K
- *Litter and MAP application*: 5 Feb, 2020 (0-20 cm deep)
- *2.5 t/ha gypsum, deep ripped (~60-80 cm)* on 6 Feb, 2020 & *180 kg urea-N/ha* fertigated in 3-splits in all treatments
- *Cotton (var.746B3F) seeding*: 2 Oct, 2020
- *Soil sampling*: 0-30 cm depth (~6 wks interval)



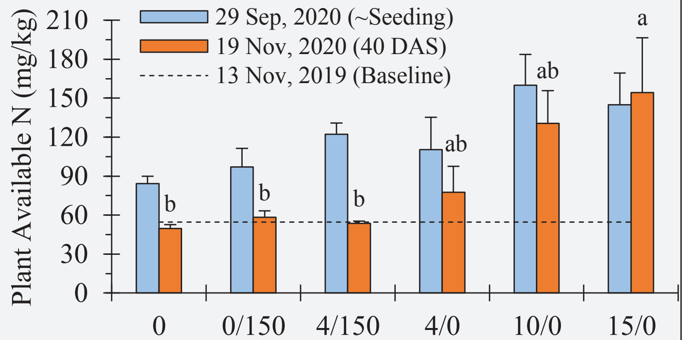
Bars are means + std err (n=3)



Bars are means + std err (n=3)



Bars are means + std err (n=3)



Means with same letters for a sampling day are not different by Tukey's HSD test at α=0.05, Bars are means + std err (n=3)

Plant growth parameters at first-flower (7 Jan, 2021)

Treatments	# Plants/m	Plant ht. (cm)	# Nodes/plant	# Squares/plant	% FB retained	NAWF
0	12.1 (0.6)†	47.0 (2.7)	18.6 (0.1)	18.5 (2.0)	79.7 (3.6)	10.4 (0.5)
0/150	12.2 (0.3)	50.9 (3.0)	18.9 (0.1)	20.6 (1.9)	83.3 (3.3)	10.1 (0.3)
4/150	13.6 (0.2)	53.8 (3.7)	19.3 (0.6)	20.8 (2.3)	80.2 (1.4)	10.2 (0.3)
4/0	12.1 (0.2)	48.5 (1.8)	18.7 (0.2)	18.5 (2.1)	85.8 (2.1)	10.2 (0.4)
10/0	12.7 (0.7)	53.8 (1.3)	18.9 (0.2)	22.9 (1.4)	86.9 (4.3)	9.6 (0.2)
15/0	12.3 (0.7)	55.5 (0.9)	19.3 (0.4)	21.6 (1.3)	83.9 (4.1)	10.1 (0.3)

†Values are means with std errors in parenthesis (n=3); ht., height; FB, first position flower; NAWF, nodes above white flower

Conclusions:

1. Despite baseline Colwell-P being at ~30 mg/kg, P-fertilisation did not affect establishment but was required to optimise early crop growth. Application of 10 t/ha or higher chicken litter rate would adequately substitute for the commercially applied MAP applications. However, 4t/ha would not meet the applied P recommendation.
2. Further data analyses will specify P release mechanisms to clarify the reliability of these P-amendments for crop nutrition and the sustainability of soil P reserves.

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SICOT 606B3F VARIETY EVALUATION

- Medium maturity variety with a relative determinate growth habit;
  - Avoid stress early in the flowering period.
- Earlier to mature than Sicot 714B3F with excellent yield potential.
- Compact, semi-cluster growth type with lower and mid canopy fruit development.
- Sicot 606B3F has been bred by CSIRO for cooler growing regions.
- **Climate suitability:** short season and/or cool growing regions.
- Low density seed type.
- Verticillium Resistance Ranking (V.rank) 117 (14 comparisons).
- Fusarium Wilt Resistance Ranking TBC.
- Suitable for irrigated growing conditions, with potential yield increase in southern regions over current varieties;
  - Early trial data suggests up to 5% yield increase (CSIRO, Table 2).

VARIETY PERFORMANCE COMPARISON

- CSD Variety and Ambassador Network data from 2 years (2018/19 and 2019/20) across 25 sites.
- **Southern region includes:** Murray, Murrumbidgee and Lachlan (Hillston and Forbes).

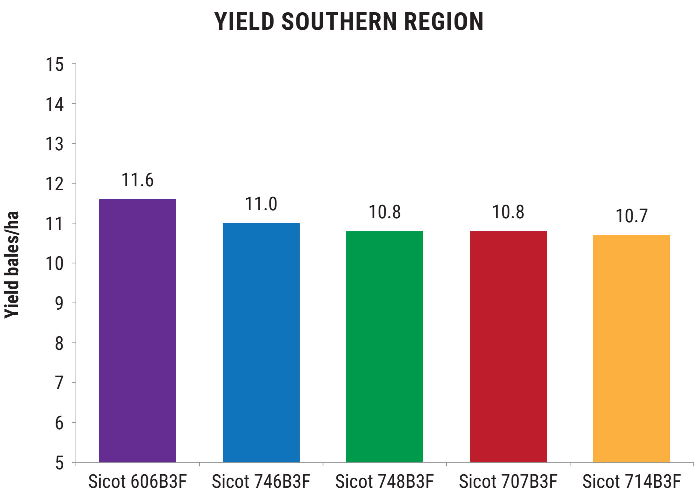


Figure 1: CSD trial data for yield for southern regions - 2 years, 18 sites.

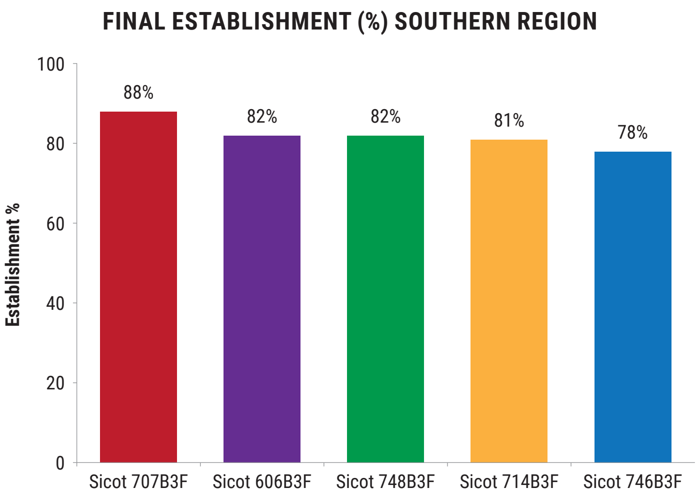


Figure 2: CSD trial data for establishment % for southern regions - 2 years, 18 sites.

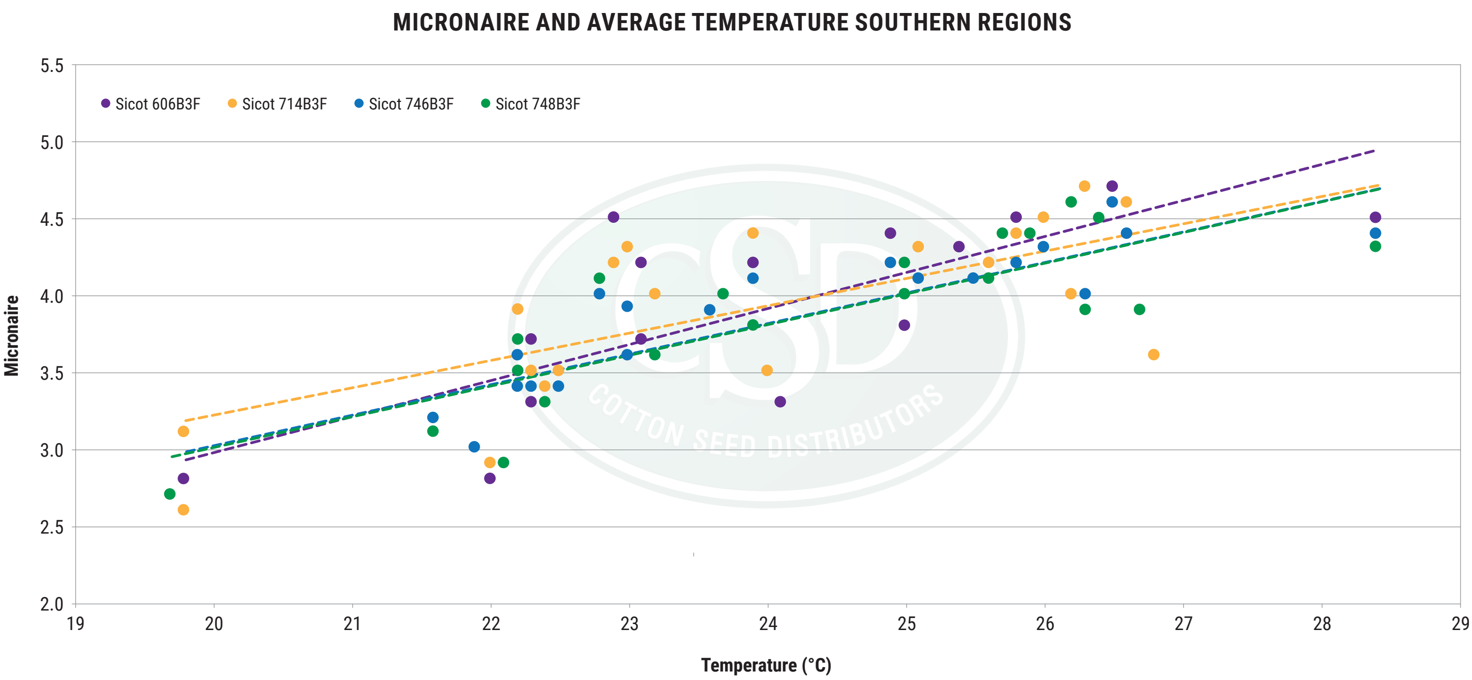


Figure 3: CSD Variety and Ambassador Network data trial data comparing all sites growing Sicot 606B3F - displays the relationship between micronaire and average temperature for 2 years (2018/19 and 2019/20).

Herbicide use patterns, resistance and all that in the cotton industry, a 2020 perspective

Eric Koetz, NSW DPI

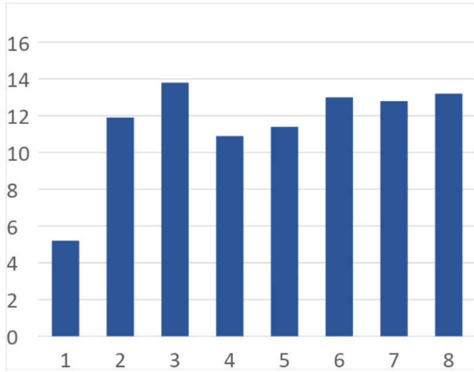
As glyphosate resistance increases the cotton industry is looking back to the "good old days". What I mean by that is we are seeing an increase in the use of residual herbicides and the introduction of other modes of action to control problem weeds.

An industry survey conducted in 2019 by Bayer Crop Science found that 85% of growers suspect that they have glyphosate resistance on farm, an increase of 11% from two years ago. The main weeds identified by growers exhibiting resistance are flaxleaf fleabane, feathertop Rhodes grass and annual ryegrass. In addition to this sobering statistic, non-glyphosate resistance has also increased with other modes of action increasing from 20% up to 31%. On a positive note, since 2016 the use of pre-emergent and residual herbicides has increased by 13%. This may be a reaction to a loss inefficacy with glyphosate or a response to the HRMS and introducing more modes of action and adopting programs such as Bayer's Roundup Ready Plus incentive package.

In response to the issues around herbicide resistance CRDC has supported NSW DPI and QDAF in a weed project looking at efficacy, plant back considerations and the role of residual herbicides in a farming system. Two trials were established in 2020 at Leeton Research Station and IREC with a range of herbicide treatments. No early damage from pre-emergent herbicides was measured and the highest yields were obtained were we had overlapped residual herbicides to provide ongoing weed control throughout the growing season.

Treatments

	Pre/at plant	Post	layby
1	Nil herbicide		
2	Gly only	Gly only	Gly only
3	Pendimethalin + gly	Bouncer + Gly	Gly only
4	Gly only	Pendi + Gly	Diuron
5	Terbyne + Gly	Pendi + Gly	
6	Terbyne + Pendi + gly	Bouncer + Gly	Prometryn
7	Bouncer + gly	Pendi + Gly	Prometryn
8	Diuron	Bouncer + Gly	Valor



IREC 2020 cotton yield, bales per hectare.

Pre-emergent, treatment 6.

Nil herbicide.

Pre-emergent herbicides reduced weed biomass by 70% compared to the Nil with pendimethalin and metholachlor the best performed treatments.

Residual herbicides provide the advantage of attacking the weeds before they germinate and by overlapping different modes of action you can achieve ongoing weed control and reduce the pressure on glyphosate to do the heavy lifting.

NSW GOVERNMENT Department of Primary Industries CRDC CottonInfo

IREC Slow Release N Fertiliser Trial

Background

From previous seasons and in particular the 2019/20 season just gone, there have been many crops overloaded with nitrogen which in turn has resulted in issues come defoliation time. Further to this, the losses of applied nitrogen from an irrigated cropping system can be large, leading to poor NUE and high emissions. Urea and anhydrous have been the main forms of applied N and are a cheap input to the cotton system however, there are some new products on the market that may offer improved efficiencies. The aim of the trial is to determine how nitrogen uptake and yield is affected through the application of slow release and more stable forms of N compared to conventional urea.

Method

Nitrogen was applied pre-plant (11/09/20), centre-busted below furrow depth. Four products were applied:

- Standard Urea (46% N)
- ENTEC Urea (46% N)
- 90 day Polymer Coated Urea (44% N)
- 180 day Polymer Coated Urea (43% N)

These products were applied at 4 rates:

- 0 kg N/ha (control)
- 100 kg N/ha
- 200 kg N/ha
- 400 kg N/ha

The trial was configured in a randomised complete block design with 5 replicates. Soil testing in August 2020 returned approximately 150 kg N/ha to 90 cm depth.

Measurements

Nitrogen uptake at peak flower and maturity including biomass and growth stage

Yield and quality

Soil testing post crop removal

Contacts

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13 Steps to Growing Mung Beans

Paul McIntosh

The first basic step in Mungbean growing is paddock preparation and that includes knowledge of your soil by having a recent profile soil test for nutrient levels and their availability, plus discover any soil constraints like chloride, sodium per cent of cations, compaction at any depth in your chosen field.

Second, maximising and protecting your full soil moisture profile prior to planting with previous cereal crops being recommended.

Third is using AMA approved Mungbean seed variety and applying good live mung inoculant either by peat or freeze dried with water injection or directly to seed by slurry mix. Mix inoculant with seed in a shaded area and look to plant into cool moist soil. Over 30 degrees C and/or sunlight will cause inoculant bacteria to perish.

Fourth is calibrating and ensuring the seeder machine is competent to deliver the seed into a perfect seed soil contact at that 5 to 8 cm depth to ensure evenness of plant emergence. Also deciding on a desired variety like Opal, Jade and Crystal, to name a few.

Fifth is engineering a suitable row spacing and plant population with a correct seed count from the said planter. Row spacing is reducing more and more, across all crops for better water use efficiency with increased yields and reduced weed seed production.

Sixth is weed control options with products and actives like pendimethalin, imazethapyr, Metolachlor, Valor, Acifluorfen, imazamox, and several fop and dim grass herbicides.

Seventh is inspecting your vegetative Mungbean crop once a week and then ramping up to twice per week at reproductive stages armed with a beat sheet.

Eighth is disease control and seed quality (halo blight and tan spot) and others like fusarium, Phytoplasma, puffy pod, gummy pod, and powdery mildew.

Powdery is the only foliar leaf disease that should be prevented from developing in Mungbeans. So apply a Tebuconazole type fungicide at first sight of powdery.

Ninth is insect scouting and using a beatsheet to find them as well as opening flowers and buds for any live insect be they pest or beneficial.

Pest insects are Helicoverpa, Bean pod borers, Mirids, Thrips, Green Vegetative Bugs, Redbanded shield beetles plus other minor pests. Be very mindful of any beneficial insect numbers.

Tenth is determining if physiological maturity has been reached for desiccation to occur.

Eleventh is the harvest operation done by a clean and well set up harvester. So harvester set up is important and contamination from previous crops like grain sorghum is important to be cleaned out, as should trucks and field bins.

Twelfth is the marketing which even though is last on my list, should be investigated from the day before you purchase your desired seed variety.

Finally, delivering your Mungbeans and filling out AMA statutory declarations on any pesticide or manure applications done before or in your Mungbean crop.

Aussie mungs have a clean and green export image from our short and quick does the trick Mungbean crops.

PULSE AUSTRALIA

Contact

Paul McIntosh — 0429 566 198
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