CottonInfo nitrogen management trials: Gwydir

Nitrogen Fertiliser Use Efficiency in the Gwydir Valley

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Trial aim

The aim of this trial was to examine Nitrogen Fertiliser Use Efficiency, through the effect on yield of different rates of Nitrogen (N) fertiliser, as well as examining the fate of nitrogen fertiliser throughout the cotton crop season. Replicated trials were also carried out across other cotton growing regions by the CottonInfo Regional Development Officers.

The Gwydir Valley trial was conducted in conjunction with the Action on the Ground and Filling the Research Gap projects. The aims of these projects were:

- Trial fertiliser management techniques on farm in three climatic zones to determine their influence on improving nitrogen use efficiency and reducing nitrous oxide emissions.
- To investigate the fate of Nitrogen in irrigation tail water. How much is being lost to the atmosphere?

These two projects have been written up in separate papers, however the results collected as part of these projects have also been incorporated into this trial and vice versa.

Trial details

Location: Red Mill, Moree. Owned by Australian Food and Fibre Ltd, managed by Ray Fox & Toby Seccombe, agronomy by Michael Stone
Soil type: Cracking grey Vertosol
Rainfall: Nov – Apr 437 mm
Planted: 24 October 2014
Variety: Sicot 74BRF
Picked: 25 April 2015
Total of 9 irrigations, 6.1 ML/ha including 1.4 for watering up
Estimate 10-15 percent run off tail water

Treatments:

	Pre plant (Anhydrous ammonia)	1st Irrigation (N26) 1/12/14	2nd Irrigation (N26) 21/12/14	Liquid spray (N42) 2/1/15 (2, 5, 6) 8/1/15 (1, 8, 9)	3rd irrigation (N26) 8/1/15	4th Irrigation (N26) 20/1/15	Total
T1	150	58	62	0	61	32	363
T2	150	58	62	100	61	32	463
T3	150	58	62	200	61	32	563

*T1 is commercial rate (same as the rest of the field)
*Plots are 12m wide

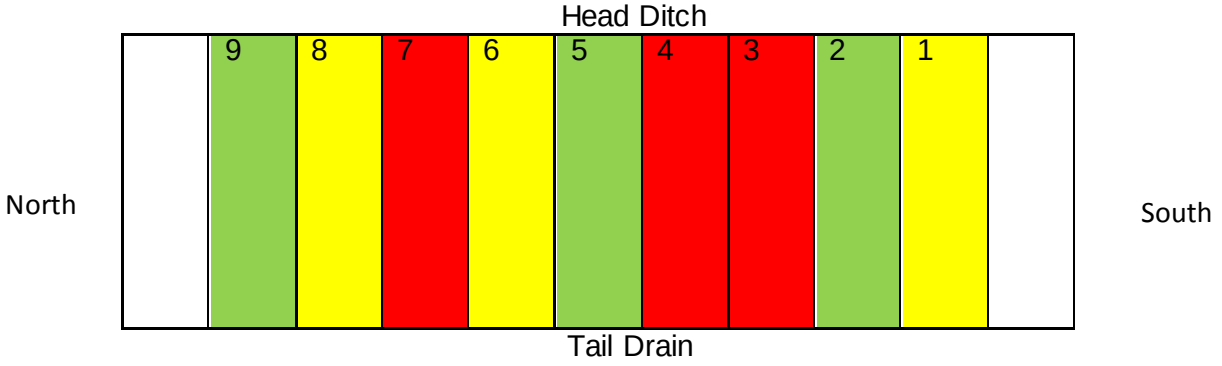

Figure 1: Trial layout

The variable rates were applied later than planned due to rain preventing access to the field. They were applied as N42, a UAN liquid spray directly to the soil in the furrow. Plots 2, 5 and 6 were applied on 2 January 2015 before the application was interrupted by a rainfall event of approximately 74mm. Following plots 1, 8 and 9 being treated on 8 January 2015, an irrigation was scheduled and delivered. Run-off from these two events was not collected due to access, but it could be assumed that some of the applied N42 was lost in tail water. The Action on the Ground project did record N2O emissions following these two applications and spikes in emissions can be seen in the data, so some was also lost to the atmosphere.

Seasonal review

The crop established well after being pre-irrigated on 10 October and then planted on 24 October. After a hot period in November, late December and January had mild weather, intermittent storms and warm, sunny days through February and March into defoliation. The season had nine cold shock days (average 14) and 44 hot days (average 23), with a total Day Degrees of 2538 (average 2280.6).

Results

The trial was picked with each treatment separately, however the plots were not separated. The following yield results were achieved:

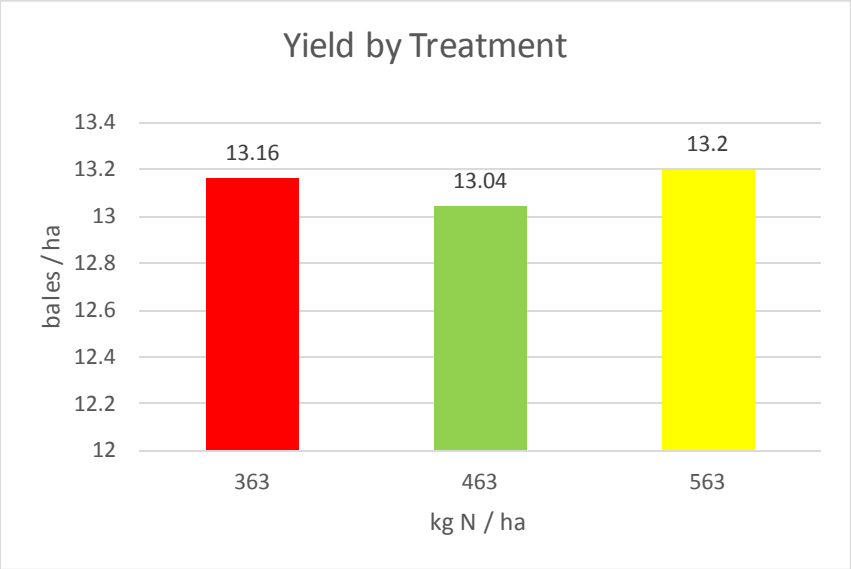

Figure 2: Yield (bales/ha) for Treatment 1, 2 and 3

Statistically, there was found to be no significant difference between yield for each treatment. Turn out for each treatment was:

- T1 – 41.9
- T2 – 41.3
- T3 – 42.2

Again, there was found to be no significant difference between these.
Seed N percent testing was undertaken with the following results but no significant difference between treatments:

- T1 – 4.21
- T2 – 4.30
- T3 – 4.28

The ideal range for Sicot74BRF is 3.7 to 4.1 percent. Every 0.1 above 3.9 percent N represents about 23 kg N /kg applied in excess.

Post season soil tests were conducted as part of the Action on the Ground Project. Samples were taken in the 0-30, 30-60 and 60-90cm profiles, at sites across the three treatments, as

well as on the hills, in the irrigated furrows and the non-irrigated (and gassed) furrows. The following graph shows high variation in the remaining mineral N, but a treatment trend from low N to high (treatment 1 to 3), and higher in the hills than furrows.

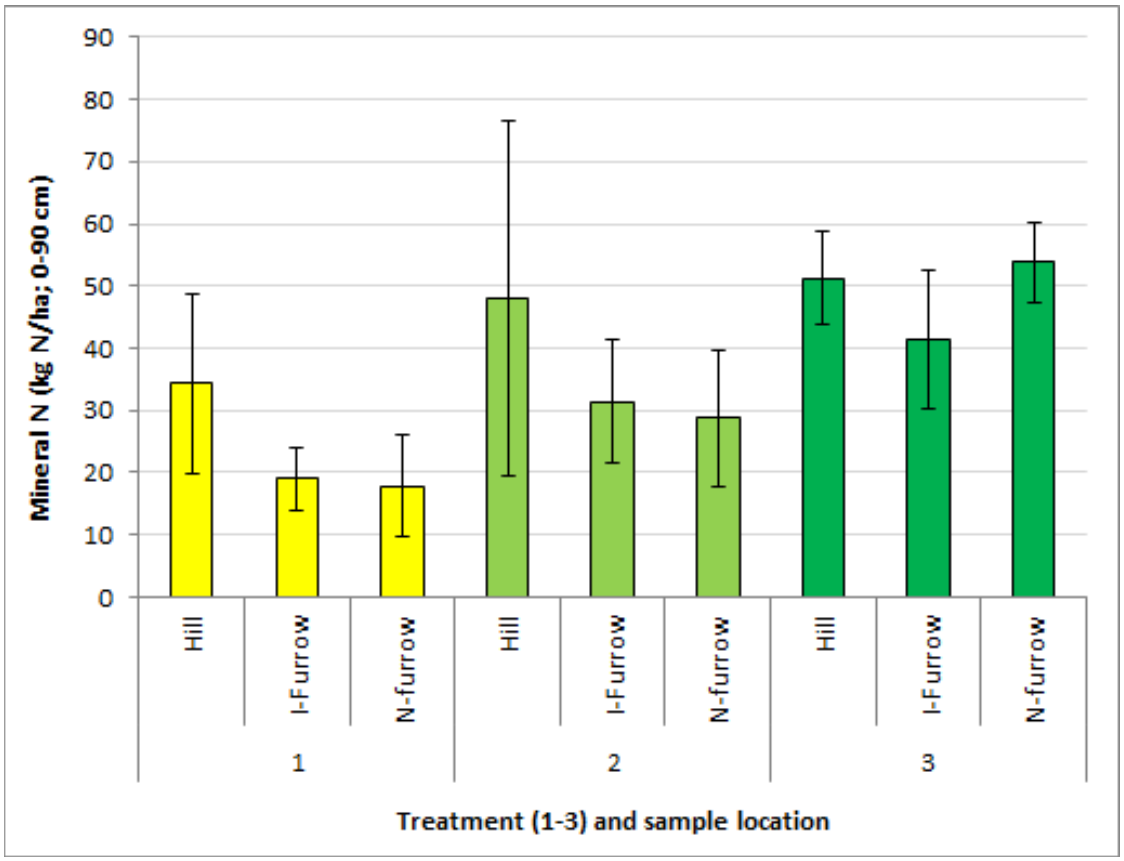

Figure 3: Mineral soil Nitrogen remaining at end of season

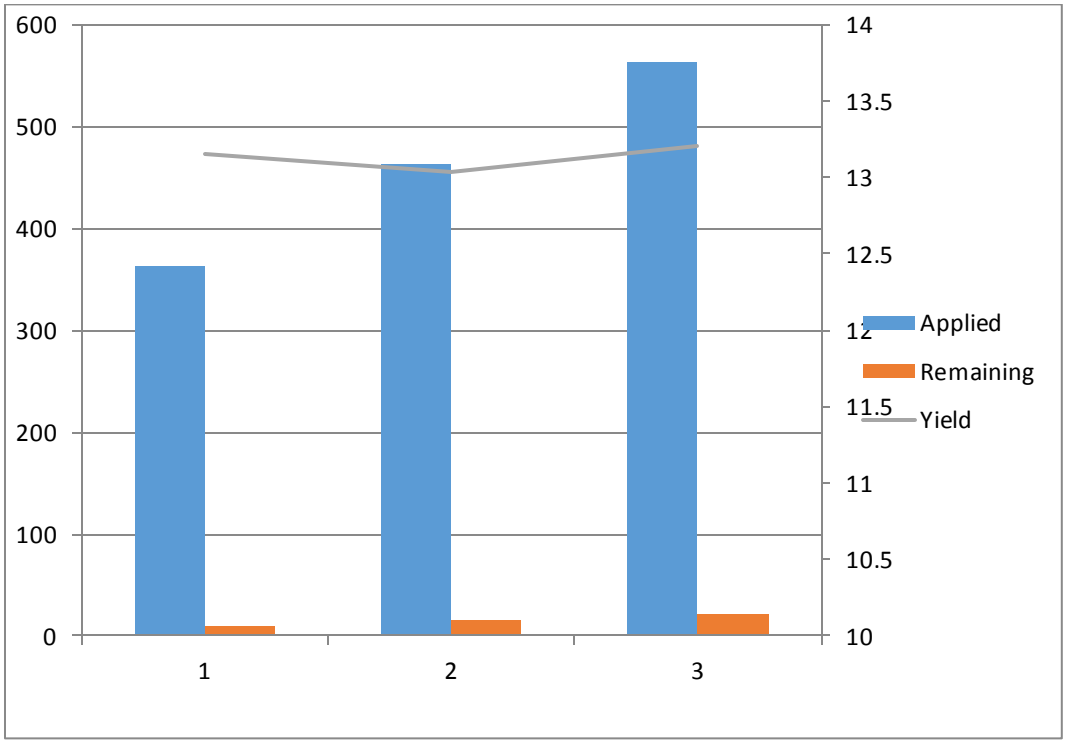

Figure 4: Applied N vs Remaining mineral N post season vs Yield

Discussion

The results indicate that the plants have not taken up the extra Nitrogen that was applied in Treatments 2 and 3. The Action on the Ground (AotG) and Filling the Research Gap (FtRG) projects both looked at the fate of excess N which is not taken up by the crop, which in this case has assisted in building a picture of where the extra N has ended up.

Soil test result from AotG showed very little N remaining in the soil across the three treatments. Nitrogen lost to run-off in the irrigation tail water was collected as part of the Filling the Research Gap and results including amounts run off can be found in the paper, 'The effect of variable nitrogen fertiliser rates on indirect nitrous oxide emissions and nitrate losses from furrow-irrigated cotton production' (Devlin, Chang & Macdonald 2015).

Given the variable rates were not applied in the ideal manner, or the manner that would be the normal practice on this farm of anhydrous ammonia pre-season and water run urea throughout the growing season, it is difficult to draw conclusions around representative losses from these high variable rates. The rates themselves however, are not unusual in the Gwydir Valley, particularly in wetter seasons than 2014-15 where more Nitrogen may be applied following perceived loss events.

In this case, this trial does demonstrate no yield advantage was achieved through the application of larger amounts of Nitrogen per hectare, and that losses to the environment will occur at these higher rates.