



NUTRITION case study

The nitrogen challenge: trial results show cost savings

A CottonInfo analysis of Cotton Seed Distributor (CSD) variety field trials from 2008-2012, based on grower practices, has demonstrated that nitrogen (N) applications in cotton production have been rising much faster than yield increases.

Further data from nitrogen trials undertaken by CottonInfo Regional Development Officers (RDOs) in crops across cotton growing regions in 2013-14, shows that increasing rates of nitrogen (N) fertiliser doesn't always correlate to higher yields.

The research indicates a reduction in the amount of lint produced in proportion to increased amounts of N applied (ie. lower Nitrogen Fertiliser Use Efficiency or NFUE), not a good scenario when N is one of the biggest costs in cotton production.

While cotton responds well to N application, increasing applications do not guarantee increased yields, given many other management and environmental variables have a significant influence over final yield results (as highlighted by both the CSD and CottonInfo RDO trials).

The research has shown that the greatest influence on NFUE (the ratio of lint yield removed for each kg of N applied) was the season in which the crop was grown and whether the field had been under fallow or cotton in the preceding season. Region and variety choice had some influence on the outcome, but to a much smaller extent.

Key results from RDO trials

A total of 11 RDO trials and field demonstrations were coordinated by CottonInfo RDOs - although one planned trial wasn't planted to cotton because of the dry season. Of the 10 sites planted, only four showed yields where N appeared to be the most influential factor.

In southern NSW, increasing N applied upfront from 254 kg N/ha to 300 kg N/ha provided an additional 0.04 bales/ha (10kg lint/ha).

The trial in the Macquarie used a split application to apply totals of 230, 260, 290 and 320 kg N/ha (140 kg N/ha was water run in-crop). Yield increased from 9.46 bales/ha at the lowest N application rate, to 9.82 bales/ha at the highest N application rate.

In Central Queensland there was only a small increase in yield by increasing N rates from 120 kg (upfront) to 360 kg N/ha (applied as a split with 120 kg N/ha in-crop), increasing from 10.8 bales/ha at the lowest rate to 11.5 bales/ha at the highest rate.

The field scale demonstration in Goondiwindi had one rate up front (184 kg N/ha) and four rates applied in crop to give total N applied rates of 250, 303, 356, 461 kg N/ha.

CSD variety field trials 2008-2012: summary

Yield and nitrogen data:

- Increase in crop yield: 6 per cent (Increased from 2,451 to 2,594 kg lint/ha)
- Increase in nitrogen application: 22 per cent (Increased from 202 to 245 kg N/ha)

There was one in-crop application for the 250 kg N/ha treatment, and there were two in-crop applications for the other three treatments.

Increasing the N from 250 to 303 kg/ha resulted in an extra 1.5 ba/ha of lint. Increasing from 303–356 kg N/ha provided an extra 0.8 ba/ha. At the highest rate of 461 kg (an additional 105 kg N/ha), yield increased by just 0.5 ba/ha.

The remaining six sites were influenced by factors other than N such as hail, disease and water shortages, which resulted in greater yield variability, although it was possible the N treatments may have exacerbated some of these issues.

In the Gwydir there was only a slight yield difference between the 250 and 300 kg N/ha treatments at 11.68 and 11.65 bales/ha. Hail and disease resulted in a 2.82 bale/ha decrease on the site with the highest rate of 400kg N/ha.

Other sites on the Darling Downs and two at Walgett were affected by water shortages and disease, resulting in no differences in yield within the range of N application rates.

Post season soil tests

Post season soil tests showed variable responses in nitrate-N to increased levels of applied N. A commonly held view is that N applied to cotton, that is not used by the crop in that season, will be there for the next crop.

“Whilst loosely true, this is an extremely risky way to apply N to a subsequent crop,” said former CottonInfo RDO, John Smith.

While increased N did increase the amount of nitrate-N left in the fields, this form of N is at a high risk of loss from the system, most commonly through denitrification due to waterlogging.

The Macquarie and Gwydir sites showed increases in the levels of soil nitrate resulting from increases in N application rates.

Other sites such as the Darling Downs did not show increased amounts of soil nitrate corresponding to increased N application rates, suggesting large

amounts of fertiliser N were unaccounted for or potentially lost from the system.

Conclusions

- Yield is not solely determined by N. There are many factors that affect the way the plant develops, sets fruit and yields lint (particularly the weather which growers can't control).
- It is possible to grow a 12-14 bale per hectare crop and to achieve NFUE outcomes of 13 to 18 kg lint per kg of N applied, however most cotton growers are not currently achieving these results.

Data from CSD trials and growers surveys shows that across the cotton growing regions there are significant difference in the amounts of N applied (see Fig.1), possibly because of yield expectations within the region and local knowledge of field constraints.

Improving NFUE can be achieved by either reducing N inputs or by improving yield to match the levels of N used.

While it may be difficult in some regions to reach NFUE rates of between 13 and 18 kg lint per kg N applied, significant improvements can be made to lift current NFUE rates by systematically addressing other production limiting factors within the cropping system.

Pictured below: An on farm RDO nitrogen trial on the Darling Downs. 250 kg of nitrogen per hectare was applied on the left side of the crop. No nitrogen was applied on the right hand side.



So what action could you take to achieve optimum efficiency without risking yield?

- Work out your current NFUE across your fields and see if there are some fields with better results. Look for differences in management of better NFUE fields that could be adapted elsewhere to improve overall farm NFUE.
- Take soil and in season tissue tests and apply N accordingly. RDO trials showed that NFUE could be improved through lower up front N application rates, followed by subsequent in season N application, without a risk to yield.
- Run your own N rate trials to see what rates and methods of application work best for your situation, or talk to your local RDO about trials in the region.

At present there is no stick to make the industry improve its N use, and the carrot (in the form of the Emissions Reduction Fund) may require too much effort for too little reward.

However, in the face of relatively static global prices for cotton and ever rising fuel and fertiliser bills, getting on top of NFUE and improving N management is one way to improve profit margins while reducing potential N losses to the environment.

For more information, visit the CottonInfo website: www.cottoninfo.com.au/crop-nutrition or contact your local CottonInfo Regional Development Officer: www.cottoninfo.com.au/contact-us.

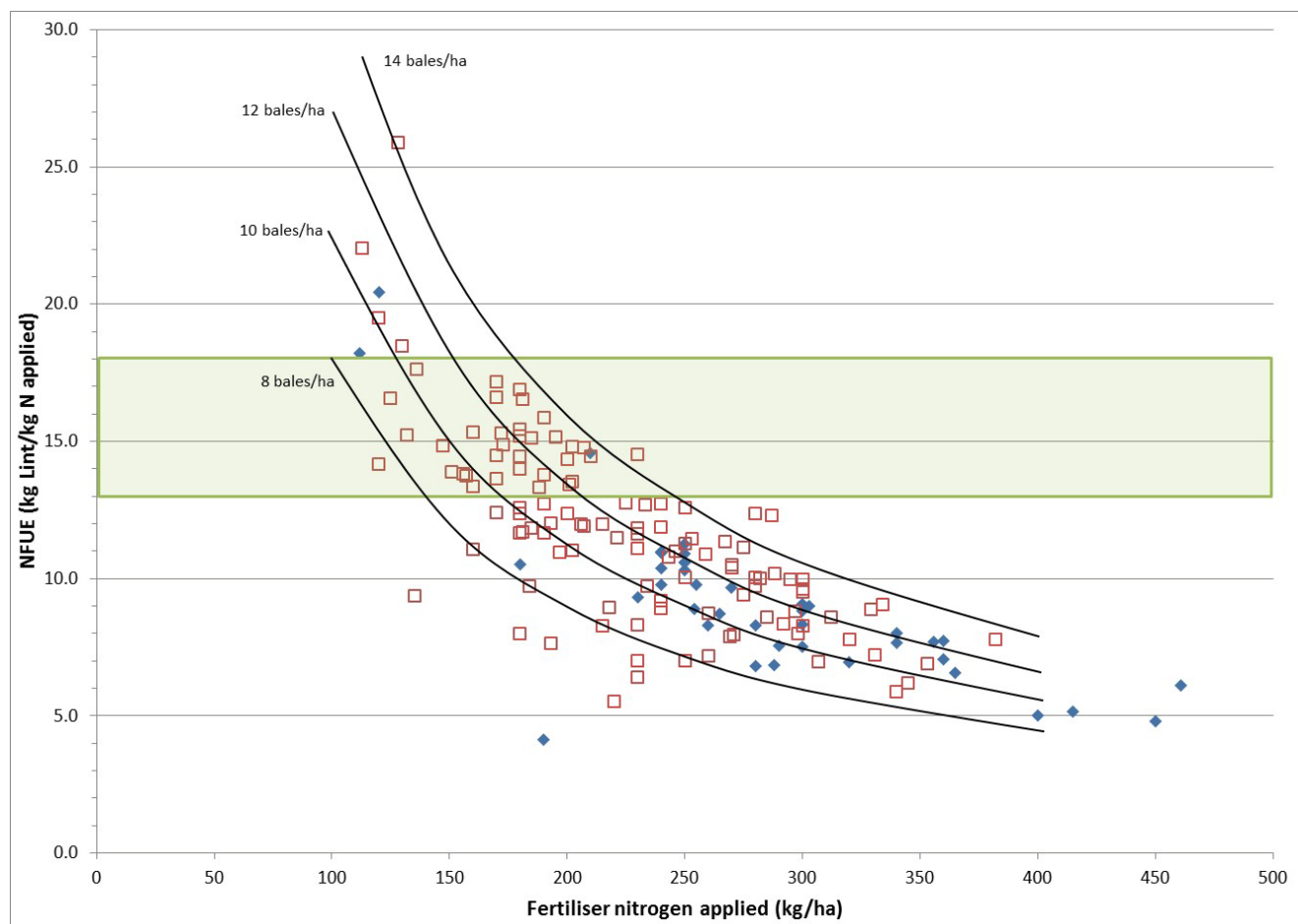


Figure 1: Increasing fertiliser nitrogen application reduces nitrogen fertiliser use efficiency (NFUE) unless other factors influencing yield are managed to ensure that nitrogen is the main factor impacting yield.

- Key:
- The area shaded in green is the industry optimum NFUE.
 - The solid lines represent the different yield potentials in the data, highlighting that optimum NFUE and high yields are achievable.
 - The red squares represent CSD trial results.
 - The blue diamonds represent CottonInfo RDO trials.