

MORE PROFIT FROM NITROGEN



Implications for timing of nitrogen (N) fertiliser application on irrigated cotton yields: apply all N up-front or split? – An economic case study.

About the research

The More Profit from Nitrogen Program (MPfN Program) is a cross-sector partnership between Australia's four intensive agricultural users of N fertilisers, formed to undertake research into improving nitrogen use efficiency (NUE).

As part of the collaborative research, NSW Department of Primary Industries (NSW DPI), in partnership with CSIRO and the Cotton Research and Development Corporation (CRDC), conducted field trials at the Australian Cotton Research Institute (ACRI) and multiple commercial sites in New South Wales.

The research sought to understand how N can be managed more effectively to maximise productivity and quality, minimise losses of applied N and provide economic benefits to the producer.

Analysis of farm level economic benefits

The focus of this research was on varying the proportion of N fertiliser applied between pre-season and in-crop. The timing of urea fertiliser application has traditionally been the main lever used to manage risk by varying combinations of pre-plant with ad-hoc in-crop N applications. In some circumstances, prevailing wet conditions may prevent fertigation or in-paddock traffic needed for broadcasting to top-up plant available soil nitrogen levels, leading to sub-optimal plant available N. In this experiment, in-crop applications (3) of fertiliser through broadcast urea were followed by irrigation within 1 day. There was no effect of the split fertiliser application on the measured yield at harvest during the 2016-17 season (Figure 1-A). During the 2017-18 season, the all applied pre-plant (100:0) yield was slightly less than the in-crop application (Fig 1-B), with significant differences between 100:0 and 30:70 treatments. The trial also showed there was no potential lint yield penalty for 70:30 or 30:70 in-crop application relative to all-in-crop treatment (0:100).

KEY MESSAGES

- Measured over two seasons, the research found no significant lint yield difference between different combinations of pre-plant and in-crop N.
- Significant lint yield differences were found between all pre-plant and 30:70 in-crop treatments in the 2017-18 season.
- Pre-season soil testing is important to calculate the required N fertiliser rather than following a fixed N recipe.
- There can be significant levels of N already in the soil (leftover), so fertiliser input costs can be reduced by taking this into consideration.
- Reducing N application to within the *myBMP* practices decreases the risk of environmental losses of excess N, saving money and reducing negative environmental impacts.

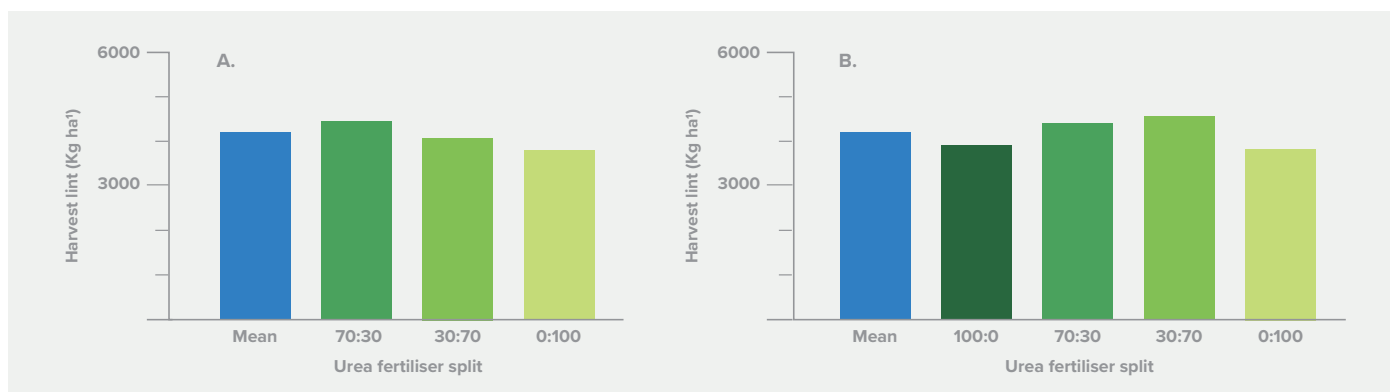


Figure 1. Cotton lint yield (kg/ha) measured by mechanical harvest (A – 2016-17) and season fertiliser application timing trial (B – 2017-18). Apparent treatment differences in graph A were not statistically significant. Bar on chart B = least significant difference.



On an individual cotton crop Gross Margin basis, the irrigation N application¹ line item can assist putting these results into context. Using a partial budget approach, four separate practices are summarised in Table 1. Taking an average yield of various treatments from 2016-17 and 2017-18 years using a nominal \$500/bale price, crop revenue was slightly less for the upfront treatments when compared with split N application (3 spreading applications at \$6/ha). Using the industry crop Gross Margins, fertiliser application costs for each treatment were sought, assuming other inputs remain constant. A single banded application is valued at \$40/ha pre-plant. N lost in runoff from the field (Figure 2) was also factored into the variable cost at \$1.50 kg/N. While the application costs and losses were lowest in the 0:100 treatment, the highest GMs were with split applications in the 2017-18 experiments due to the higher yield.

Table 1 — Partial Gross Margin budget showing four separate treatments: upfront and split in-crop N applications.

Treatment	Lint yield (bales/Ha)	Revenue (\$/ha)	N Application cost ¹ (\$/ha)	Lost N from field (\$/ha)	Partial Budget GM (\$/ha)
100% up-front	15.2	\$7,600	\$40	\$53	\$2,825
70:30	16.3	\$8,150	\$58	\$42	\$3,368
30:70	16.3	\$8,150	\$70	\$29	\$3,369
100% in-crop	15.7	\$7,850	\$18	\$21	\$3,123

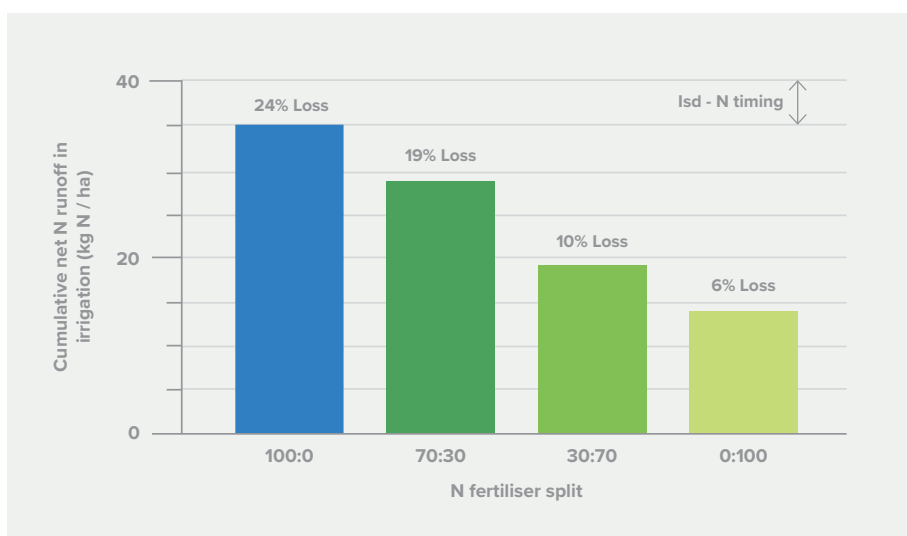


Figure 2. Irrigation field runoff comparison and effect of N application timing trial 2017-18

NITROGEN USE AND RESIDUAL N

There was a large difference in the post-harvest residual soil N between treatments, particularly in the first year, when the N rate used was the region average. Leftover N from in-crop fertiliser strategies (0:100, 30:70) can be utilised by the following rotation or cotton crop, provided no post-harvest off-farm losses occur.

In second year trials, pre-trial soil N levels were used to reduce the N rate.

During this experiment, there was no clear effect on cotton plant physiology or yield penalty of split pre-plant/in-crop application relative to all in-crop application

¹https://cottoninfo.com.au/sites/default/files/img/Furrow%20irrigated_contracted%202019.pdf
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Overhead irrigation at on the commercial property of Andrew Watson in 2018, Boggabri, NSW



Cotton growers and industry having a nutrition update with speakers from the MPfN Program, Gwydir Valley Irrigators Association, Norwood, NSW



Cotton harvest at the ACRI trial site, May, 2017



Cotton harvest on Field C4 at ACRI- the trial investigated split N application strategies



**FURTHER
INFORMATION**

FOR FURTHER INFORMATION ON THE MPfN PROGRAM:

Enhancing nutrient use efficiency in cotton project, contact the project leader:

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This case study was prepared by Jon Welsh, Agricultural Research Economist at AgEcon, with assistance from the NSW DPI cotton team.

Visit www.crdc.com.au/more-profit-nitrogen

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