# GOA Trial Site Report

## Comparing four different urea application methods on relative response in wheat yield and quality- Coolah 2016

**Trial Code:** GONU011162

**Year:** Summer 2016

**Location:** 'Kurrajong Park', Coolah

**Trial Partners:** Paspaley farms and Andrew McFadyen


### Keywords

GONU011, wheat nutrition, nitrogen placement, banding, broadcast, fallow nitrogen


### Take home messages

Drilling urea improved utilization efficiency when compared to broadcasting and incorporating.

Application of large rates of nitrogen can provide high levels of return on investment in favourable seasons.

### Background

Changes in the regions farming systems is seeing increasing needs to apply nitrogen (N) to crops to optimise their performance. Farming systems are now requiring higher rates and more frequent N applications than in the past. This is adding additional workload. It is increasingly difficult to find enough time to apply N by traditional means which are often slower and more specific in their timings. Traditional methods of application include drilling N or broadcasting N only 1-3 days ahead of rain events, mostly in crop.

In dry seasons some nutrients may become stratified, research in Queensland has shown significant benefit from deep application of phosphorus (a much less mobile nutrient) as it can become unavailable in dry conditions. It is plausible that nitrogen might also be prone to the same limitations, where its horizontal availability may be limited when banded, and/or its vertical availability may be limited where it is surface applied.

Recent research by NSW DPI has shown that volatilisation losses from urea applied to the soil surface following broadcast application is much lower than previously thought, which opens the windows for broadcast applications. But questions remain over whether it is not more efficient and safer to incorporate or bury applied urea to minimise volatilisation losses. Options tested to incorporate urea include drilling or banding it into the seed bed or alternatively incorporating urea by sowing (IBS) in the case of tyne planters.

This research evaluates the potential impact on N efficiency of alternate methods of urea application on subsequent wheat yields.

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## Aim

- Compare yield and grain quality response to different N application placements in fallow
- Compare wheat response to various rates of applied N

## Methods

A small plot trial was established in summer fallow and included treatments with the following N application timings.

- Broadcast and incorporated (IBS)
- Drilled
- Broadcast

For the 'broadcast and incorporated' treatments fertiliser was spread by hand on the plots and incorporated using a plot seeder fitted with Horward Bagshaw PSS tyne openers set at 27.5 cm tyne spacings. 'Drilled' banded fertiliser was placed approximately 6-8 cm deep resulting in 3-4 cm of soil cover over the fertiliser band. Broadcast treatments were spread by hand. To ensure that all plots had the same 'tillage' effect, the tyne seeder also passed through the broadcast treatments prior to application. Nitrogen was applied as urea at 4 rates supplying 0, 50, 100, and 200 kg N/ha.

Table 1. Trial site details

| | | | |
|---|---|---|---|
| Trial Establishment Date | Summer 2016 | | |
| Crop and Variety | Wheat - Gregory | Seeding rate | 55 kg/ha |
| Fertiliser treatment application | 7/1/2016 | | |
| Sowing date | 20/5/2016 | Harvest date | 6/12/2016 |
| Seedling equipment | Double Boot Tyne | Row spacing | 27.5 cm |
| Crop Nutrition (kg/ha) | 100 triphos | Soil type | Medium Clay |
| Previous Crop | Canola | Pre-sowing stubble management | Standing stubble |
| Soil residual nutrition (at sowing) | Colwell P ~ 23 ppm, Sulphur KCl~ 7 ppm | Nitrogen | 0-90cm ~ 58 kg/ha |

For the purpose of analysis and discussion unless otherwise stated, treatments and their effects are compared to untreated control (UTC). Outcomes are statistically analysed by ANOVA at a 95% confidence interval with means compared by the LSD method. Any references to differences between treatments should be assumed to be statistically different unless otherwise stated.

## Results

**Rainfall[1]:** Fallow rainfall 234 mm (i.e. 4th January to the 18th May 2016)

[1] Rainfall measured at Premer, Long Paddock site no 055017

In-crop rainfall 538 mm (21st May to the 30th November 2016)

Thirty-two mm of rain fell in the four-day period 13-16th January, starting approximately 6 days after application of N.

There was a response to both nitrogen placement and rate.

**Placement -** there is a significant impact of application method with a yield advantage of ~0.6 t/ha from drilled treatment over 'Broadcast' treatment and broadcast plus incorporated (**Figure 1**). Drilled treatment also achieved significantly higher protein than Broadcast plus incorporated but was not different to broadcast. There was no impact of placement on screenings.

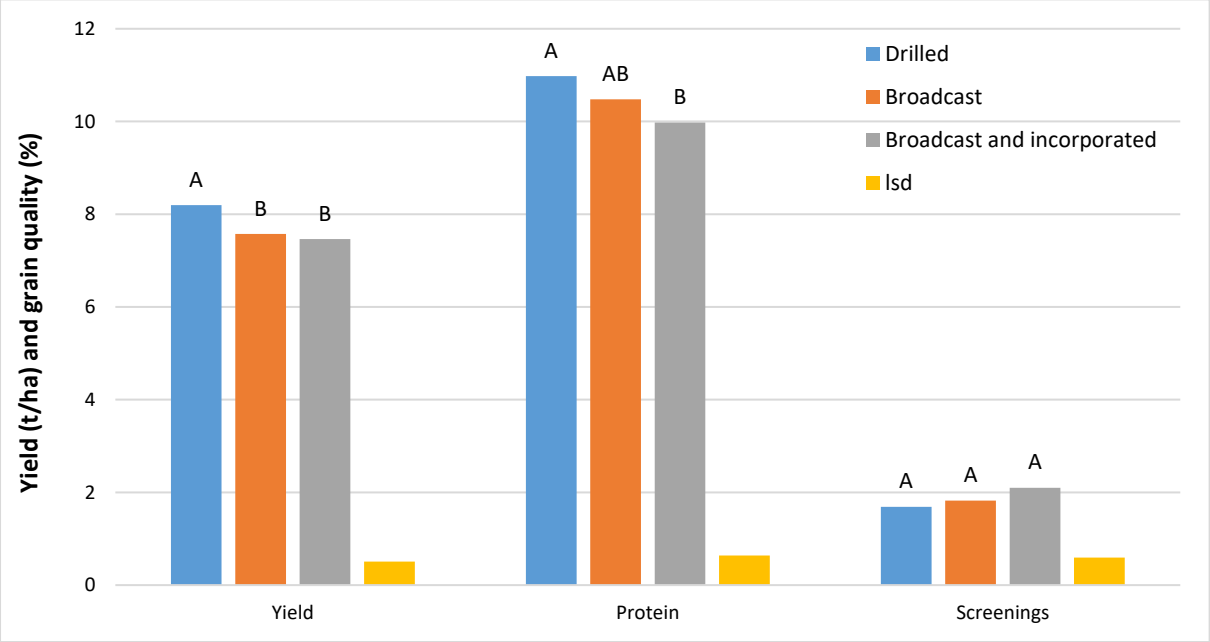


**Figure 1.** Wheat yield (t/ha) and grain quality (%) for nitrogen application techniques.

**Rate -** Increasing N rate increased both yield and protein, but decreased screenings as illustrated in **Figure 2**. The addition of 50 kg N/ha did not significantly increase yields from where no N was applied, however going to higher rates did, resulting in a yield improvement of ~1.7t/ha for the 200 N treatment. All rates of N resulted in significant increases in grain protein up to ~12% for 200 N from ~8.5% for 0N. Screenings tended to decrease with increasing N rates but 0, 50 & 100N were no different with 200N lower than both 0 and 50N.

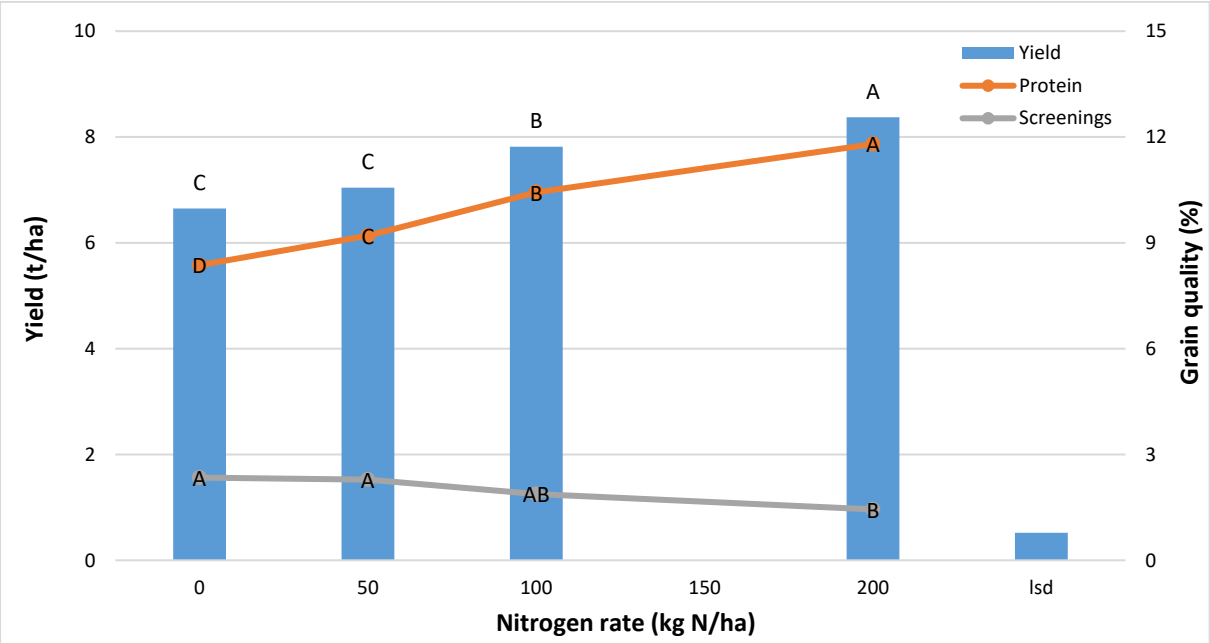


**Figure 2.** Wheat yield (t/ha) and quality by nitrogen rate (kg N/ha)

## Discussion

This was a high yielding site however there remained a strong response to applied N.

Yield response to nitrogen rate was significant, with an almost linear response. Addition of 200 kg N/ha added 1.7 t/ha to grain yield. This suggests that there may have been either further yield increases at higher N rates. There was also a strong, near linear, response in grain protein with increases of 2.6% achieved through the addition of 200N. There was a significant reduction in screening in response to increasing N rates although no impact on wheat quality grades would occur.

There was an influence of application method on both yields and protein. In both cases drilled application was better than alternate application options tested, suggesting that these techniques were less efficient. Around 30 mm of rain fell within the 6-10 days period post N application, and while some research suggests this should have resulted in good incorporation of surface applied N treatments, the 6-10 day period may have exposed surface applied urea to volatilization pathways OR it may be still in the soil.

The yield advantage of drilled applied N was around 0.6t/ha. Applying the optimum N rate resulted in 1.7T/ha yield advantage. Regardless of application method applying sufficient N has a greater influence on yield than how it is applied.

## Conclusion

Drilling urea in the fallow was a more efficient (in terms of conversion of fertiliser to grain and quality) than surface application or broadcasting and incorporating. However high rates of nitrogen, regardless of application method, provide high levels of return on investment in favourable seasons.

## Acknowledgements

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## Appendix -

| N rate (kg/ha) | Application method | Yield (t/ha) | Protein (%) | Screenings (%) | NDVI |
|---|---|---|---|---|---|
| 0 | Drilled | 6.5 E | 8.4 F | 2.2 ABCD | 85.8 ABC |
| 0 | Broadcast and incorporated | 6.6 E | 8.2 F | 2.5 AB | 86.3 A |
| 0 | Broadcast | 6.9 DE | 8.5 EF | 2.3 ABC | 85.8 ABC |
| 50 | Drilled | 7.5 BCD | 9.9 CD | 1.8 ABCD | 86.3 A |
| 50 | Broadcast and incorporated | 6.7 DE | 8.9 DEF | 2.5 AB | 85.9 ABC |
| 50 | Broadcast | 6.9 DE | 8.8 DEF | 2.6 A | 86.0 ABC |
| 100 | Drilled | 8.4 AB | 10.9 BC | 2.0 ABCD | 85.7 BC |
| 100 | Broadcast and incorporated | 7.5 CD | 9.5 DE | 2.2 ABC | 86.1 AB |
| 100 | Broadcast | 7.6 BCD | 10.9 BC | 1.4 CD | 86.3 A |
| 200 | Drilled | 8.7 A | 12.1 A | 1.3 D | 85.6 BC |
| 200 | Broadcast and incorporated | 8.2 ABC | 11.5 AB | 1.6 BCD | 85.5 C |
| 200 | Broadcast | 8.3 ABC | 11.8 AB | 1.5 CD | 85.7 BC |
| LSD | | 0.9 | 1.0 | 1.0 | 0.5 |

Values are grouped by the letter (A, B, etc.) in the adjacent column, values within a group are not significantly different from one another.