GOA Trial Site Report

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

Trial Code: GONU011161

Year: Summer 2016

Location: 'Allawah', Tullamore

Trial Partners: Neville Jones

Keywords

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

Take home messages

Broadcasting or broadcasting and incorporation nitrogen (as urea in the fallow) provide similar yield results to drilling and maybe more cost effective.

There was a very large nitrogen response, in a wet season, indicating significant N deficiency for the rainfall received.

Background

Changes in the regions farming systems is seeing increasing need to apply higher rates of nitrogen (N) to optimise crop performance. Finding opportunities to apply this additional N can be challenging, the traditional method of pre-drilling nitrogen is time consuming, and the windows for topdressing with incorporating rainfall within 2-3 days (and of sufficient amount) can be limiting.

GOA has been undertaking research to understand whether fallow application of nitrogen (N) fertiliser can improve wheat yields and grain quality by using fallow rainfall and time to move nitrogen deeper into the profile. This is partially driven by anecdotal evidence that topdressing N may be less available to crops in a dry finish, sometimes resulting in high screenings and lower than expected protein and yields.

In some of the fallow applied N trials conducted in 2015 on wheat, pre-drilling high N rates in the fallow could not be accounted for in soil testing nor in subsequent yields[1]. The most plausible reason is that some N was lost to denitrification, where very high N rates concentrated in a band were exposed to ideal conditions for denitrification, i.e. hot and wet conditions, that occurred after summer storms.

In addition, 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,

[1] Soil testing 108 days after application could only account for 27% of the applied N where 200 kg/ha applied in the fallow. http://grainorana.com.au/documents?download=100

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, however questions remain over whether it is not more efficient and safer to incorporate or bury applied urea to minimise volatilisation losses.

This led to the question as to whether alternative application methods that reduce concentration of nitrogen could also increase nitrogen usage efficiency. This research may also provide growers with confidence in a range of application options.

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

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 methods.

- Broadcast and mechanically incorporated
- 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 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 – Nitrogen treatments applied on the 4/1/2016		
Crop and Variety	Wheat - Gregory	Seeding rate	55 kg/ha
Sowing date	18/5/2016	Harvest date	28/11/2016
Seedling equipment	Double Boot Tyne	Row spacing	27.5 cm
Crop Nutrition (kg/ha)	100 kg/ha triphos	Soil type	Clay Loam
Previous Crop	Canola	Pre-sowing stubble management	Standing stubble
Soil residual nutrition (at sowing)	Colwell P ~ 39 ppm, Sulphur ~ 6 ppm	Nitrogen	0-30cm ~ 81 kg/ha

For 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[2]: Fallow rainfall 223 mm (i.e. 4th January to the 18th May 2016)

In-crop rainfall 435 mm (19th May to the 28th November 2016)

Fallow rainfall might vary from the actual site. Tullamore Post Office has been used for rainfall figures. 20 mm was recorded in the 3 days directly after application of N fertiliser treatments.

Yield and grain quality: The three application techniques had no influence on yields or grain quality (**Figure 1**).

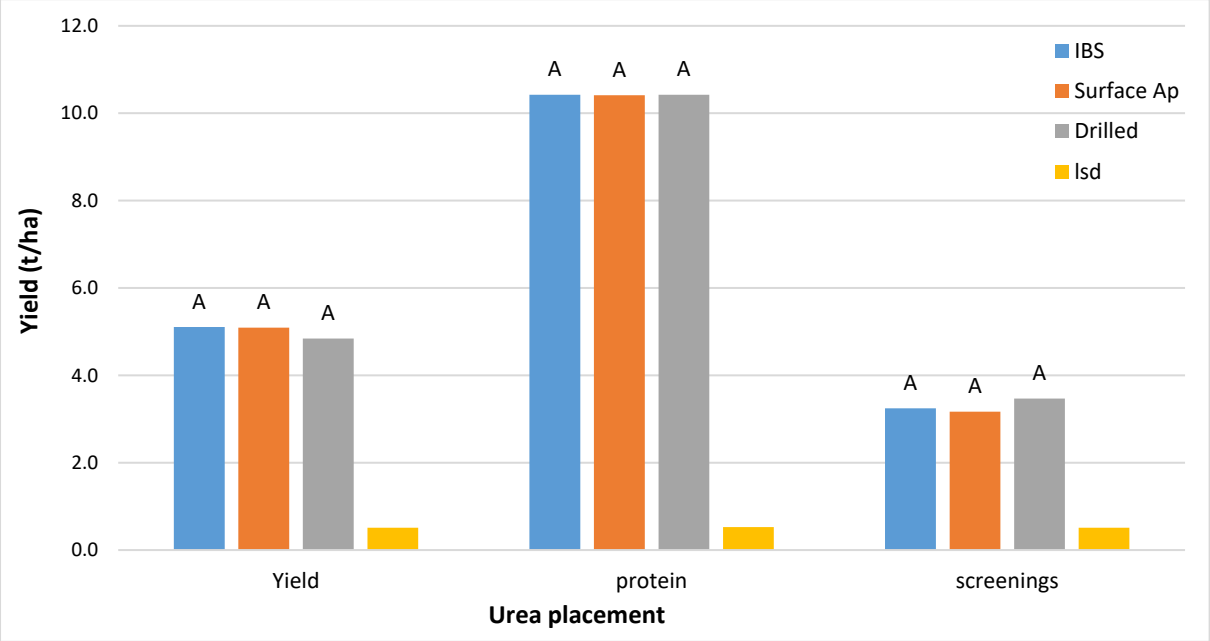

Figure 1. Wheat yield (t/ha) and grain quality for the 3 application techniques.

However, there was a strong response to nitrogen rate (Figure 2). Yields increased by close to 4.0 t/ha with addition of 200 kg N/ha. There was also a positive protein response with levels increasing from 9.7% to 11.3% from no N to 200 kg N/ha. Screenings decreased with increasing rates of N from 4.3% to 2.3% from no N to 200 kg N/ha (**Figure 2**).

[2] Rainfall measured at Tullamore (Old Post Office), site no 050037

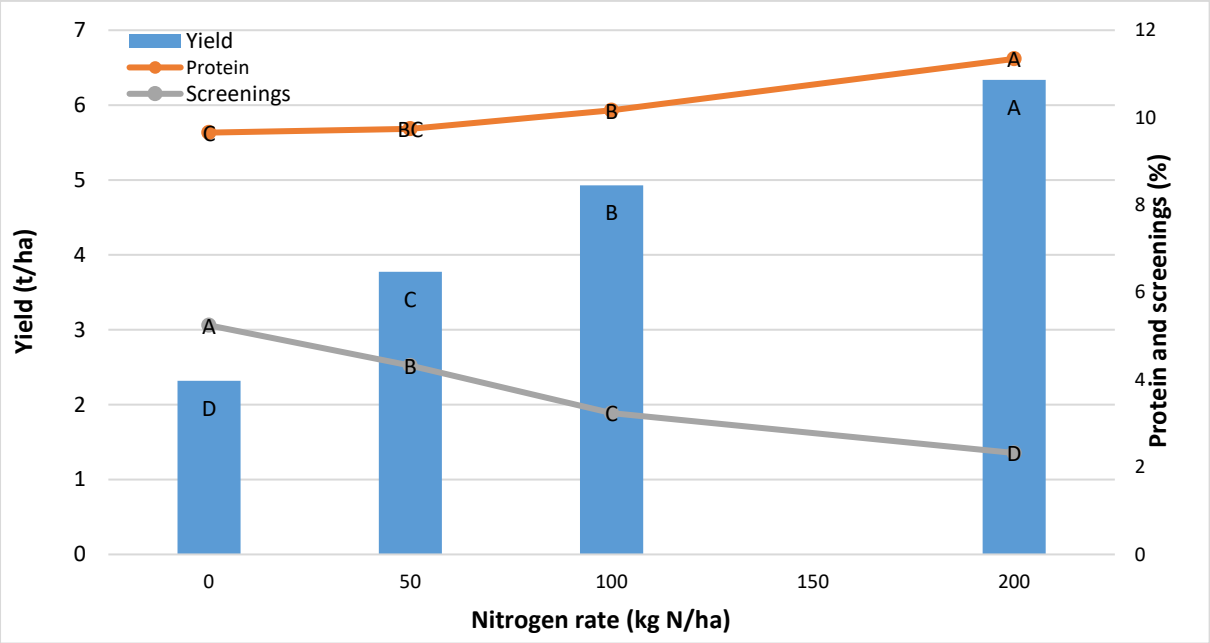

Figure 2. Wheat yield (t/ha) and quality by nitrogen rate (kg N/ha) averaged for all application techniques.

Discussion

Placement of nitrogen fertiliser had no effect on yields or grain quality, indicating that there was not much difference in the efficiency of urea conversion to nitrates between the alternate application methods. Broadcasting with no mechanical incorporation proved to be a viable option. It should be noted that incorporating rain (20mm) fell within three days of fertiliser application which may have well contributed to this result.

The trial site was very N responsive, yield response to increasing nitrogen rates was almost linear, with no indication of haying off. Improvement in grain quality with increasing N is most likely attributable to the favourable seasonal conditions, with 435 mm of in-crop rainfall. The trend of screenings to decrease as N rates increased may possibly be explained by higher levels of disease in the low N treatments (observed but not assessed).

Gross income for the UTC (i.e. where no nitrogen fertiliser was used) was about $330/ha. Change in net profit from application of additional N fertiliser when compared to the untreated was significant. Adding 50 kg N/ha resulted in close to $170/ha additional profit (after fertiliser costs removed). Improved yield and grain quality where 200 kg N/ha lifted the grade and hence price, with net profit increasing by $660/ha more than where no nitrogen fertiliser was used (**Figure 3**)[3].

[3] *Note that these caluclations do not include any costs associated with the spreading or incorporation of the nitrogen.

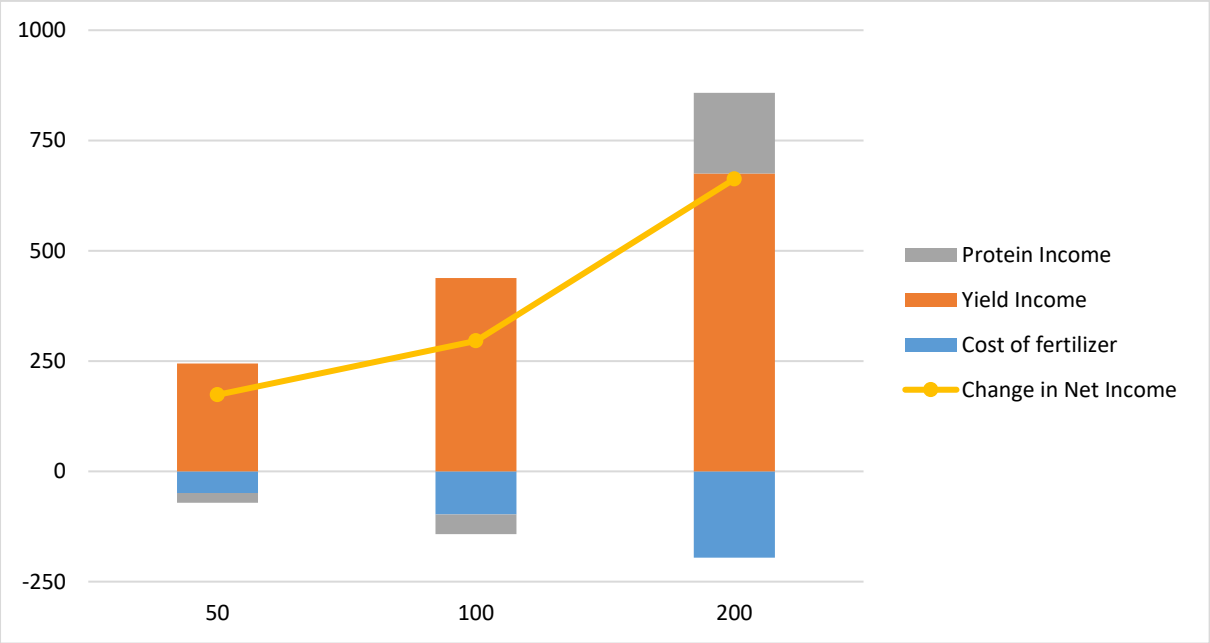

Figure 3. Change in net income ($/ha) for the various treatments (less fertiliser costs)

Conclusion

Under the right circumstances broadcasting and broadcasting plus incorporation provide similar yield results to drilling fertiliser. Broadcasting urea on the fallow was just as effective and less costly (spreading costs) than the other techniques tested. However, further trials are required to validate these findings.

There was a very large nitrogen response, in a very wet season, indicating a possible history of under use of fertilisers.

Acknowledgements

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Appendix -

N rate (kg/ha)	Application method	Yield (t/ha)	Protein %	Screenings %
0	Drilled	2.3 E	9.9 BC	5.8 A
0	Broadcast and incorporated	2.4 E	9.8 BC	5.3 AB
0	Broadcast	2.3 E	9.2 C	4.6 BC
50	Drilled	3.5 D	9.9 BC	4.8 ABC
50	Broadcast and incorporated	4.0 CD	9.9 BC	4.1 CD
50	Broadcast	3.8 D	9.5 BC	4.1 CD
100	Drilled	5.0 B	10.2 B	3.1 DEF
100	Broadcast and incorporated	4.6 BC	10.1 B	3.4 DE
100	Broadcast	5.2 B	10.2 B	3.2 DEF
200	Drilled	6.1 A	11.2 A	2.4 EF
200	Broadcast and incorporated	6.7 A	11.2 A	2.3 F
200	Broadcast	6.2 A	11.6 A	2.3 F
	LSD	0.8	0.8	0.1

Values followed by letter in the same letter in adjacent columns indicate that there is no significant difference between the values.