GOA Trial Site Report

Wheat – comparison of fallow nitrogen application methods

Trial Code: GONU01117

Year: Summer 2016

Location: 'Old Gwandalan", Peak Hill, NSW

Trial Partners: Paul Bell

Keywords

GONU01117, wheat nutrition, nitrogen placement, banding, broadcast, fallow nitrogen, Peak Hill

Take home messages

Under the right circumstances broadcasting and incorporating provide similar yield results to drilling urea fertiliser.

Application of urea to a moist soil surface may result in volatilization losses and should be avoided.

Even in a very dry season there was a good case for use of nitrogen.

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 the summer fallow and included treatments with the following N application timings.

- Broadcast and incorporated (B&I)
- Drilled
- Broadcast
- Untreated control – no applied nitrogen

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	Autumn 2016 – Nitrogen treatments applied on the 29/3/2017		
Crop and Variety	Wheat - Gregory	Seeding rate	55 kg/ha
Sowing date	16/5/2017	Harvest date	21/11/2017
Seedling equipment	Double Boot Tyne	Row spacing	27.5 cm
Crop Nutrition (kg/ha)	150 triphos	Soil type	Clay Loam
Previous Crop	Canola	Pre-sowing stubble management	Standing stubble
Soil residual nutrition (at sowing)	Colwell P ~ 26 ppm, Sulphur ~ <5 ppm	Nitrogen	0-60cm ~ 56 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 30 mm (i.e. 29th March to Sowing)

In-crop rainfall 142 mm (sowing till harvest)

Yield and grain quality: Drilling urea resulted in 0.5 t/ha higher yield in the subsequent crop than where it was broadcasting (both applied in the fallow period). There was a similar trend in the protein levels with the drilled slightly higher (12.1%) than the broadcast (11.7%) (**Figure 1**).

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

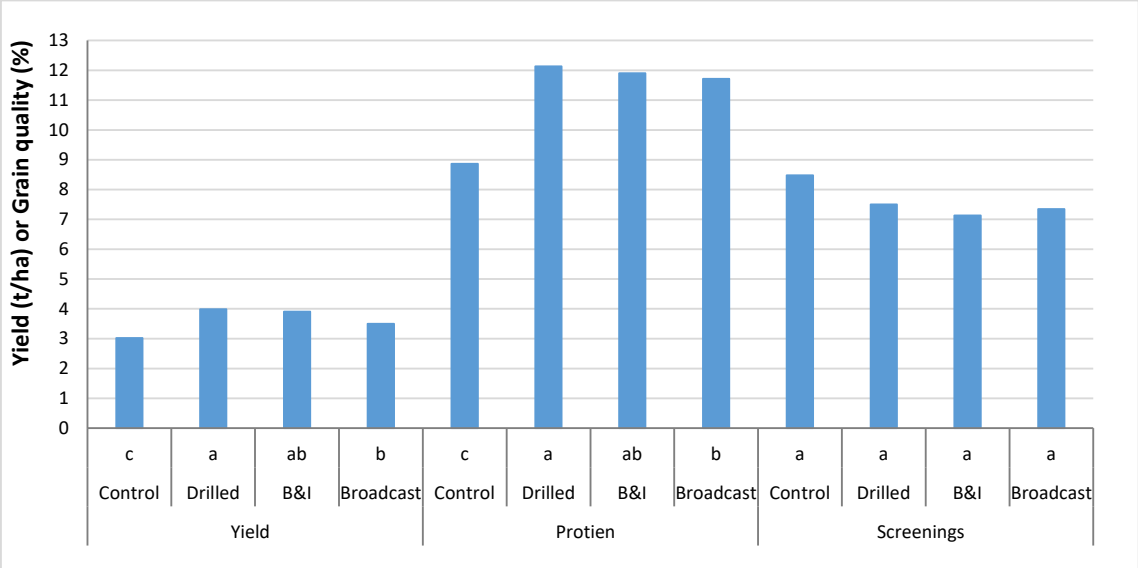

Figure 1. Wheat yield (t/ha) and grain quality for 3 application techniques (regardless of rate) compared to untreated control. Data within each variable with the same letter are not significantly different.

There was a stronger response to nitrogen (Figure 2). Yields increased by close to 0.7 t/ha with addition of 50 kg N/ha, but tended to plateau at the higher N rates. There was also a positive protein response with levels increasing from 8.9% to 12.8% from no N to 200 kg N/ha. Screenings decreased with increasing rates of N from 8.5% to 6.7% from no N to 200 kg N/ha (**Figure 2**).

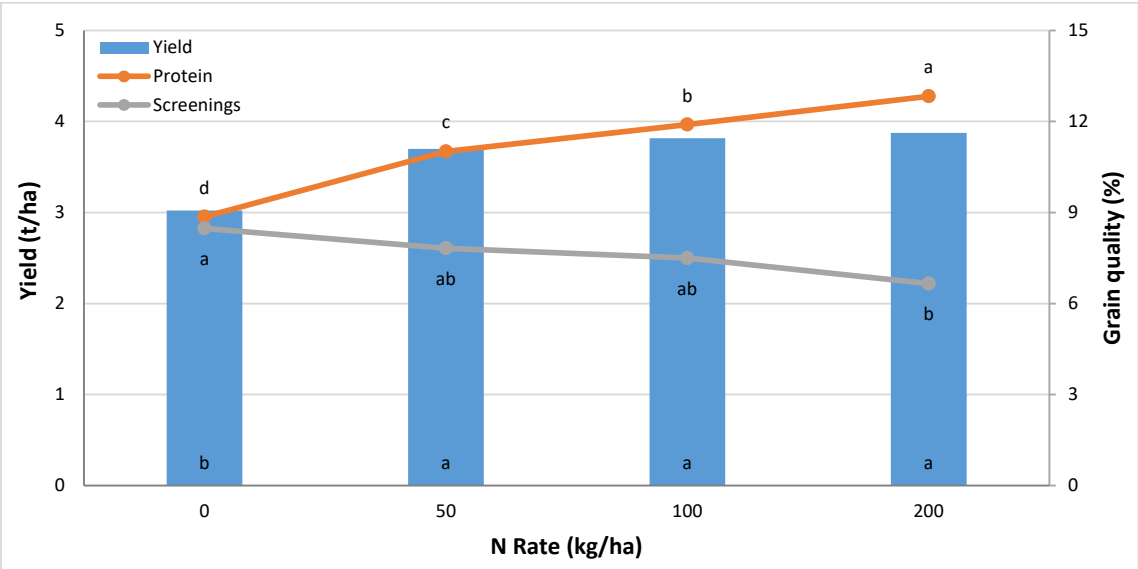

Figure 2. Wheat yield (t/ha) and quality by nitrogen rate (kg N/ha) for all application techniques. Data within each variable with the same letter are not significantly different.

Discussion

Broadcasting N as urea did reduce the yield and protein when compared to banding the fertilizer, resulting in a reduction of 0.5 t/ha in yield and 0.4% in protein. The 2017 season was very dry. Of 142 mm in crop rain, 40 mm fell 5 days after planting and a further 60 mm fell in October. Nitrogen

broadcast on the soil surface would have been incorporated by post sowing rain but availability to the emerging crop may have been limited. The effect on grain quality could have been caused by rain in October, but it likely was too late to influence yields, however not too late to impact of protein and screenings.

The 'broadcast' treatment was applied to soil that had just been worked (to mitigate any 'tillage' effects between treatments') and an observation recorded at the time was that the surface was 'moist'. Ironically this action may have introduced a tillage effect, as the application to wet soil may have resulted in some volatilization and hence the yield and quality reductions.

Yield response to increasing nitrogen rates levelled at 50 kg/ha, almost certainly due to the dry season. However yields and grain quality were not adversely impacted at high N rates, and significant improvements in quality were observed.

Conclusion

Spreading then incorporating N can be as efficient as predrilling fertiliser, however applying N to moist soil can reduce its utilisation efficiency.

Avoid spreading urea onto moist soil or stubble unless rain is imminent.

Even in a very dry season there was a good nitrogen response, indicating a possible history of under use of fertilisers.

Acknowledgements

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DISCLAIMER — TECHNICAL

Appendix -

N rate (kg/ha)	Application method	Yield (t/ha)	Protein %	Screenings %
0	Broadcast	3.0	8.9	8.5
50	Drilled	3.7	11.0	8.4
50	Broadcast and incorporated	3.8	11.5	7.5
50	Surface	3.6	10.5	7.6
100	Drilled	3.7	12.3	7.6
100	Broadcast and incorporated	4.0	11.5	8.0
100	Surface	3.7	11.9	6.9
200	Drilled	4.5	13.1	6.6
200	Broadcast and incorporated	3.9	12.7	5.8
200	Surface	3.2	12.7	7.6
LSD		ns	ns	ns

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