

4.7 Different sowing and topdressing nitrogen options in wheat - Inverleigh, Vic

Location: SFS Inverleigh Research Site

Funding:

This trial was funded by Incitec Pivot Fertilisers

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Acknowledgements:

Southern Farming Systems for site selection and preparation

Summary of findings:

- The application of 40 kgN/ha at sowing resulted in significant yield responses from all products over the control where only starter fertiliser was applied.
- Fertilisers banded at sowing generally resulted in higher yields and grain N recovery then top dress applications, while the inverse was true for grain protein levels.
- Low grain protein levels (less than 10.5%) for all treatments and application timings generally indicates that yield was not optimised due to limited nitrogen supply.
- There were no significant responses found from the use of inhibitors in this trial.

Background/Aim:

Incitec Pivot Fertilisers continues to evaluate a range of enhanced efficiency nitrogen fertilisers (EENF) to demonstrate their value in modern cropping systems. By retaining nitrogen in forms that are less susceptible to loss, these products have the potential to increase the efficiency with which nitrogen is used and to reduce the environmental impacts of nitrogen fertilisation. This trial aims to assess the potential production benefits of various EENFs and liquid fertiliser strategies.

Rainfall:

2011 Total:	595mm
Avg. Annual:	548mm
2011 G.S.R.:	377mm
Avg. G.S.R.:	407mm

Paddock History:

2009:	Barley
2010:	Wheat

Variety: Beaufort wheat

Sowing rate: 80 kg/ha

Sowing date: 10 June 2011

Harvest date: 15 Dec 2011

Herbicide:	10-Jun-11	Roundup Power Max at 1.5 L/ha
	5-Aug-11	Lontrel at 100 ml/ha plus Hussar at 100 g/ha.

Fungicide:	26-Sep-11	Laguna at 290 ml/ha plus 1% DC Trate
	3-Nov-11	Laguna at 290 ml/ha plus 1% DC Trate

Plot size: 17.4m x 1.74m x 3 reps.

Plot type: Flats

Measurements: Yield, grain moisture %, protein %, screenings and test weight.

Tillage type: Sown with 6 row cone seeder with knife points.

Trial information:

A field trial was established at Inverleigh to evaluate the response of wheat (cv. Beaufort) to nitrogen banded at sowing or top-dressed at the 5 leaf stage or jointing. Various straight, compound and liquid nitrogen fertilisers were evaluated and where appropriate these products were treated with urease and nitrification inhibitors (ie. Agrotain, UI V2 evaluation inhibitor and Entec).

Soil analysis indicated the site should be responsive to nitrogen with deep N soil test results (40cm) showing a total of 33.6 kgN/ha was present prior to establishing the trial. The complete soil analysis results from the site are presented in Table 1. Various fertilisers were banded at sowing or top dressed at crop stages DC15 (5/8/2011) or DC31 (8/9/2011) as indicated in Table 2. All fertiliser treatments supplied the equivalent of 40 kg/ha of applied nitrogen. In addition, at sowing all plots received a basal application of Granulock Z at 115 kg/ha to ensure that P was not limiting.

Table 1. Initial Soil test results summary

Soil Test Analyte	Result
Sample Depth To	0-10cm
Sampling Date	8 Apr 2011
pH (1:5 CaCl ₂)	6.2
Elec. Cond. (Sat. Ext.) dS/m	0.1
Chloride (mg/kg)	24
Nitrate Nitrogen (NO ₃) mg/kg	12
Ammonium Nitrogen (KCl) mg/kg	3.3
Phosphorus (Colwell)	91
Phosphorus Buffer Index (PBI-Col)	52
Available Potassium (mg/kg)	300
Calcium (Amm-acet.) Meq/100g	4.6
Calcium/Magnesium Ratio	6.6
Cation Exch. Cap. Meq/100g	6.21
Sodium % of Cations (ESP) mg/kg	2.3
Copper (DTPA) mg/kg	0.29
Iron (DTPA) mg/kg	98
Manganese (DTPA) mg/kg	4.5
Zinc (DTPA) mg/kg	0.99
Boron (Hot CaCl ₂) mg/kg	0.94
Sulfate Sulfur (KCl40) mg/kg	6.5
Organic Carbon (OC) %	1.2
Soil Colour	Brown
Soil Texture	Sandy Loam
Disp. Index, Loveday/Pyle	2
Slaking 2Hrs	Water stable

Table 2: Treatments and nutrient rates applied (kg/ha)

Treatment	Product	N%	N sowing	N DC15	N DC 31	Product rate kg/ha
1	Control	0	0			0
2	S Coated Urea	39	40			102.6
3	Urea	46	40			87.0
4	Gran AM	20.2	40			198.0
5	Entec GranAM ; Urea	30.52	40			131.1
6	Urea with organic amendment	46	40			87.0
7	CalGran	23.9	40			167.4
8	Entec Urea	46	40			87.0
9	Entec Gran Am	20.2	40			198.0
10	S Coated Urea	39		40		102.6
11	Urea	46		40		87.0
12	Entec Urea	46		40		87.0
13	CalGran	23.9		40		167.4
14	Entec Gran AM: Urea (60:40)	30.52		40		131.1
15	Easy N	32		40		125.0
16	Green Urea	46		40		87.0
17	UI V2 evaluation inhibitor	46		40		87.0
18	Gran AM	20.2		40		198.0
19	Entec Gran AM	20.2		40		198.0
20	S Coated Urea	39			40	102.6
21	Urea	46			40	87.0
22	Entec Urea	46			40	87.0
23	CalGran	23.9			40	167.4
24	Entec Gran AM : Urea (60:40)	30.52			40	131.1
25	Easy N	32			40	125.0
26	Green Urea	46			40	87.0
27	UI V2 evaluation inhibitor	46			40	87.0
28	Gran Am	20.2			40	198.0

Results and discussion:

The application of 40 kgN/ha at sowing resulted in significant yield responses from all products over the control, however yield responses were not statistically different between any individual fertiliser treatments applied at sowing (Table 3). With only 3 replicates used in this trial, this may have been a function of trial site variability, (ie. relatively high CV value). Gran Am banded at sowing produced the highest yield in the trial and also performed consistently as a top dress application option. While not statistically significant, a sulphur response at this site is likely given the yields of Gran Am and CalGran when compared with urea. Yields and grain N recovery were generally higher and often significantly higher from fertilisers banded at sowing compared with top dress applications at 5 leaf stage or jointing.

The addition of nitrification inhibitors to urea or Gran Am provided no response at sowing or top dress application timings. Similarly the yield responses of urea treated with various urease inhibitors were not significantly different from urea alone. Results were also confounded by inconsistent performance of the urease inhibitor treatments, with the evaluation inhibitor (UI V2) performing better than urea, though not significant, and Green urea not as well as urea alone. Further research on soil activity of urease and nitrification potential is being undertaken to better determine situations where a response to using inhibitors is likely. Based on our preliminary research this site was of low activity and therefore use of inhibitors will unlikely see any potential response on this site. Further work is being undertaken to validate this assessment.

Overall, low grain protein levels (less than 10.5%), across all treatments and application timings indicates that yield may have been limited by nitrogen deficiency. There were significant protein responses in delaying application from sowing to top dress at DC31 stage, although this was at the expense of yield. With a couple of exceptions, grain protein levels were generally not statistically different between treatments within application timings. In this trial the liquid (Easy N) treatment did not perform as well as urea, though not significant.

Table 3: Results

			Grain Yield	Grain Protein	Grain Fert N recovery	Screenings	Test Weight
Treatment	N rate kg/ha	Growth Stage	t/ha	%	%	%	kg/hL
Control	0		2.17	8.9		0.7	66.9
S Coated Urea	40	Sowing	3.30	9.0	45.7	0.4	69.2
Urea	40	Sowing	3.66	9.0	59.7	0.5	67.7
Gran AM	40	Sowing	3.94	9.3	76.0	0.4	67.8
Entec GranAM ; Urea	40	Sowing	3.62	8.9	56.5	0.5	70.1
Urea + organic amendment	40	Sowing	3.23	9.1	44.0	0.4	69.6
CalGran	40	Sowing	3.62	9.2	61.3	0.7	67.8
Entec Urea	40	Sowing	3.20	9.3	45.8	0.6	69.1
Entec Gran Am	40	Sowing	3.32	8.9	45.0	0.7	69.3
S Coated Urea	40	DC15	2.13	9.5	4.3	1.0	65.3
Urea	40	DC15	2.72	9.5	28.5	0.8	67.8
Entec Urea	40	DC15	3.04	9.7	44.5	0.8	68.1
CalGran	40	DC15	3.40	9.4	55.4	0.7	68.9
Entec Gran AM: Urea	40	DC15	2.96	8.7	28.2	0.7	69.9
Easy N	40	DC15	2.04	9.4	-0.7	1.1	66.6
Green Urea	40	DC15	2.36	9.3	11.4	1.0	65.8
UI V2 evaluation inhibitor	40	DC15	3.33	9.4	52.7	0.8	65.9
Gran AM	40	DC15	3.30	9.4	51.3	0.8	66.6
Entec Gran AM	40	DC15	3.01	9.5	40.6	0.7	67.9
S Coated Urea	40	DC 31	2.90	10.0	42.4	0.7	66.1
Urea	40	DC 31	3.09	9.9	49.2	0.7	68.1
Entec Urea	40	DC 31	2.76	9.6	31.5	0.7	67.7
CalGran	40	DC 31	1.98	9.7	-0.2	1.4	67.3
Entec Gran AM : Urea	40	DC 31	3.10	10.0	51.0	0.9	65.9
Easy N	40	DC 31	2.78	9.5	31.3	1.0	67.4
Green Urea	40	DC 31	2.53	9.8	24.1	0.9	66.6
UI V@ evaluation inhibitor	40	DC 31	3.23	10.2	59.7	0.6	65.3
Gran Am	40	DC 31	3.39	9.8	61.1	0.8	66.8
		CV	16.40	3.5		33.2	3.0
		LSD	0.81	0.6		0.4	NSD

Summary:

Incitec Pivot Fertiliser will continue to assess the place and value of enhanced efficiency nitrogen fertilisers with future research to incorporate methodologies for predicting responses in different soil types and situations. This trial does highlight the importance of nitrogen application rate and timing in ensuring that grain yield and protein levels are optimised.