

3.4 Cereal Nutrition / Canopy Management Trials

3.4.1 Enhanced efficiency nitrogen fertilisers in wheat - Inverleigh, Vic

Location:

Inverleigh Research Site.

Funding:

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Researchers:

Incitec Pivot Fertilisers

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Acknowledgements:

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Background/Aim:

Incitec Pivot Fertilisers has been assessing a range of enhanced efficiency nitrogen fertilisers (EENF) in recent years. EENFs retain nitrogen in forms that are less susceptible to specific loss mechanisms e.g. volatilisation, leaching and denitrification.

The adoption of EENFs has ramped up globally in recent years, possibly due to a spike in nitrogen prices along with a desire to keep nutrients where they are placed. Locally, the adoption of liquid fertilisers has accelerated in the last five years.

Two EENFs have shown promise at SFS trial sites in recent years. The nitrification inhibitor DMPP (ENTEC®) has generated significant production increases when applied with urea at sowing when reasonable winter rainfall has occurred.

The urease inhibitor NBPT (Green Urea™) has given significant production increases under situations where nitrogen is top-dressed late in the season and follow-up rainfall has been minimal in the days following application.

This trial aimed to test these EENFs and liquid fertiliser strategies.

Take home messages:

- Trial work with Southern Farming Systems over the past four years has demonstrated significant improvements in nitrogen efficiency from applying ENTEC® treated urea to wheat crops, compared to untreated urea.
- The experiment this year showed no response to nitrogen, but did highlight some important tools for predicting the likelihood of nitrogen response.

Rainfall:

Avg. Annual: 620 mm
Avg. G.S.R.: 413 mm
2009 Total: 502.1 mm
2009 G.S.R.: 379.7 mm

Treatments:

All treatments were applied at sowing by banding approximately 4 cm below the seed line.

Product	Description	Nitrogen fertiliser application rate (kg N/ha)		
Control	Only starter fertiliser applied	0		
Urea	The standard N fertiliser		50	100
Urea with ENTEC®	The nitrification inhibitor DMPP		50	100
Urea with Nutrisphere®	A new inhibitor from the United States		50	100
EASY N®	Urea ammonium nitrate solution		50	100
EASY N with ENTEC	The nitrification inhibitor DMPP		50	100

Source: Incitec Pivot Fertilisers, 2010

Plot size: 20 m x 1.75 m x 4 reps.

Herbicides: Trifluralin / Logran

Measurements:

- Pre-plant soil samples
- Plant tissue samples and dry matter measurements at DC41
- Harvest measurements:
 - Yield
 - Protein
 - Screenings

Soil Type: Brown sandy clay loam

Soil test (0 – 10 cm):

NH₄⁺ N = 4.9 mg/kg
Organic Carbon = 0.87%
PBI = 55
KCl-40 S = 17 mg/kg
NO₃⁻ N = 22 mg/kg
Colwell P = 44 mg/kg
pH = 5.8

Soil characteristics provided by SFS

Variety: Derrimut

Sowing rate: 75 kg/ha

Disease levels: low disease levels

Sowing date: 22 May 2009

Tillage type: zero

Fertiliser:

Granulock® SuPreme Z® at 70 kg/ha

Results and discussion:

What is clear from the outset is that nitrogen was never limiting in this trial. This is based on three pieces of information:

1. Soil tests – 22 mg NO₃ N in top 0-10cm
2. Dry matter samples indicated only minimal or no responses to nitrogen.
3. Grain protein – all grain proteins including the control were within the 'critical' range of 11 – 12%. Proteins in this range generally indicate adequate nitrogen was available for the crop but water was more likely to be a limiting factor. The likelihood of yield responses to nitrogen in wheat decreases as protein exceeds around 11.5%, whereas lower proteins (less than 10.5%), generally indicate that yield has been sacrificed possibly due to nitrogen deficiency.

While the lack of response is disappointing from the perspective of the trial and may be partially attributed to the drier than average year and possibly heat during grain fill, it highlights the fact that simple, cost effective diagnostics exist to assist grain growers in making nutrient decisions:

- Deep N soil tests are a reliable way of segmenting paddocks into nitrogen responsive, borderline and likely to be non-responsive areas. Soil testing allows growers to have a good understanding of nutrient levels in the soil for the season ahead. Application of nitrogen fertilisers on paddocks with low levels of inorganic nitrogen can significantly lift yield potential.
- Grain protein of the previous crop should always be observed – if a paddock has returned particularly low protein, growers should consider that the following season's crop is likely to be nitrogen responsive and may want to look at returning the paddock to a legume pasture phase.
- The other simple diagnostic tool is to apply some nitrogen strips at or close to sowing to monitor throughout the crop. If as the crop starts to grow, these strips start showing, then it may be time to apply additional nitrogen.

Table 1: Inverleigh in-crop dry matter results at DC41 (kg/DM/ha)

Product	0 kg N /ha	50 kg N/ha	100 kg N/ha
Control	5704		
EASY N		6173	5847
ENTEC EASY N		5673	6211
Urea		5812	5906
ENTEC Urea		6056	6273
F pr.	0.017		
lsd	358.3		
cv%	4.2		

Table 2: Inverleigh yield (t/ha) and protein (%)

Product	0 kg N /ha	50 kg N/ha	100 kg N/ha
Control	4.19 (11.1)		
EASY N		4.57 (11.8)	4.24 (12.2)
ENTEC EASY N		4.15 (11.3)	4.39 (12.1)
Urea		4.26 (10.9)	4.26 (12.1)
ENTEC Urea		4.12 (11.6)	4.10 (12.4)
Urea + Nutrisphere		4.08 (11.5)	4.17 (11.9)
F pr.	0.157 (0.341)		
lsd	0.33 (1.256)		
cv%	5.4 (7.4)		

Table 3: Inverleigh apparent nitrogen use efficiency (%) and screenings (%)

Product	0 kg N /ha	50 kg N/ha	100 kg N/ha
Control	- (2.4)		
EASY N		26.1 (2.0)	9.6 (2.5)
ENTEC EASY N		2.6 (1.6)	11.7 (3.4)
Urea		0.6 (1.8)	9.4 (3.3)
ENTEC Urea		5.4 (2.3)	7.9 (3.7)
Urea + Nutrisphere		2.8 (2.8)	5.5 (3.0)
F pr.	0.08 (0.046)		
Isd	15.1 (1.35)		
cv%	141.4 (35.8)		

While there are some significant differences between screenings, these are discounted due to the very high co-efficient of variance.

Summary:

Incitec Pivot Fertilisers will continue to assess the place and value of enhanced efficiency nitrogen fertilisers. While this site was not nitrogen responsive, it did highlight three pieces of simple information that can help in making profitable nitrogen decisions.

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