New nitrogen sources for improved efficiency

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Aim

To assess the logistical advantages and crop safety of resin coated urea relative to standard urea for use in WA agriculture.

Background

Nitrogen strategy and risk management can be difficult issues for farmers to address. One possible new technology to reduce both leaching and volatilization is resin coated urea, and this trial was designed to examine this strategy in comparison to more traditional products (Urea and UAN). This resin coating (Figure 1) forms a physical barrier to mineralization of the Urea and can be varied in thickness to increase the delay between seeding and N becoming available.

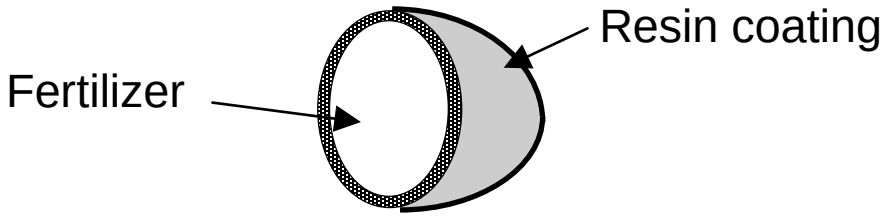

Figure 1. Diagram of Coated Urea

In recent years there has been a large increase in the number of growers who band UAN at seeding, which places a large amount of nitrogen in a highly leachable form beneath a plant without any root system to take up that N. Similarly there has been reduction in the amount of urea being spread IBS due to logistical concerns, and the importance of herbicide incorporation.

The aim of this experiment is to examine the possible agronomic and logistical advantages of coated Urea with the use of standard urea.

Trial Details

Plot size & replication	15m x 1.84m x 3 replications
Soil type:	Sandy Loam
Sowing date:	5/6/10
Seeding rate:	75 kg/ha, var. Wyalkatchem
Fertiliser (kg/ha)	5/6/10: 100 kg/ha MAPSZC, 100 kg/ha SOP
Herbicides:	5/6/10: 2.5 L/ha Glyphosate, 2.5 L/ha Trifluralin, 1.8 L/ha Avadex Xtra, 600 mL/ha Diuron 1/7/10: 300 mL/ha Axial, 800 mL/ha Precept, 50 mL/ha Brodal
Insecticides:	5/6/10: 1 L/ha Chlorpyriphos, 400 mL/ha Alphacypermethrin
Growing Season Rainfall	166mm (Buntine)

Table 1 : Treatment List.

No.	Name	Rate	Unit	N Rate (kg N/ha)	N source	Time of application
1	0 N	0	kg/ha	0		
2	CU 25 (3 WBS)	58.1	kg/ha	25	Coated Urea	3 weeks before seeding
3	Urea 25 (3 WBS)	54.3	kg/ha	25	Urea	3 weeks before seeding
4	CU 50 (3 WBS)	139.5	kg/ha	50	Coated Urea	3 weeks before seeding
5	Urea 50 (3 WBS)	130.4	kg/ha	50	Urea	3 weeks before seeding
6	CU 25 (WS)	58.1	kg/ha	25	Coated Urea	Drilled with seed
7	Urea 25 (WS)	54.3	kg/ha	25	Urea	Drilled with seed
8	CU 50 (WS)	139.5	kg/ha	50	Coated Urea	Drilled with seed
9	Urea 50 (WS)	130.4	kg/ha	50	Urea	Drilled with seed
10	Urea 50 (3-4 WAS)	130.4	kg/ha	50	Urea	Topdressed 4 weeks after seeding

Results

There were no significant differences between plant emergence for the untreated control and any of the top dressed nitrogen treatments (as expected) (Figure 2). Drilling Urea with the seed at the higher rate resulted in significantly lower plant emergence than all other treatments, while the resin coated urea showed no significant decrease in emergence at either rate.

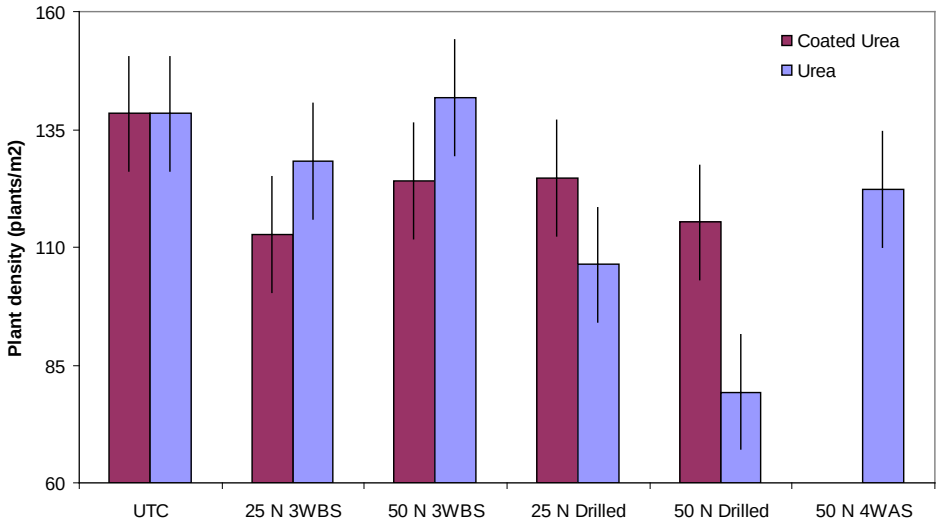

Figure 2. Plant emergence (plants/m^2) measured at 59 DAS.

Grain yields at the site were responsive to nitrogen, with all standard urea treatments yielding significantly higher than the untreated control, with increases ranging from 0.35-0.7 t/ha (Figure 3). Both top dressed coated urea treatments were equal to the untreated control, and both were they significantly less than the equivalent urea treatment, which suggests that the coating persists for a long period when it is present in dry top soil.

Coated urea was as effective as standard urea when drilled at 50 kg N/ha, however it yielded less when applied at the lower rate. Due to the extremely dry finish to the season there was no penalty in having significantly lower plant emergence for the standard urea drilled treatments.

It is worth noting that in the absence of significant rainfall in the three weeks prior to seeding, there was very little nitrogen loss from the standard urea treatments at this site.

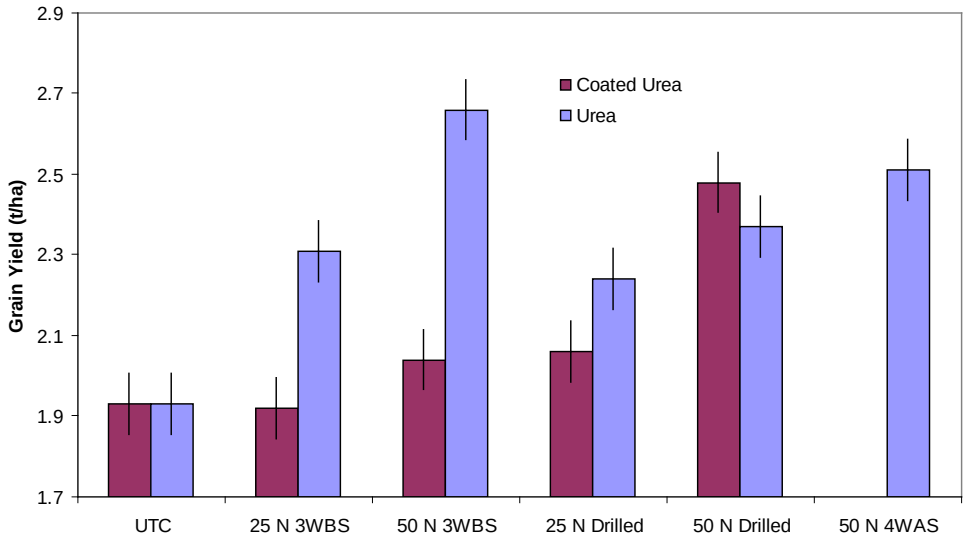

Figure 3. Grain Yield (t/ha) for each treatment as measured at crop maturity.

Table 2: Yield, quality and grade of wheat sown at Xantipee.

No.	Name	Rate	Unit	Vigour (0-100)	Grain Yield (t/ha)	Protein (%)	H/Weight (kg/hL)	Screenings (%)
1	0 N	0	kg/ha	5.7 bc	1.92 d	8.40 d	79.7 a	3.23 e
2	CU 25 (3 WBS)	58.1	kg/ha	4.7 cd	1.92 d	9.00 cd	79.1 a	3.70 de
3	Urea 25 (3 WBS)	54.3	kg/ha	8.0 a	2.31 c	9.78 b	77.4 a	5.10 ab
4	CU 50 (3 WBS)	139.5	kg/ha	6.0 b	2.04 d	9.67 b	78.6 a	4.29 bcd
5	Urea 50 (3 WBS)	130.4	kg/ha	9.0 a	2.65 a	11.17 a	77.9 a	5.42 A
6	CU 25 (WS)	58.1	kg/ha	5.7 bc	2.06 d	9.67 b	79.9 a	4.54 a-d
7	Urea 25 (WS)	54.3	kg/ha	5.7 bc	2.24 c	9.60 bc	80.1 a	3.90 cde
8	CU 50 (WS)	139.5	kg/ha	6.3 b	2.48 b	10.17 b	78.0 a	4.96 ab
9	Urea 50 (WS)	130.4	kg/ha	4.3 d	2.37 bc	11.00 a	79.1 a	4.84 abc
10	Urea 50 (3-4 WAS)	130.4	kg/ha	8.3 a	2.51 b	11.27 a	79.0 a	4.78 abc
LSD (P=.05)				**1.27**	**0.14966**	**0.658**	**2.118**	**1.0506**
Standard Deviation				**0.74**	**0.08646**	**0.382**	**1.2294**	**0.6098**
CV				**11.59**	**3.84**	**3.83**	**1.56**	**13.62**
Treatment F				**13.531**	**26.652**	**18.221**	**1.616**	**3.812**
Treatment Prob(F)				**0.0001**	**0.0001**	**0.0001**	**0.1883**	**0.0085**

Means followed by same letter do not significantly differ (P=.05, LSD)

All nitrogen treatments had higher grain protein than the untreated, although this increase was not significant for the coated urea at 25 kg N/ha. Application of nitrogen also increased screenings for all treatments, although again this increase was not significant for the low rate coated urea 3 WBS. Both of these results further suggest that the coating for this treatment did not break down during the early parts of the growing season.

Comments

There was very little nitrogen loss with standard urea through pre topdressing at this site. This suggests that the timing of top dressing applications prior to rain may be less important on acidic sands. This may expand the timing window for nitrogen topdressing on these soils during the season.

The resin coating evaluated in this trial appears to work well when drilled and banded, but did not break down when topdressed. Further work may continue to investigate agronomic suitability in WA.

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