3.1 Investigation of the benefits of specialty nitrogen products and liquid nitrogen options in cereals

Location: Inverleigh Victoria

Funding: Grains Research and Development Corporation

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Rainfall: 223 mm GSR (April – November)

Summary of Findings:

As a result of the very poor seasonal conditions, there is very little that can be taken from this trial. Data sets on early growth at Z15 and Z30, which was done to evaluate the relative release rates of the fertilizers and management treatments showed very few differences. The data collected showed that even at the early stages of growth, there was no evidence of altered N uptake rates in the field experiments as a result of the amendments supplied with the urea.

Background:

It is now well accepted that post sowing application of nitrogen to cereals (and possibly canola) can provide equal or better results than pre-drill/at sowing applications. Environmental issues are also becoming more prominent with respect to nitrogen use. Logistically post sowing applications can be difficult, particularly in areas with unreliable rainfall patterns. The following questions are often asked:

(i) Is there a nitrogen product that can be applied at sowing that will have a slow or delayed release?

(ii) Are there alternate safer means other than spreading urea when the likelihood of rainfall is low or alternatively are there methods that will allow rapid application rain is imminent?

(iii) Are products or application technologies available that can limit losses of N to the environment?

(iv) Is the application of liquid nitrogen sources a viable alternative?

The use of nitrification & urease inhibitors and/or liquid nitrogen sources potentially answers some of these questions, while if anything improving environmental outcomes on the farm.

As an integral part of the GRDC Nutrient Management Initiative, Incitec Pivot in co-operation with Melbourne University, DPI Victoria, Birchip Cropping Group and Southern Farming Systems has trialled the following products at a range of nitrogen application rates and timing of applications (see table below) to answer some of the above questions. The trial was also repeated at Hopetoun (Mallee) and at Kalkee (Wimmera) using 0.5 rates of N applied at Inverleigh

Trial products/treatments at Inverleigh (Table1)

Treatment no	Treatment
1	Control - 0 Nitrogen
2	Urea deep banded at sowing @ 20kgN/ha
3	Urea deep banded at sowing @ 40kgN/ha
4	Urea deep banded at sowing @ 80kgN/ha
5	Urea deep banded at sowing @ 160kgN/ha
6	Polycoat Urea (ESN™) deepbanded @sowing 40kgN/ha
7	Entec Urea deep banded at sowing @ 40kgN\/ha
8	Black Urea deep banded at sowing @ 40kgN/ha
9	Black Urea + Zeolite deep banded at sowing @ 40kgN/ha
10	Urea + Zeolite deep banded at sowing @ 40kgN/ha
11	Urea prespread @ 40kgN/ha
12	Urea predrilled @ 40 kgN/ha
13	Urea mid-row banded @40 kgN/ha
14	Easy N® deep banded @40 kgN/ha
15	Urea deep banded 20kg N/ha and 20kg N @Z31
16	Urea top dressed at Z31 @ 40 kgN/ha
17	Agrotain® Urea (3L) top dressed Z31 @40kg N/ha
18	Agrotain Urea (5L) top dressed Z31 @40kg N/ha
19	Easy N top dressed Z31 @40kg N/ha
20	Agrotain Urea (5L) + Zeolite top dressed Z31 @40kg N/ha
21	Urea + Zeolite top dressed Z31 @ 40kg N/ha
22	Polycoat Urea (ESN) top dressed Z31 @ 40kg N/ha

Soil Test Results (table 2)

Top soil 0-10cm	Colwell P	Nitrate	Total N	EC	pH (H2O)	pH	S
Rep1	120	43	60.2	0.24	6.5	6.1	50
Rep2	150	36	50.4	0.16	6.1	5.6	27
Rep3	110	44	61.6	0.2	6.1	5.7	41
Average	127	41	57.4	0.2	6.2	5.8	39

Sub-Soil Test Results (table 3)

Sub Soil (10-90cm)	Total Soil N (kg N/ha)
Rep A	88.2
Rep B	59.5
Rep C	72.2

Trial Inputs: The trial was sown at the SFS Inverleigh site into raised beds on 8th June 2006. The trial site was previous canola stubble (not raised beds) and treatments were sown with Ruby wheat at sowing rate of 80kg/ha. All treatments were sown with Granulock 10Z (11.5 : 21 : 0: 3.5 Zn 1%) starter fertilizer at 85kg/ha. This product ensured that phosphorus, sulphur and zinc were not limiting nutrients. The trials was monitored and spayed for weeds by SFS staff during growing season. Neither weeds or foliar diseases were issues encountered during the season.

Growing season data collected (table4)

T No.	Treatment	Plants No./sqm @Z15	Dry matter kg/ha @ Z15	Dry matter kg/ha early grain fill	Heads No./m2
1	Control – no N	154	3698	7195.4	**719**
2	Urea deep-banded 20kgN	137	3294	6898.9	**690**
3	Urea deep-banded 40kgN	171	4103	8834	**883**
4	Urea deep-banded 80kgN	113	2716	7241.4	**724**
5	Urea deep-banded 160kgN	72	1734	6063.6	**606**
6	Polycoat Urea (ESN) 40kgN	142	3409	6917	**692**
7	Entec urea deep banded 40kgN	142	3409	8371.2	**837**
8	Black Urea deepbanded40kgN	135	3236	7163.3	**716**
9	Black Urea + Zeolite deepbanded 40kgN	115	2774	6496.3	**650**
10	Urea + zeolite deepbanded 40kgN	123	2947	7980.6	**798**
11	Urea Pre-spread 40kgN	127	3063	6298	**630**

12	Urea pre drilled 40kgN	135	3236	7439.8	**744**
13	Urea Mid-row banded 40kgN	137	3294	7728	**773**
14	Easy N Deep-banded 40kgN	151	3641	6304	**630**
15	Urea 20kgN @sowing, 20kgN @Z31	132	3178	**7427.7**	**743**
16	Urea 40kgN @Z31			6129.7	**613**
17	Agrotain Urea 3L 40kgN @ Z31			6712.6	**671**
18	Agrotain Urea 5L 40kgN @ Z31			7836.4	**783**
19	Easy N 40kgN foliar @Z31			6856.8	**685**
20	Agrotain urea 5 L + zeolite 40kgN @Z31			6291.9	**629**
21	Urea + zeolite 40kgN @Z31			7481.8	**748**
22	Polycoat Urea (ESN) 40kgN @Z31			5654.9	**565**
	lsd(0.05)			1705	171
	CV			**17.4**	**17.4**

Harvest data (table 5)

		Yield	**Protein**	**N removal**	**N recovery**
T No.	**Treatment**	**T/ha**	**%**		
1	Control – no N	2.330	11.63	47.32	0
2	Urea deep-banded 20kgN	2.276	11.88	47.37	0.00281
3	Urea deep-banded 40kgN	2.216	12.33	47.51	0.00485
4	Urea deep-banded 80kgN	1.765	13.2	40.44	-0.08591
5	Urea deep-banded 160kgN	0.894	13.46	21.26	-0.16283
6	Polycoat Urea (ESN) 40kgN	2.479	12.18	52.81	0.13725
7	Entec urea deep banded 40kgN	2.170	12.84	48.61	0.03219
8	Black Urea deepbanded40kgN	2.116	12.59	46.31	-0.02253
9	Black Urea + Zeolite deepbanded 40kgN	2.176	11.66	44.62	-0.06739
10	Urea + zeolite deepbanded 40kgN	2.280	12.54	49.98	0.00017
11	Urea Pre-spread 40kgN	2.246	12.5	47.63	0.00773
12	Urea pre drilled 40kgN	2.551	12.5	55.84	0.21310
13	Urea Mid-row banded 40kgN	2.572	11.06	49.76	0.06105
14	Easy N Deep-banded 40kgN	1.994	12.04	40.79	-0.01632
15	Urea 20kgN @sowing, 20kgN @DC31	2.564	12.12	54.45	0.17823
16	Urea 40kgN @DC31	2.285	11.93	47.96	0.01605
17	Agrotain Urea 3L 40kgN @ DC31	2.396	11.71	48.92	0.04008
18	Agrotain Urea 5L 40kgN @ DC31	2.558	11.51	51.49	0.10441
19	Easy N 40kgN foliar @DC31	2.274	12.18	48.34	0.02564
20	Agrotain urea 5 L + zeolite foliar 40kgN @DC31	2.424	11.71	49.67	0.05891
21	Urea + zeolite 40kgN @DC31	2.351	11.54	47.33	0.06664
22	Polycoat Urea (ESN) 40kgN @DC31	2.339	11.37	46.59	-0.01818
	lsd(0.05)	0.33	1.28	7.96	0.194
	CV	**10.7**	**7.7**	**12.2**	

Observations:

The dry spring in 2007 resulted in considerably lower yields than expected. Soil available total nitrogen plus nitrogen fertilizer applied by the treatments possibly provided an expected yield, if water was unlimited, of between 4.5 and 8.5 tonnes/ha. Total soil N averaged across the plots was 115kgN/ha.

There were no significant yield differences above the control (no N), but treatments 5 and 6 (80 and 160 kgN/ha deepbanded) were significantly lower yielding than the control. The results for these two treatments were also reflected in grain protein (only two significantly higher) and in plant establishment at Z 15. The results from these 2 treatments re-inforces the message to maintain adequate clearance between seed and very high rates of nitrogen fertilizer at sowing, especially at wider row spacing and when using narrow points on seeding equipment.