Nitrogen rate and timing at Conmurra

Charlton Jeisman, SARDI Struan, Ph: 8762 9132, email: charlton.jeisman@sa.gov.au

Key Outcomes

- The influence of nitrogen on grain yield and protein depends on the amount of fertilizer applied, the timing and the growing season
- Fertilising to increase grain protein is profitable if farmers are being paid a premiums for protein above 10.5 -11%.
- Multiple wheat varieties responded to nitrogen when applied at GS31, particularly at the high rate of 100 kg/ha.
- A 7.2% yield increase was observed by treating SQP-Revenue with fungicide

Trial Objectives: To assess the impact of applying nitrogen at different rates and timings on grain yield of selected wheat varieties

Trial Duration: 2012

Location: Conmurra **Farmer Cooperator:** Lachie Seears

Soil Type: Black clay over limestone

Monthly Rainfall:

Rain	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	April-Oct	Total
Conmurra (NRM)	9	7	34	39	51	151	71	121	42	39	29	11	514	604

Paddock History: faba beans (2011)

Plot Size: 1.6m x 8m (8 rows x 15cm spacings), 3 replicates

Trial Details

Table 1: Treatments applied at Conmurra nitrogen rate and timing trial in 2012.

Trial	*Nitrogen rate x Timing*	*GS31 top-dress timing*
Sowing date	May 17	
Harvest date	January 10 (2013)	
Seeding rate	75 kg/ha (6 wheat varieties)	
Sowing fertiliser rate	18:13:0:10 @ 140 kg/ha	Aug-01
Fungicide	Opus @ 500 mL/ha	
Nitrogen treatment	Nil	**25 N** = 54 kg/ha Urea
	25, 50 & 100 kg/ha at sowing	**50 N** = 108 kg/ha Urea
	25, 50 & 100 kg/ha at GS31	**100 N** = 216 kg/ha Urea

Trial Results

Variety x Nitrogen

A significant variety by nitrogen rate/ timing interaction occurred for grain yield. Bolac, Scout and SQP-Revenue yielded higher than Brennan, while the highest yield (8 t/ha) was attained by SQP-Revenue when sprayed with fungicide (Table 1).

25 kg/ha nitrogen applied at sowing gave a response over nil for Bolac, Mackellar and Scout wheat while 50 kg/ha nitrogen at sowing gave a response over nil for Bolac, Scout, Forrest and SQP-Revenue. 100 kg/ha nitrogen gave a response when fungicide was also applied (except for Scout and Brennan). Wheat responded when 100 kg/ha nitrogen was applied at GS31 for Bolac (with and without fungicide), Brennan (fungicide), Forrest (fungicide) and SQP-Revenue (fungicide). 100 kg/ha nitrogen reduced yields slightly when it was applied at sowing, particularly for Brennan and Forrest wheat.

Variety x Fungicide

All varieties responded to fungicide application except Brennan. Although some differences were only small, there was on average a 2% yield increase by applying fungicide. The greatest impact was for SQP-Revenue and Forrest which recorded a 4.9% and 7.2% increase (respectively) by treating with fungicide.

Grain Quality

An increase in grain protein was observed with higher nitrogen levels, particularly for Mackellar, Scout and SQP-Revenue when 100 kg/ha nitrogen was applied at GS31.

There were no differences in test weight between nitrogen rates and fungicide treatments for each variety; however test weights varied somewhat between varieties. The most noticeable differences were for Mackellar and SQP-Revenue, both of which recorded an average test weight around 3 kg/hL lower than the site average. The highest test weight was Scout with an average of 85.5 kg/hL.

Comments

Grain yield for the trial generally responded to nitrogen when applied at GS31, which is a different result to the site at Frances in 2012. Nitrogen, when applied at GS31, generally builds toward grain yield with some attributing to protein. Partitioning of nitrogen to grain protein depends greatly on the season and the timing of when the nitrogen was applied. The season was favourable at Conmurra in 2012 with no shortage of moisture.

Paddock history at this site was faba beans (2011) and pasture (2010) which contributed to nitrogen fixation in the profile. Stored nitrogen is a valuable source to developing plants.

The influence of nitrogen on grain protein was observed mainly in Mackellar, Scout and SQP-Revenue when 100 kg/ha nitrogen was applied at GS31. This also aligns with the yield data. Anecdotal evidence suggests fungicide played a role in maintaining this protein, although this was not supported in this trial. It is possible that since fungicide is used to protect the green leaf area, the plant can continue to photosynthesise without suffering stress from pathogen attack.

Table 1: Yield of six wheat varieties at three fertiliser rates (+ control) and two application timings, Conmurra 2012

Variety	Fungicide Treatment	N Rate kg/ha	Test Wt hectolitre	Protein %	Yield kg/ha
Bolac	Nil	0N	84.5	11	6484
		25N-Sow	85	10.7	6760
		25N-GS31	84.2	11.4	7143
		50N-Sow	-	11.2	6789
		50N-GS31	84.4	11	6789
		100N-Sow	83.9	11.9	6922
		100N-GS31	83.9	11.8	7198
	Fungicide	0N	84.9	10.6	6583
		25N-Sow	84.7	11.3	6833
		25N-GS31	84.5	11.3	6836
		50N-Sow	84.5	11.1	6750
		50N-GS31	84.6	11.5	6883
		100N-Sow	84	11.7	6521
		100N-GS31	84.1	11.6	6977
Brennan	Nil	0N	84	11.4	6445
		25N-Sow	84	11.8	6099
		25N-GS31	84.4	11.7	5831
		50N-Sow	83.9	11.5	6146
		50N-GS31	83.6	11.9	5971
		100N-Sow	83.7	11.8	5667
		100N-GS31	83.8	12.1	5828
	Fungicide	0N	84.5	10.7	5919
		25N-Sow	83.9	11	6211
		25N-GS31	84.4	11.3	6042
		50N-Sow	84.4	11.8	6008
		50N-GS31	84.1	11.5	6055
		100N-Sow	84	11.6	5893
		100N-GS31	84.1	11.7	6245
Forrest	Nil	0N	84.3	10.3	6404
		25N-Sow	83.7	11.3	6344
		25N-GS31	84.4	10.5	6727
		50N-Sow	83.6	11.2	6898
		50N-GS31	83.4	11.1	6573
		100N-Sow	83.2	11.5	5865
		100N-GS31	82.6	11.6	6091
	Fungicide	0N	84.2	10.5	6641
		25N-Sow	83.7	11.2	6331
		25N-GS31	83.8	10.7	6846
		50N-Sow	83.9	11.4	6771
		50N-GS31	83.2	11.7	6594
		100N-Sow	82.7	12.3	6836
		100N-GS31	84	11.1	7096

Variety	Fungicide Treatment	N Rate kg/ha	Test Wt hectolitre	Protein %	Yield kg/ha
Mackellar	Nil	0N	80.8	10.1	6331
		25N-Sow	80.5	10.6	6807
		25N-GS31	80.4	10.4	6214
		50N-Sow	80	10.8	6573
		50N-GS31	80.5	10.8	6794
		100N-Sow	79.7	11.2	6648
		100N-GS31	79	11.6	6286
	Fungicide	0N	81.8	9.7	6273
		25N-Sow	80.6	10.5	6625
		25N-GS31	81.1	10	6612
		50N-Sow	81.1	10.3	6523
		50N-GS31	81.9	10.5	6193
		100N-Sow	80.1	11.1	6747
		100N-GS31	80.5	11	6656
Scout	Nil	0N	86	11	6607
		25N-Sow	83.9	11.5	7086
		25N-GS31	85.8	10.9	6836
		50N-Sow	85.7	11.2	6859
		50N-GS31	85.5	11.4	7240
		100N-Sow	85.3	11.3	6865
		100N-GS31	85.2	11.6	6576
	Fungicide	0N	85.8	11.3	6693
		25N-Sow	85.7	11.3	6987
		25N-GS31	86.1	11.1	7057
		50N-Sow	85.8	11	7352
		50N-GS31	86.1	11.3	7042
		100N-Sow	85.3	11.2	6742
		100N-GS31	85.6	11.7	6773
SQP-Revenue	Nil	0N	80	9.4	7372
		25N-Sow	79.3	10.6	7133
		25N-GS31	79	10.1	7729
		50N-Sow	79.9	10.3	7560
		50N-GS31	78.9	10.5	6844
		100N-Sow	78	11.2	7005
		100N-GS31	78.8	11.1	6826
	Fungicide	0N	79.8	10	7732
		25N-Sow	80.1	9.8	7518
		25N-GS31	80.1	10	7885
		50N-Sow	79.9	10.2	8120
		50N-GS31	79.9	10	7956
		100N-Sow	79.9	10.3	7208
		100N-GS31	79.6	10.6	7708

Conclusion and into the paddock

The impact of nitrogen and timing of application on crop yield and quality will largely depend on the season. The response to nitrogen applied at GS31 was significant in this trial, particularly at the higher rate of 100 kg/ha.

Fertilising to increase grain protein is profitable if farmers are being paid a premiums for protein above 10.5 -11%. If not, the application of additional nitrogen to a crop becomes an added cost of production. Ensure that grain protein does not fall below 10.5 % to maximise yield and return for most efficient use of nitrogen.

Acknowledgements

Trials were conducted by the SARDI New Variety Agronomy group at Struan.

Funding Body

This work was funded by the GRDC Water Use Efficiency Initiative