Impact of Nitrogen on Irrigated Wheat

SA Focus Paddock

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Background

This project aims to put you at the centre of grassroots led research by acting as a collaborative hub between growers, farming systems groups, researchers on linked projects and the GRDC. Our vision is to create the opportunity for you to become an active participant in the research, ensuring projects deliver information relevant to your farming business.
Using a facilitated group approach, farming systems groups will create an environment where growers can learn from each other and be part of a network to bounce ideas, have frank discussions, trash out issues and develop real on farm solutions. Groups will discuss research results relevant to their region and provide support to manage the risk of implementing change within your irrigated farming business through:

- Identifying agronomy and soil improvement techniques that have potential to increase returns of irrigated durum's, barley, canola, faba beans, chickpeas and maize
- Determine how irrigation water may be best allocated for a given cropping season and how to maximise $/ML returns across the whole farm
- Experimenting with new techniques on your property through focus paddock projects

Gross margin optimisation is a key profit driver in mixed and cropping businesses. Changing crop production systems and increased water costs have contributed to the reliance on responsive and proactive crop management as well as timely water application in an irrigated cropping system.

One element of the project is to host a focus paddock and collect two years' worth of data to drive production or system chance. This is also an opportunity to quantify something that was once just a 'gut feel'

In this case our aim was to assess the strategic use of nitrogen in the form of urea to improve spring wheat yields under irrigation. The demonstration trial was conducted on Scullions property near Apsley in 2020. One of our aims was to achieve a yield of 10t/ha in this system using N.

Activities

The demonstration was conducted in 2020 using seven different rates of N, which was applied at three key timings through the production season. This is outlined below

	Timing 1 - Seeding	Timing 2 - GS 30	Timing 3 - GS 37	Total Urea
Treatment 1	0kg/ha	0kg/ha	0kg/ha	0kg/ha
Treatment 2	0kg/ha	100kg/ha	0kg/ha	100kg/ha
Treatment 3	100kg/ha	100kg/ha	0kg/ha	200kg/ha
Treatment 4	200kg/ha	100kg/ha	0kg/ha	300kg/ha
Treatment 5	100kg/ha	200kg/ha	200kg/ha	500kg/ha
Treatment 6	200kg/ha	200kg/ha	200kg/ha	600kg/ha
Treatment 7	0kg/ha	200kg/ha	200kg/ha	400kg/ha

Table 1: Demonstration treatments

The demonstration was sown to Trojan wheat on the 17th of May 2020. This was sown into a Lucerne stand, with a residual nitrogen level of 120kg N/ha. The demonstration received its first spread of urea straight after on the 19th of May 2020. Timing 2 application was applied on the 28th July 2020 and the timing 3 application occurred on the 5th September 2020.

Through the growing season the group employed several tools to assist with quantifying decision making. This included:

- Data Farming: high resolution satellite imagery to determine paddock NDVI readings. The determine if the treatments were showing up
- CSIRO, Your Soils Potential Yield and N Fertiliser Calculator
- Yield Prophet – Crop simulation for water and Nitrogen management
- Soil Moisture Probe to 100cm and weather station.

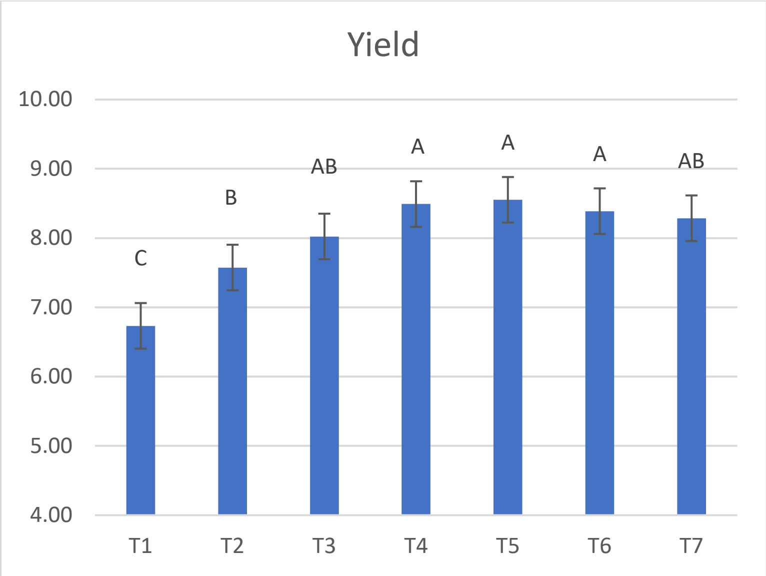
Annual rainfall for the focus paddock in 2020 was 518.6mm. With 411.8mm of this falling within the growing season. As a result, the focus paddock was mainly rainfed. The centre pivot was turned on once during the trial to endure that water was not a yield limiting factor. This happened on the 27th of October with an application of around 15mm.

Due to COVID-19 restrictions, we were unable to hold a field day at the site.

Results and Discussion – note treatments were not randomised in small plots. The demonstration was conducted using farmer equipment and harvested using a small plot harvester to collect data.

The demonstration was harvested using a small plot harvester on 15th January and some significant differences between treatments were noted.

The average grain yield across the demonstration was 8.01t/ha. With treatment 5 showing the greatest yield of 8.55t/ha, after receiving 500kg/ha of urea. This is outlined below in figure 1. All treatments had a significantly higher yield when compared to the control (T1). T4,5 and 6 also showed a significant yield response when compared to T2.



Mean: 8.0079

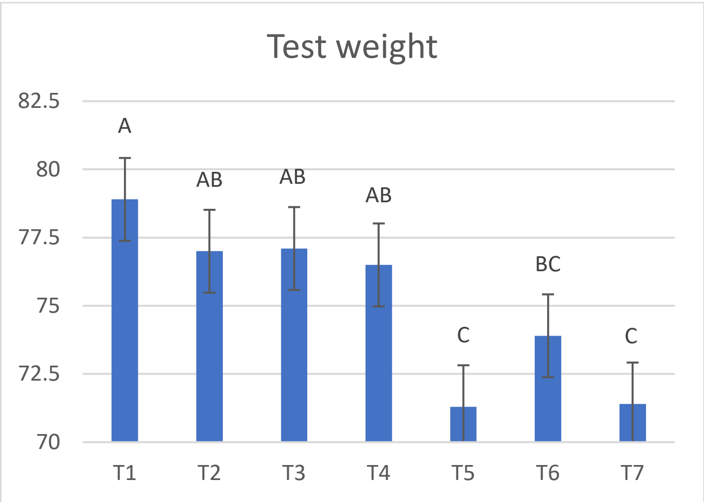
LSD: 0.3291

P Value: <.001

CV%: 5.03

figure 1: yield data.

In conjunction with yield, we also analysed grain quality to understand the relationship between nitrogen application and timing and the result. Quality results can be seen in figures 2,3 and 4 below.



Mean: 75.148

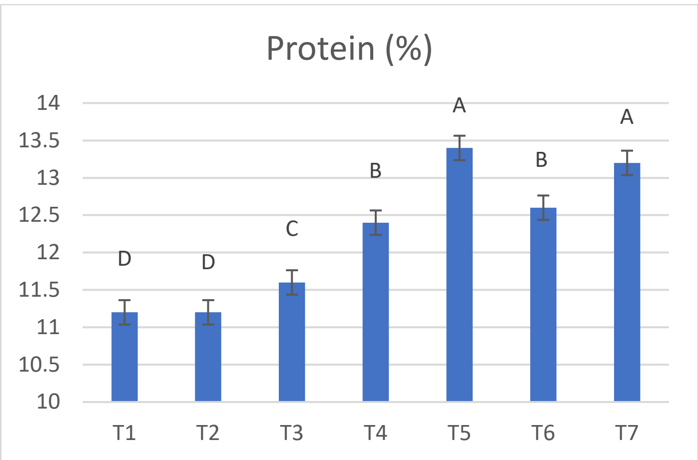
LSD: 1.5190

P Value: <.001

CV%: 2.48

Figure 2 – Test weight data

With the addition of an application of N at GS37 we seen a significant drop in test weight compared to the control (T1) and other treatments which didn't receive an application of N at this timing.



Mean: 12.242

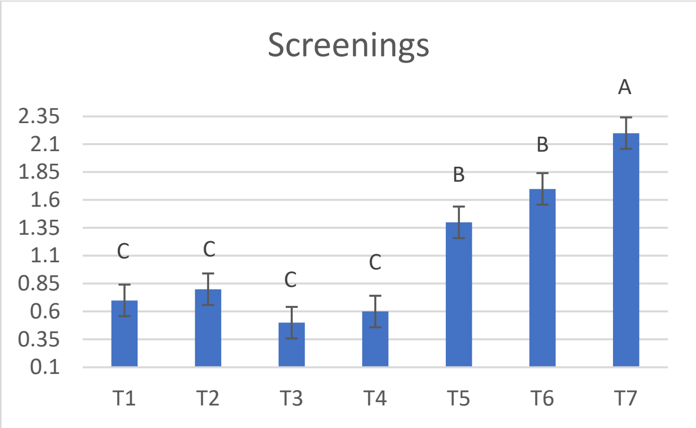
LSD: 0.1633

P Value: <0.001

CV%: 1.63

Figure 3 – grain protein data

The addition of nitrogen had a positive impact on grain protein levels. However T6, which received the most urea (600kg/ha was in fact significantly lower in protein compared to T5 which received 500kg/ha of urea.



Mean: 1.133

LSD: 0.1414

P Value: <0.001

CV%: 15.28

Figure 4 – grain screenings

Treatment	Yield (t/ha)	Grade	Price - Del. Frances (based on grade)	Gross Income/ ha	Total expense	Net Income / Ha
1	6.730	APW	$ 275.00	$ 1,850.73	$ -	$ 1,850.73
2	7.201	APW	$ 275.00	$ 1,980.26	$ 70.00	$ 1,910.26
3	7.974	H2	$ 277.00	$ 2,208.93	$ 140.00	$ 2,068.93
4	**8.272**	**H2**	**$ 277.00**	**$ 2,291.25**	**$ 185.00**	**$ 2,106.25**
5	8.570	AUH2	$ 270.00	$ 2,313.79	$ 300.00	$ 2,013.79
6	8.573	AUH2	$ 270.00	$ 2,314.58	$ 345.00	$ 1,969.58
7	8.341	AUH2	$ 270.00	$ 2,251.95	$ 230.00	$ 2,021.95

Table 2 – economic outcome based on treatments

Based on the data we have compiled an economics table. This factors in some assumptions around fertiliser price, contract spreading rates and grain prices based on the quality achieved.

Conclusions

From the addition of nitrogen at high rates, we have found that yield and grain quality can be influenced. There is also a threshold where nitrogen can be overdone. Based on the results from this demonstration, it appeared that all treatments with a GS37 application of N had a lower test weight as well as higher level of screenings and protein. In most instances this was a significant difference.

The best overall economic return form the use of nitrogen was 200kg/ha applied following seeding, then a top-up 100kg/ha at GS30. Giving a total application of 300kg urea.

This information is based on 1 year of data. Through the project we plan on having replicated trials established in 2021 to investigate this response further.

Acknowledgements

- Kalyx for harvesting the demonstration and conducting grain quality analysis.
- Beau and Tyrone Scullion as co-operating growers

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