Managing your fertiliser dollar in wheat and barley

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Key findings

- For La Trobe barley, 20 kg N/ha was sufficient to achieve the highest grain yield and a protein level for malt classification.
- Similarly in wheat, 20 kg N/ha was sufficient to achieve the highest grain yield in 2018. Greater rates of N were required to improve protein levels to achieve AH classification.

Why do the trial?

Management of nitrogen can have substantial impacts on final yield and quality of your crop. The two main grower questions with nitrogen (N) management are how much N needs to be applied and when should it be applied? The basis of most nitrogen management strategies is an N budget however decisions can often be 'reactive' to the season and can be based on previous experiences and attitude to risk.

The key components to N budgeting are target yield and protein, as crop yield potential is the major driver of N requirement. This trial is designed to look at nitrogen management strategies in wheat, barley and canola across multiple seasons. This is the second season that the trial has run. It will be run over one more season to total three seasons of data. The specific aims are to:

- Assess simple nitrogen management strategies to determine the best return on investment from fertiliser nitrogen applications.
- Determine within a crop rotation (wheat and barley) where your fertiliser dollar was best spent over a number of seasons.

How was it done?

Plot size	1.75 m x 10.0 m	**Fertiliser**	DAP (18:20) @ 60 kg/ha at seeding (equivalent to 10 kg N/ha)
Seeding date	15th May 2018		In-season nitrogen rates Table 1

Each trial was a randomised complete block design. The trials were blocked separately by crop type (Scepter wheat and La Trobe barley). The trial also included 44Y90 canola however, the data cannot be presented due to significant bird damage to some plots.

Prior to sowing (16th April) the trial area was assessed for available soil nitrogen (0-10, 10-30 and 30-60 cm). The total available soil nitrogen pre-seeding was 78 kg N/ha. All plots were assessed for grain yield and quality (protein, test weight kg/hL, retention % and screenings %).

Table 1. Nitrogen rates applied to wheat, barley and canola nutrition trials at Hart in 2018

Wheat	Barley	Canola
1. Nil	1. Nil	1. Nil
2. 80 kg N/ha @ seeding	2. 80 kg N/ha @ seeding	2. 100 kg N/ha @ seeding
3. 20 kg N/ha @ GS31	3. 20 kg N/ha @ GS31	3. 50 kg N/ha @ seeding + 50 kg N/ha @ rosette
4. 40 kg N/ha @ GS31	4. 40 kg N/ha @ GS31	4. 50 kg N/ha @ seeding + 50 kg N/ha @ rosette + 100 kg N/ha @ bolting
5. 80 kg N/ha @ GS31		5. 200 kg N/ha @ bolting
6. 100 kg N/ha @ GS31		
7. 200 kg N/ha @ GS31		

Results and discussion

Barley

The nitrogen rates trialed in La Trobe barley showed applying 20 kg N/ha at GS31 was sufficient to achieve the highest yield and protein to meet malt specification (Table 2). Applying 20 kg N/ha resulted in a 0.3 t/ha yield increase when compared to the nil treatment. Increasing the N rate above 20 kg/ha did not increase grain yield however, grain protein was increased where 80 kg N/ha was applied. This increase in grain protein was not advantageous as it exceeded 12% (the maximum required for malt 1). Applying 80 kg N/ha at seeding had the same yield and protein compared to if applied in season.

Grain screenings were not affected by the different nitrogen applications and were all below the 7% maximum for malt 1. All test weights were above the 65 kg/hL and retention above 70% minimum for malting classification. The low N rate required for maximum grain yield and quality in barley is not surprising this season, given the lower yield potential in a below average rainfall season.

Table 2. La Trobe barley grain yield and quality for the nitrogen treatments at Hart, 2018. Treatments shaded grey are not significantly different from the highest yielding/quality treatment.

Treatment	Yield t/ha	Protein %	Screenings %	Test Weight kg/hL	Retention %
Nil	2.64^{a}	9.0^{a}	0.8	71.6^{c}	92.3^{b}
80 kg N/ha @ seeding	2.96^{b}	12.2^{c}	2.1	70.0^{a}	70.3^{a}
20 kg N/ha @ GS31	2.96^{b}	9.7^{ab}	1.3	71.1^{bc}	88.5^{b}
40 kg N/ha @ GS31	3.01^{b}	10.7^{b}	1.5	70.6^{b}	81.5^{ab}
80 kg N/ha @ GS31	3.11^{b}	12.4^{c}	2.3	70.5^{ab}	70.9^{a}
LSD (P≤0.05)	0.17	1.5	NS	0.7	12.1

Wheat

Application of 20 kg N/ha was sufficient to achieve the highest wheat yield at Hart in 2018. There was no yield benefit when 40 kg N/ha up to 200 kg N/ha was applied in season. Where 80 kg N/ha was applied at seeding versus in-season, there was a slight yield advantage of applying N in-season (Table 4). However, delaying N applications in a dry season will not always achieve the desired response. The risk of the crop not accessing in-season applied N is high due to limited rainfall and soil moisture required for plant uptake.

As expected, higher rates of N (200 kg N/ha) increased grain protein up to 13.2%. A minimum of 80 kg N/ha (at seeding) or higher was required to achieve protein levels above 11.5% for H2 classification. Generally, at Hart we observe the 80 kg N/ha applied in-season resulting in a similar or higher protein level compared to the at seeding application. However, lack of rainfall and soil moisture would have caused reduced N uptake from the in-season application this season. The lowest protein levels in the trial were found in the chicken litter and biochar treatments. This is most likely due to the tie up of N as soil microbes breakdown these organic materials. Over time this N will become available through microbial mineralisation (release of N from dying microbes).

Grain screening levels were low across the trial, with all treatments below the 5% maximum. Test weights were high (>76 kg/hL) and did not differ between N application treatments.

Table 3. Scepter wheat grain yield and quality for the nitrogen treatments at Hart, 2018. Treatments shaded grey are not significantly different from the highest yielding/quality treatment.

Treatment	Yield t/ha	Protein %	Screenings %	Test Weight kg/hL
Nil	2.24^{c}	8.4^{ab}	0.9^{b}	80.1
80 kg N/ha @ seeding	2.54^{bc}	11.6^{de}	0.9^{b}	79.6
20 kg N/ha @ GS31	2.67^{abc}	9.3^{bc}	1.1^{b}	80.3
40 kg N/ha @ GS31	2.54^{bc}	9.6^{c}	1.1^{b}	78.1
80 kg N/ha @ GS31	3.14^{a}	10.7^{d}	0.6^{a}	80.7
100 kg N/ha @ GS31	2.99^{ab}	11.8^{e}	0.7^{ab}	80.5
200 kg N/ha @ GS31	2.98^{ab}	13.2^{f}	0.8^{ab}	79.9
Chicken litter 2.5 t/ha	2.52^{bc}	8.6^{ab}	1.2^{b}	80.3
Chicken litter with Bio Char 2.5 t/ha	2.49^{bc}	8.3^{ab}	0.9^{b}	80.1
Bio Char 100 kg/ha	2.33^{c}	7.8^{a}	1.0^{b}	80.2
LSD (P≤0.05)	0.51	1.0	0.3	NS

Summary

The results from 2018 indicate using lower N fertiliser rates was the best use of your fertiliser dollar in a dry season. Decisions on nitrogen application rates and timing are made by taking into account current available soil nitrogen, target yield, seasonal climatic forecasts, grain prices and fertiliser costs. Developing your own nitrogen budget is a good way to make decisions on your up-front and in-season nitrogen rates. Seasonal climatic forecasts and Yield Prophet® can more accurately determine potential yield and therefore assist in decisions on nitrogen application rates and timing.