Influence of nitrogen application on the need for disease management in malting barley – Wimmera

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The aim of this trial was to establish the interaction between nitrogen and timing and the need for fungicide management.

Take home messages

- *However, the influence of seedbed N application (50kg/ha N) was evident in the crop structure scores, producing 150-200 more shoots/m2 and producing higher readings when the crop sensor Greenseeker® was passed over the trial than the GS30 stem elongation timing or the zero nitrogen controls.*
- *Despite a relatively low soil nitrogen reserve at sowing (43 kg/ha N 0-100cm), there was no influence of nitrogen on yield.*
- *In a trial subject to low levels of spot form of net blotch (SFNB), there was no response to fungicide over the untreated.*
- *Overall, with no combination of fungicide and nitrogen timing significantly superior to the untreated crop, the unfertilised and unsprayed crop produced the optimum margin.*
- *In the Wimmera, three years of trial results suggest the advantages of delaying nitrogen until stem elongation to reduce canopy density are not great enough to justify the risk of increasing protein above malt specifications.*

Method

Plot size: 25m x 3m

Replications: Four

Two varieties of barley, Baudin and Gairdner, were sown into moist conditions on 23 May at a target plant population of 200 plants/m^2 (actual plant populations are reported in Table 2).

The two varieties were subject to two variables: fungicide management and nitrogen management (Table 1). In all other respects the crops were treated with the same overall inputs.

Table 1. Fungicide management programs and nitrogen regimes (kg/ha N) at Longerenong.

1. Fungicide management
Three fungicide programs were applied to each variety

GS30-31 (Pseudo stem -1st node) 22 August	GS45–49 (Booting - 1st awns) 20 September
1. Untreated	
2. Tilt/Bumper 250ml/ha	----
3. Tilt/Bumper 250ml/ha	Tilt/Bumper 250ml/ha

Tilt or Bumper @ 250ml/ha contains 62.5g/ha ai propiconazole.

Each fungicide strategy was superimposed on three nitrogen regimes, as below, where the crop received 50kg/ha N either before sowing or at GS30, or no applied nitrogen.

2. Nitrogen regime (kg/ha N)

Treatment no.	Nitrogen timing Seedbed (23 May)	 GS30 (15 August)
1	50 N	----
2.	----	50 N
3.	----	----

Results

Plant establishment and crop structure assessments

Actual establishment exceeded the target plant population of 200plants/m^2 in both varieties (Table 2). Germination was unaffected by the application of seedbed nitrogen which was pre-drilled immediately before sowing.

Table 2. Plant establishment (plants/m^2) in Baudin and Gairdner with and without seedbed nitrogen, assessed 19 July at GS13.

	Baudin	Gairdner
Untreated 248	208	
Seedbed nitrogen (50kg/ha N)	242	217

The application of seedbed nitrogen increased tiller numbers recorded in spring (GS31) by 150-200 shoots/m^2 with both varieties, a figure consistent with the two previous seasons of this trial (Table 3).

Table 3. Effect of seedbed N on tillers/m^2 in Baudin and Gairdner on 21 August at GS31.

Nitrogen regime	Baudin	Gairdner
50 N seedbed	937	919
50 N GS30	774	701
Untreated	754	753

With low soil nitrogen at sowing (43kg/ha N (0-100cm)), the visual appearance of nitrogen application to the seedbed was obvious in the greenness in the crop measured with the N tech Greenseeker®. This crop sensor measures the greenness of biomass present in the crop by recording the red and infrared light reflected from the crop. The units of measurement are referred to as the NDVI (normalised difference vegetative index). The greater the intensity of greeness the higher the NDVI reading.

Table 4. Effect of seedbed N and variety on NDVI readings recorded in Baudin and Gairdner on 17 August at GS30 (NDVI readings are based on over 100 counts per plot and are between 0 and 1.0 (1.0 being maximum greenness)).

Nitrogen regime	Baudin	Gairdner
50 N seedbed	0.81	0.80
50 N GS30	0.72	0.71
Untreated	0.73	0.71

The large differences in tiller numbers were not apparent in the final ear counts taken for this trial (Table 5).

Variability lead to large, non-significant differences in ear counts, for example, nitrogen did not influence ear number to any great extent. There are no trends within these figures to suggest treatment effects that are consistent.

Table 5. Effect of nitrogen strategy and fungicide treatment on ears/m^2 in Baudin and Gairdner at the end of grain fill on 22 November.

Variety	Fungicide treatment	Nitrogen strategy		
		50 N Seedbed	50 N GS30	Zero N
Baudin	Tilt GS30+49	968	803	681
	Tilt GS30-31	674	769	851
	Untreated	855	698	792
Gairdner	Tilt GS30+49	847	837	835
	Tilt GS30-31	761	846	888
	Untreated	866	730	807
LSD 0.05 Variety/Nitrogen/Fungicide		**291**		

Yields

Influence of variety

There were no significant differences between the yields of the two varieties. The mean yield of Gairdner treatments was 2.84t/ha compared to 2.71t/ha with Baudin.

Influence of nitrogen

There was no response to nitrogen (50kg/ha N) in this trial and no influence of nitrogen timing on yield (Figure 1), despite the extra tillers produced from the seedbed treatment and detection of differences in the greenness of the crop measured by the Greenseeker at GS30.

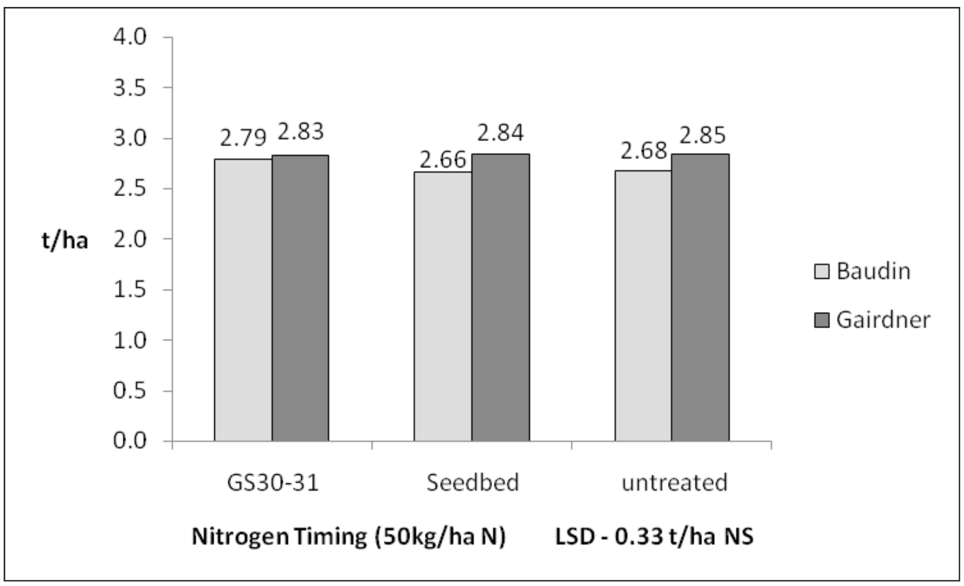

Figure 1. Influence of different nitrogen strategies on yield (t/ha) in Baudin and Gairdner (mean of three fungicide treatments).

Influence of fungicide

There were no significant responses to fungicide in comparison to the untreated controls.

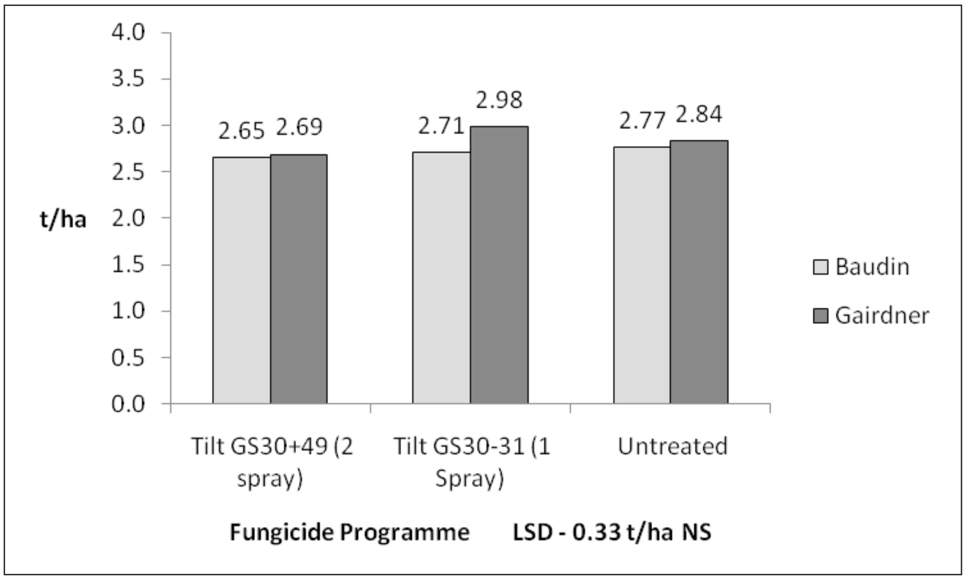

Figure 2. Influence of different fungicide strategies on yield (t/ha) in Baudin and Gairdner (mean of three nitrogen treatments).

Nitrogen timing fungicide interaction in individual varieties

There were no significant interactions between nitrogen timing and fungicide program in this trial. Therefore with both Gairdner and Baudin, the unfertilised and unsprayed crop produced the greatest return, assuming there no differences in quality (see next section).

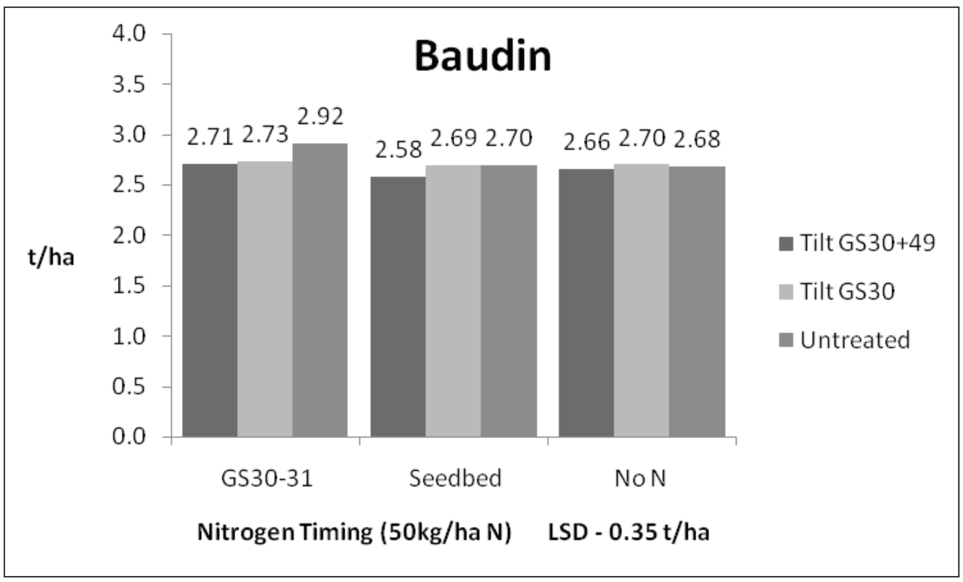

Figure 3. Influence of nitrogen timing and fungicide strategy on yield of Baudin.

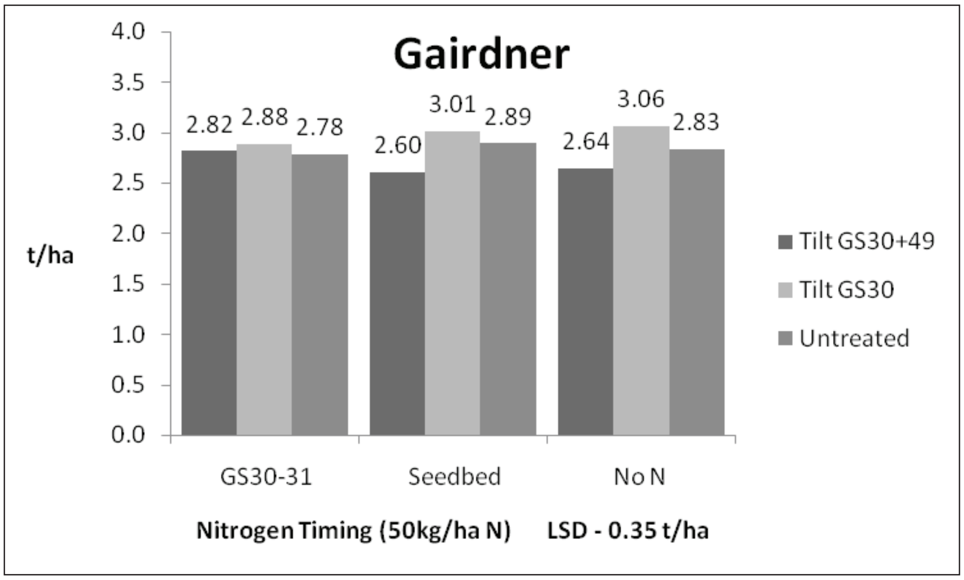

Figure 4. Influence of nitrogen timing and fungicide strategy on yield of Gairdner.

Quality

Influence on Protein

There was no significant influence of variety, nitrogen or fungicide application on protein content of the grain (Table 6).

All samples produced were in the malting range for protein content and there were no significant differences in protein between Gairdner and Baudin (averaged over all treatments).

Table 6. Protein associated with individual nitrogen and fungicide treatments.

Variety	Fungicide treatment	Nitrogen timing (50kg/ha N)		
		GS30-31 N	Seedbed N	No N
Baudin	2 spray GS30 + 49	10.9	10.6	11.0
	1 spray GS30	10.8	11.3	10.9
	Untreated	11.5	10.7	10.9
	mean	**11.1**	**10.9**	**10.9**
Gairdner	2 spray GS30 + 49	10.8	10.9	10.5
	1 spray GS30	10.3	10.0	10.8
	Untreated	10.8	11.2	10.6
	mean	**10.6**	**10.7**	**10.6**
Overall Mean		**10.8**	**10.8**	**10.8**
LSD – variety means		**0.5 (NS)**		
LSD – Nitrogen timing/variety means		**0.7 (NS)**		
LSD – Nitrogen timing/variety/fungicide		**1.3 (NS)**		

Influence on retention and screenings

Screenings for all treatments were below the 7% grade 1 maximum, though Gairdner had slightly higher screening levels (4.6%) than Baudin (3.0%).

Table 7. Retention (Ret) and Screening (Scr) percentages associated with variety and individual nitrogen and fungicide treatments.

Variety	Fungicide treatment	Nitrogen Timing (50kg/ha N)						
		GS30-31 N		Seedbed N		No N		Mean
		% Ret	%Scr	% Ret	%Scr	% Ret	%Scr	Ret.
Baudin	2 spray GS30 + 49	79.1	3.0	78.2	3.7	80.9	2.7	**79.4**
	1 spray GS30	85.4	1.6	80.1	3.1	83.0	2.3	**82.9**
	Untreated	69.2	4.5	79.3	3.1	77.4	3.2	**75.3**
	mean	**77.9**	**3.0**	**79.2**	**3.3**	**80.5**	**2.7**	
Gairdner	2 spray GS30 + 49	72.1	4.0	65.4	6.4	71.0	4.3	**69.5**
	1 spray GS30	75.4	3.8	77.2	3.4	78.2	3.6	**76.9**
	Untreated	67.3	5.7	68.2	5.7	73.7	4.4	**69.7**
	mean	**71.6**	**4.5**	**70.2**	**5.2**	**74.3**	**4.1**	
Overall Mean		**74.7**	**3.8**	**74.7**	**4.3**	**77.4**	**3.4**	
LSD – variety means		**11.0**	**2.2**					
LSD – Nitrogen timing/ variety means		**11.9**	**2.4**					
LSD – Fungicide/Nitrogen timing/variety means		**17.8**	**3.5**					

Receival Grade

All quality parameters assessed indicated that most treatments in the trial produced grade 1 malting samples (for Gairdner GA1 and for Baudin BA1).

Margin after input costs

Since nitrogen fertiliser produced no yield or quality benefit, the application of 50kg/ha N only served to lose money compared to the unfertilised crop.

The quality of Gairdner lifted from GA2 to GA1 when a single fungicide was applied at GS30. Though the differences were not significant, there was a slight yield increase accompanied with a small improvement in retention and screenings which account for this lift in quality. This benefit was not as marked where no nitrogen was applied. The same yield and quality effects were not apparent where two fungicide applications were applied on Gairdner; whether this was due to stress created by a second application is unclear.

Interpretation

This trial has been run for three seasons to establish whether nitrogen timing in barley influences the need for fungicide for this crop in the Wimmera. Over the three seasons, the mean yield in the trial has varied enormously: 5.5t/ha in 2005, 1.4t/ha in 2006 and 2.8t/ha in 2007, but in no season have disease levels been sufficiently high to test the hypothesis.

In only one year (2005) of the last three has there been an indication of an interaction between applied nitrogen and response to fungicide application in barley grown in the Wimmera. In the last two seasons when yields have been at 3t/ha or below, there has been little disease, little response to fungicide and no indication that nitrogen timing influences response to fungicide.

In 2005 when the yields in the trial were 5-6t/ha, there was an indication that stem elongation (GS30-31) nitrogen reduced the need for fungicide, but the commercial benefit of this saving was eroded by the loss of malting premium associated with higher protein where stem elongation nitrogen had been applied.

Whilst the overall nitrogen total for the trial has been reduced since 2005 (from 100kg/ha N in 2005 to75kg/ha N in 2006 to 50kg/ha N in 2007), there have only been significant differences in yield due to nitrogen timing in 2006, when GS30 applied N was significantly higher yielding than seedbed N. In 2005 and 2007 there was no difference in yield due to nitrogen timing.

Commercial practice

The commercial benefits of withholding nitrogen until stem elongation are clearly manifest in terms of allowing more time to assess the seasonal weather pattern before application. However, with malting barley there is a risk of increasing protein above malt specifications with delayed nitrogen. This occurred in 2005 when there was a yield response to nitrogen but splitting the application between tillering and third node significantly increased grain protein such that the sample produced fell into a feed rather than malt category. In contrast, the seedbed N/late tillering split produced malting grade with the same level of nitrogen applied.

In conclusion, the advantages of stem elongation nitrogen in reducing disease risk through reducing canopy density in malting barley are not sufficiently great in an environment of generally lower disease risk to offset the potential penalty of higher proteins.

Therefore, it is not as easy to see the benefits of delayed nitrogen approach with malting barley production in the Wimmera as it is with wheat, even though many of the crop structure benefits can still be evident. To capitalise on these benefits (less tillers and lower screenings) while still maintaining time to assess the season before applying nitrogen, application during tillering, as opposed to waiting until stem elongation, may be a better option.