

Nitrogen Strategies for Yield and Grain Quality at Dandaragan

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Key messages

- Dandaragan experienced a decile 2 rainfall in 2019, though this was not reflective of the trial productivity due to the water holding capacity and overall quality of the loamy soil at this site.
- Grain yield averaged 4.6t/ha across the treatments at the site and yield responses of up to 2.5 t/ha were seen from N application.
- Under 2019 conditions the most profitable treatment was early application of 190 kg N/ha by 8WAE with a gross margin – grain value minus fert. cost – of \$1360/ha.
- The importance of avoiding “hidden hunger” was evidenced in consistent and significantly higher yields and returns from early application of nitrogen compared with late application at all rates.
- Applying N at 5 and 8 weeks after emergence indicatively returns \$90 to \$150/ha more profit than application at 8 and 12 weeks. Late applications require more N to catch earlier applications in yield but are at an input cost disadvantage.

Background

Managing wheat nutrient inputs for both yield and protein is an ongoing challenge with seasonal rainfall variability, management practices and other factors continually increasing yield potential. Traditional approaches to N management may be leaving crops short – evidenced by disappointing grain protein levels in recent seasons. Growers may be forgoing profit by playing the season late and not addressing crop demand early when yield potential is critically set.

We compared a number of strategies to increase nitrogen application rates to match site conditions for yield potential. Applying various N rates at multiple combinations of timing splits provides a range of contrasts to assess impact on yield, grain quality and profitability.

Table 1. Fertilizer treatments and application timings.

no.	trt.	Banded (kg/ha)	PSPE (L/ha)	5WAE Z14 (L/ha)	8WAE Z24 (L/ha)	10WAE Z31 (L/ha)	12WAE Z41 (L/ha)	14WAE Z51 (L/ha)	
1	N15								
2	N85 Early			85 UAN	85 UAN				
3	N120 Early			85 UAN	85 UAN		85 UAN		
4	N155 Early			165 UAN	165 UAN				
5	N190 Early			165 UAN	165 UAN		85 UAN		
6	N85 Late				85 UAN		85 UAN		
7	N120 Late				85 UAN		165 UAN		
8	N155 Late				165 UAN		165 UAN		
9	N190 Late				250 UAN		165 UAN		
10	Constant-Supply N	35 Urea		85 UAN	85 UAN	85 UAN	85 UAN	85 UAN	
11	N-Rich Strip Plus		225 UAN	85 UAN	85 UAN				
12	N-calc REC	35 Urea			43 UAN				
13	N-calc REC x 2	35 Urea			43UAN		48 UAN		
*Basal fertilizer banded at sowing =				150kg/ha Vigour-Mn + 30kg/ha SOP :					
			N	P	K	S	Cu	Zn	Mn
			15	20	25	10	0.1	0.25	1.5
									kg/ha

Results

Yields were high across the trial, averaging 4.6t/ha, reflecting soil type and water holding capacity. Of the farm practice strategy treatments, maximum yield of 5.3 t/ha was achieved by 190 kg N/ha early (sowing + 5 + 8WAE) and by 205 kg N/ha applied as constant supply by a urea addition at seeding and fortnightly N applications from 5 to 14 WAE. The lowest yield of 3t/ha received 15kg N/ha banded at sowing and no in-season N.

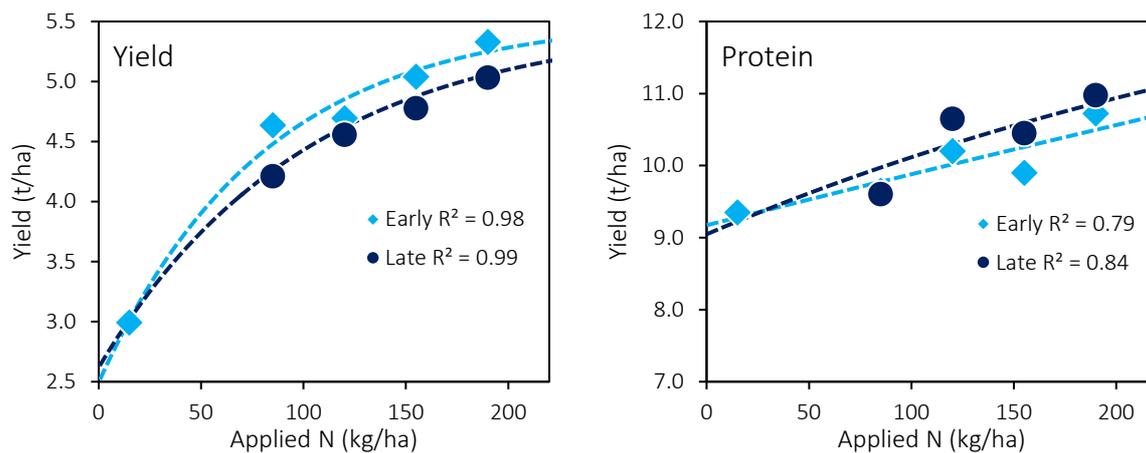


Figure 1. Comparison of early and late in-season nitrogen application on yield and grain protein accumulation.

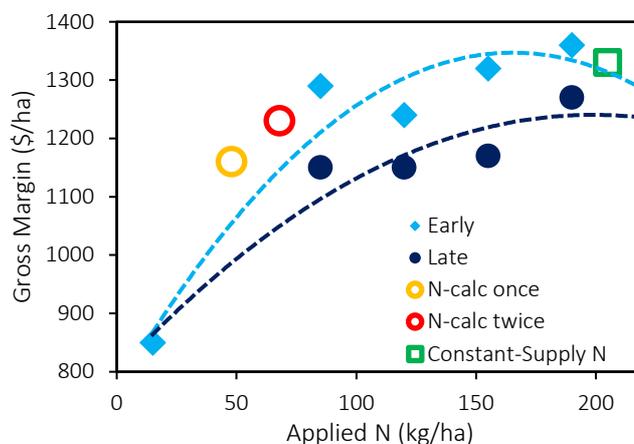


Figure 2. Profits increased with applied N and closely mirrored yields. Gross margins show an economic advantage to applying N earlier in the season and efficiency of N-calculator on producing returns from guided but conservative N applications relative to higher rates applied late.

When comparing 85, 120, 155 and 190kg N/ha there was a significant increase in yield with applied N ($p < 0.05$). A trend of higher yield when N was applied early - 5WAE & 8WAE - in the growing season was also significant ($p < 0.05$) compared to later application - 8WAE & 12WAE (Figure 1).

Grain protein content ranged between 9.4%-11% and significantly increased ($p < 0.05$) with both rate and lateness of applied N (Figure 1).

Yield was the greatest determinant of gross margin returns due to little pricing advantage between APW and ASW at time of harvest. The most profitable fertilizer regime was \$1360/ha from early application of 190 kg N/ha by 8WAE. The lowest return was \$850/ha from applying only 15kg N/ha at sowing. Profits were \$90 to \$150 higher for 85, 120, 155 and 190 kg N/ha when applied earlier in the season (Figure 2).

Discussion

Loss of yield potential early in the growing season is difficult to regain without high inputs and favourable conditions to allow the high inputs to have an effect. Data showed that applying higher rates of N later in the season did not increase yield to levels achieved when N was applied early.

Greatest N use efficiency is seen from early applications of N. Such applications avoid crops reaching a point where N demand begins to outpace supply, even before any deficiency symptoms are observable – otherwise known as “hidden hunger”. Growers should consider a substantial proportion of their nitrogen applications early in the season, to fit with their yield target and risk management approach to avoid this hidden hunger negatively impacting their crops’ yield potential.