Tactical nitrogen using NDVI, N-Gauges and In-Season N Calculator, Binnu [SUM15-17]

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AIM:

Demonstrate and evaluate nitrogen-rich strips (N Gauges) and Normalised Difference Vegetation Index (NDVI) measurement as decision support tools to guide economic application of nitrogen during the growing season.

KEY MESSAGES:

- Summit's In-Season Nitrogen Calculator aims to calculate a precise N rate to maximize yield potential of a paddock where N may be limiting, using NDVI as on-the-spot growth measurement.
- This trial demonstrates using dynamic and real-time comparisons between growth of wheat with and without N limitations to determine optimal N application for yield and returns.
- The Nitrogen Calculator shows real promise on light country in the northern wheat belt. The Calculator optimised yield and gross margin at the 9WAS application and gave a reasonable estimation of optimal N rate at 7WAS.
- Summit's In-Season N Calculator adds another tool to predict yield potential during a broad window of the growing season so growers can have increased confidence in their N application decisions, decreasing risks of over-application and inefficient fertilizer usage.

TRIAL DETAILS:

Property:	**NAG Trial Site, Yanjanooka Farms, Binnu Road East, Binnu**
Treatment plots per rep:	10m, 24 Treatments in 3 Randomised Replicates
Soil Type:	Yellow/Grey Sand
Crop Variety, seeded:	Mace wheat, 70 kg/ha, 18/05/2015

Soil Test Results

Depth	NO_3^-	NH_4^+	OC	P	PBI	K	S	Cu	Zn	$pH_{[Ca]}$	Al
0-10cm	19	4	0.46	23	13	**33**	6			5.8	0.3
10-20cm	2	2	0.27	30	14	**29**	2			**4.6**	2.6
20-30cm	1	1	0.16	25	16	**30**	3			**4.3**	2.4

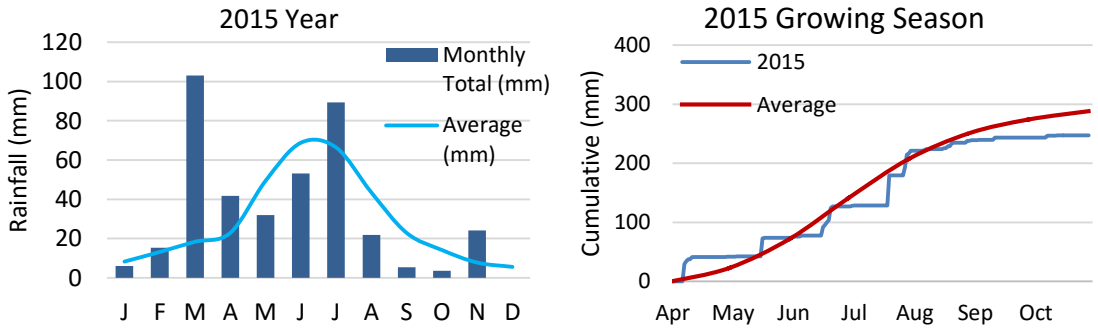

Figure 1. *2015 monthly rainfall data (mm) for Binnu BOM Stn 8010, ~9 km W of trial site*

This trial is part of a series that aims to evaluate the accuracy of the N Calculator's recommended N rates and predictions of yield in various conditions and crops.

The trial incorporated:

i) long plots (assessment strips) to simulate farmer starter fertiliser practice with or without N at establishment and an N-rich strip (N Gauge);

ii) replicated and randomised plots to apply a series of tactical N treatments based on the predictions of optimal N application determined by the Summit In-Season Nitrogen Calculator after Greenseeker® NDVI readings of the long plots established at i); and

iii) two timings of calculation and application to test any response difference in a late application.

RESULTS:

Table 2. *NDVI readings from assessment plots and N Gauge which were used for N Calculator input.*

Plot	N	Seeding fertiliser product kg/ha	NDVI measurement for input into N Calculator for N rate recommendation 01/07/15	16/07/15
A	0	50TSP + 50MOP	0.255	0.255
B	6	50 MAPSZC + 50MOP	0.278	0.275
C	90	50 MAPSZC + 50MOP + 200L UAN (N Gauge)	0.317	0.372

Using these NDVI comparisons, the In-Season Nitrogen Calculator:

i) modelled the yield potential at 2.522 t/ha on at 7WAS (1/7) and 2.207 t/ha at 9WAS (16/7);

ii) calculated an optimized N application rate of 11.2 kg/ha on 1/7 and 20.7 kg/ha on the 16/7 to achieve these yields; and

iii) predicted this regime would out-yield a paddock with no N top up by 0.311 and 0.576 t/ha respectively.

Table 3. *In-Season Nitrogen Calculator recommended N treatment rates and application after NDVI comparison (Table 2)*

Tmt	Seeding N kg/ha	Product kg/ha	N applied as determined by In-Season N Calculator	N kg/ha	= Urea kg/ha
			7 weeks after sowing		
1	0	50TSP + 50MOP	N Calc rate from NDVI strips A:C x100%	18	39
2	6	50 MAPSZC + 50MOP	Nil N top-up	0	0
3	6	50 MAPSZC + 50MOP	N Calc rate from NDVI strips B:C x50%	6	12
4	6	50 MAPSZC + 50MOP	N Calc rate from NDVI strips B:C x100%	11	24
5	6	50 MAPSZC + 50MOP	N Calc rate from NDVI strips B:C x150%	17	36
			9 weeks after sowing		
6	0	50TSP + 50MOP	N Calc rate from NDVI strips A:C x100%	25	55
7	6	50 MAPSZC + 50MOP	Nil N top-up	0	0
8	6	50 MAPSZC + 50MOP	N Calc rate from NDVI strips B:C x50%	11	23
9	6	50 MAPSZC + 50MOP	N Calc rate from NDVI strips B:C x100%	21	45
10	6	50 MAPSZC + 50MOP	N Calc rate from NDVI strips B:C x150%	31	68

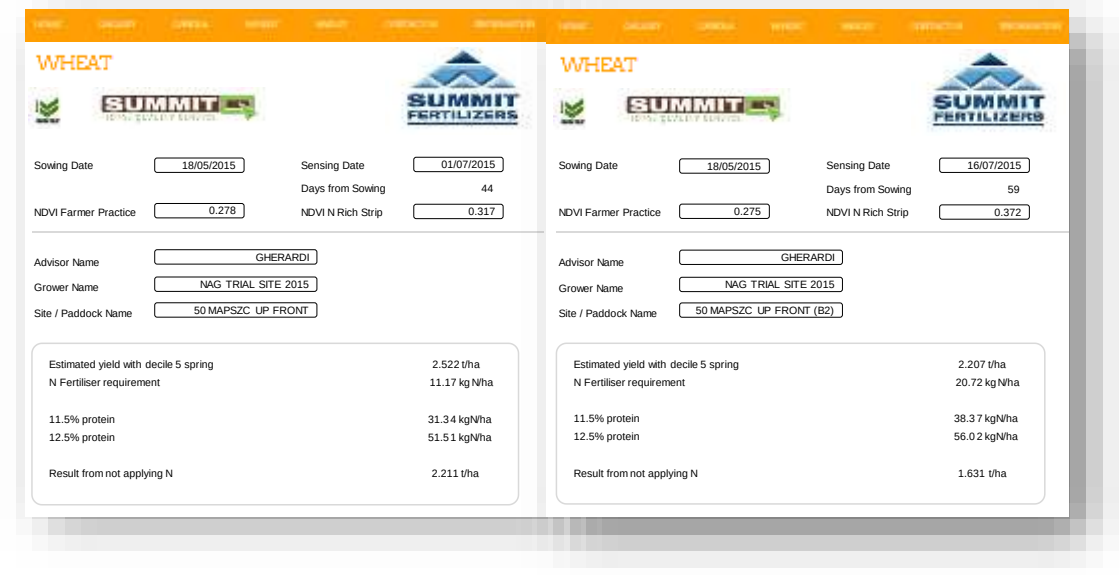

Figure 2. *Summit In-Season N Calculator input/output for the B:C plot NDVI comparisons at 01/07/2015 (left) and at 16/07/2015 (right).*

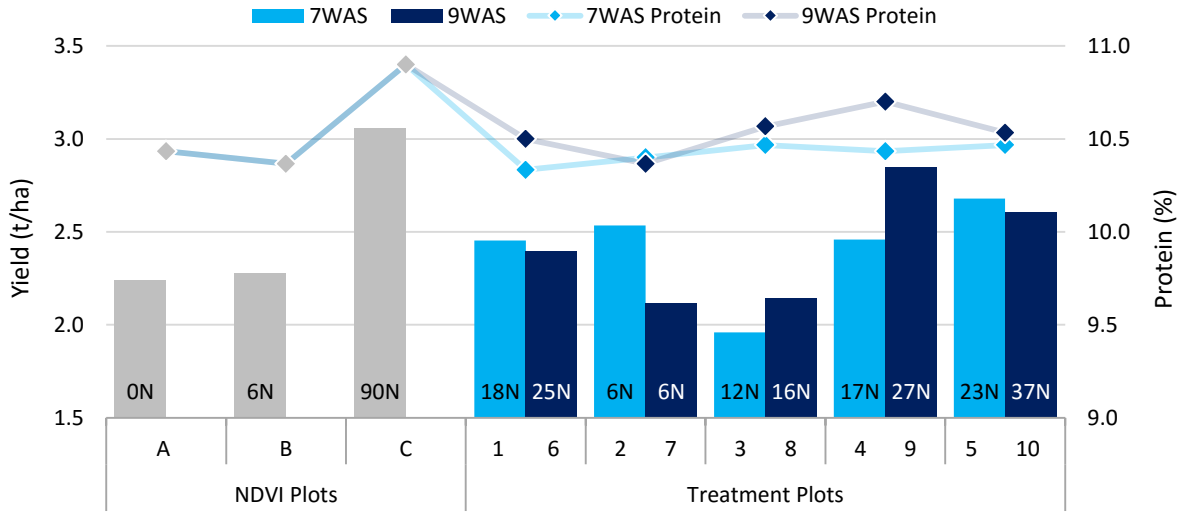

Figure 3. *Yield and protein results of treatments at 7 and 9 weeks. N treatments applied as Urea from N Calculator recommendation using NDVI plots. Total season N received is shown on columns.*

Yield observations and economics

- N Calculator at 1 July predicted 2.52t/ha compared to the actual 2.46t/ha.
- Protein (10.43%) was close to the 10.5% target.
- Yield prediction at 16 July was 2.21t/ha which underestimated the actual yield of 2.85t/ha
- Protein (10.7%) was just above the 10.5% target.
- Protein close to 10.5% indicates efficient utilisation of applied N.

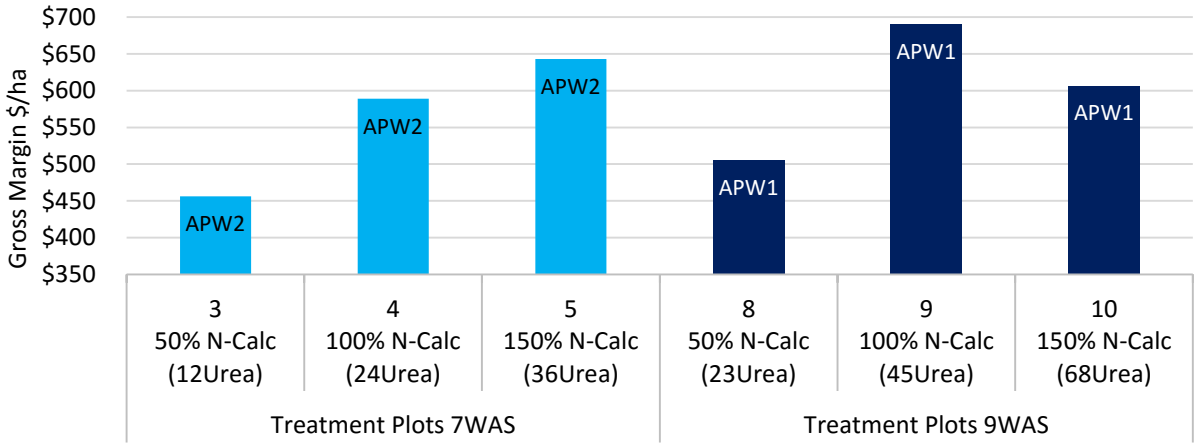

Figure 5. *Gross margin return from grain net of all fertiliser input costs in plots with N applied at the N Calculator recommended rate and +/- 50%, comparing applications 7 and 9 weeks after sowing. Value assumptions are Geraldton delivery grade prices 7 Dec 2015 and Mar 2015 fertiliser retail list prices.*

- The recommended N rate from the In-Season N Calculator at 6WAS (treatment 4) was a reasonable optimization of yield and return, but increasing the rate by 50% (treatment 5) gave an indicative 9% greater return.
- The N Calculator-recommended N rate at 9WAS (Treatment 9) was the best treatment in the trial, in terms of both yield and gross margin returns.
- Overall, the In-Season N Calculator gave very reasonable estimates of optimal N application and yield potential at the site.
- The results also highlight to the value of including some N in the starter fertilizer mix.

Table 3. *Yield, quality and gross margin data of treatment plots. Highlighted rows indicate Nitrogen Calculator recommended rate (b) at 7 and 9 weeks after sowing (WAS).*

Tmt		N˜ kg/ha	Fert cost# $/ha	Yield (t/ha)	Protein (%)	Weight kg/hl	Screenings %	Grade	Grain* $/ha	Return $/ha
A	Nil N	0	$73	2.24	10.43	81.60	2.05	APW2	$627	$554
B	50 MAPSZC	6	$85	2.28	10.37	81.68	2.20	APW2	$637	$552
C	N-Gauge	90	$227	3.06	10.90	82.10	1.62	APW2	$856	$629
1	39 Urea 7WAS	18	$97	2.45	10.33	81.94	2.00	APW2	$687	$590
2	Nil N 7WAS	0	$85	2.54	10.40	81.82	2.00	APW2	$710	$625
3	12 Urea 7WAS	12	$92	1.96	10.47	81.68	2.00	APW2	$548	$456
4	24 Urea 7WAS	17	$100	2.46	10.43	81.86	2.00	APW2	$689	$589
5	36 Urea 7WAS	23	$107	2.68	10.47	81.82	2.00	APW2	$750	$643
6	55 Urea 9WAS	25	$107	2.39	10.50	82.34	2.00	APW1	$675	$568
7	Nil N 9WAS	0	$85	2.12	10.37	81.79	2.00	APW2	$592	$508
8	23 Urea 9WAS	17	$99	2.14	10.57	82.19	2.00	APW1	$604	$505
9	45 Urea 9WAS	27	$113	2.85	10.70	82.22	2.00	APW1	$803	$690
10	68 Urea 9WAS	37	$127	2.60	10.53	82.20	2.00	APW1	$734	$607

Notes: All prices net delivered/received Geraldton and GST Exclusive
` Total nitrogen applied to the crop over the season
* Delivery grade $/t Geraldton, 7 December 2015: APW1 $282, APW2 $280
# Total of all fertilizer products applied. March 2015 retail price (ex Geraldton)

CONCLUSIONS:

- N Calculator recommendation was accurate for 9WAS application with additional nitrogen not increasing yield. The recommendation was slightly below optimum for 7WAS application.
- Achieving close to the target 10.5% protein indicates that recommended N rates were utilised to optimise growth and yield and application of N was not deficient or excessive.
- This provides confidence to incorporate the use of N-gauges and the N Calculator to assist in making N application decisions to wheat crops during the season based on the growth status of the crop.
- Summit will continue further testing of the N Calculator under different seasonal conditions in the northern wheat belt and the effect of timing of NDVI assessment and N-calculator recommendations on yield response to in-season N applications.

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SUMMIT FIELD RESEARCH

SUMMIT FERTILIZERS

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