Trial 5. Nutrition for Hyper Yielding Wheat (FAR VIC W23-05-01)

Key Points:

- *Following faba beans in 2022 there was no significant yield response to applied nitrogen (0-280kg N/ha), although there was a significant increase in grain protein from 0-160kg N/ha (9.6% - 12.2%).*
- *With 133.5kg N/ha in the soil 0 – 100cm on 26 April, the zero N treatment (only 10kg N/ha MAP applied) yielded 5.93t/ha with a protein of 9.6% indicating the presence of approximately 100kg N/ha in grain at harvest.*
- *If 75% of the N is assumed to be in the grain and 25% in the straw residue then the total N uptake at harvest in zero N plots was approximately 133kg N/ha, indicating that the soil could have provided sufficient N to satisfy this yield.*
- *There were no significant differences in harvest dry matter as a result of N application, although there was a trend suggesting higher N rate applications increased harvest dry matter up to 120kg N/ha.*
- *This trend in increased dry matter at harvest was linked to significantly higher head numbers up to 120kg N/ha.*
- *Although lodging levels at harvest were low there was a gradual increase in lodging as N input increased from 0 -160kg N/ha.*
- *No differences were observed in NDVI during early season, but during late season, treatments with 160kg N/ha and 120kg N/ha + PKS had statistically better NDVI scores (0.21 and 0.23 respectively) than other treatments. Treatment with 0kg N/ha had the lowest NDVI rating (0.11) recorded at GS89 on 24 November.*

Treatments:

RGT Cesario wheat was subjected to 10 nutrition treatments of varying nitrogen (timing and rate) and manure rates (Table 1). The 3t/ha (dry weight) manure (chicken manure) treatments were applied on top of 120kg N/ha applied as a two split 50% at GS30 (pseudo stem erect) and 50% at GS32 (2nd node). The chicken manure had an analysis of N 0.98%, P 1.0 %, K 2.4% and S 0.66% based on dry weight. The available soil N was measured on 26 April with 0-30cm 96.9kg N/ha, 30-60cm 21.1kg N/ha and 60-100cm 15.6kg N/ha giving a total of 133.5kg N/ha in the 0 – 100cm horizon. The trial site had an organic carbon content of 2.4% in the 0 – 10cm.

Table 1. Treatment details and application timings.

		Sowing	GS30	GS32	GS39
		29 April	6 Jul	~6 Sep	~26 Sep
Treatment		**kg/ha (MAP at sowing)**	**kg N/ha**	**kg N/ha**	**kg N/ha**
1	0N	100	-	-	-
2	80kg N/ha	100	40	40	-
3	120kg N/ha	100	60	60	-
4	160kg N/ha	100	80	80	-
5	200kg N/ha	100	100	100	-
6	240kg N/ha	100	120	120	-
7	280kg N/ha	100	140	140	-
8	200kg N/ha (3 split)	100	80	80	40
9	120kg N/ha + Manure*	100+3t/ha Manure	60	60	-
10	120kg N/ha + add NPKS **	100+ NPKS	60	60	-

**Manure nutrient analysis and equivalent nutrient rates detailed in table 4*

***130kg N/ha, 65 Kg P/ha, 120 Kg K/ha and 48 Kg S/ha applied 2 June.*

Table 2. Influence of nutrition strategy on wheat grain yield (t/ha), protein (%), test weight (kg/hL), and screenings (%).

		Grain Yield and Quality				
Treatment		**Yield t/ha**	**Protein %**	**Test Weight kg/hL**	**Screenings %**	**Lodging Index %**
1	0N	5.93 -	9.6 e	72.8 -	1.8 -	5.0 d
2	80kg N/ha	5.97 -	11.3 d	72.9 -	1.6 -	15.0 cd
3	120kg N/ha	6.16 -	11.8 cd	72.8 -	1.7 -	72.5 abc
4	160kg N/ha	6.36 -	12.2 abc	73.1 -	1.7 -	96.3 ab
5	200kg N/ha	5.75 -	12.6 ab	72.6 -	1.7 -	92.5 ab
6	240kg N/ha	5.95 -	12.6 ab	73.2 -	1.7 -	85.0 ab
7	280kg N/ha	6.31 -	12.7 a	73.5 -	1.7 -	127.5 a
8	200kg N/ha (3 split)	6.23 -	12.2 abc	72.7 -	1.8 -	43.8 bcd
9	120kg N/ha + Manure	5.99 -	12.2 abc	72.9 -	1.8 -	123.8 a
10	120kg N/ha + additional NPKS	6.63 -	12.0 bc	73.6 -	1.8 -	85.0 ab
Mean		6.13	11.9	73.0	1.7	74.6
P Value		0.152	<0.001	0.114	0.982	0.007
LSD P=0.05		ns	0.6	ns	ns	66

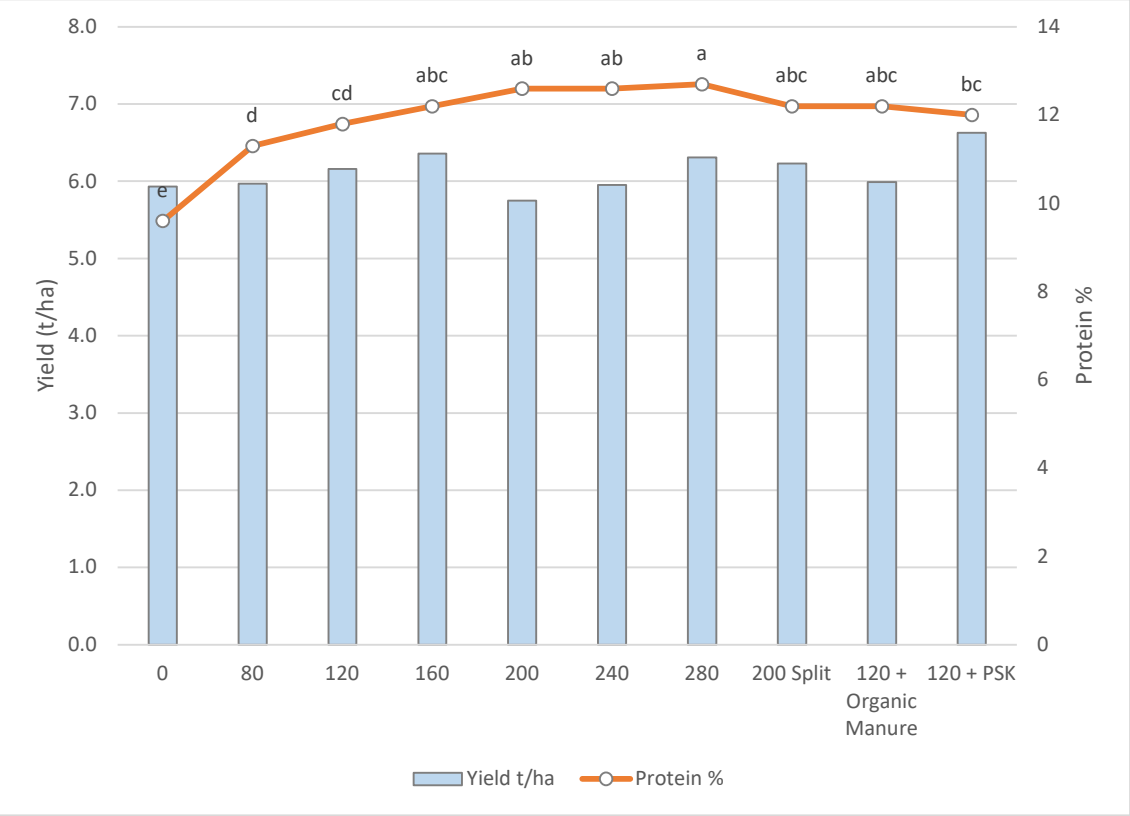

Figure 1: Influence of nutrition strategy on grain yield (t/ha) and protein content (%)

Table 3: Influence of nutrition strategy on plant dry matter (DM) yield (t/ha) and head counts(m^2)

		GS65		GS99		GS99	
Treatment		**DM t/ha**		**DM t/ha**		**Head Counts (m^2)**	
1	0N	12.36	-	14.99	-	393.6	c
2	80kg N/ha	13.91	-	15.36	-	458.0	bc
3	120kg N/ha	13.17	-	16.59	-	508.6	ab
4	160kg N/ha	12.60	-	14.78	-	443.9	bc
5	200kg N/ha	14.48	-	16.69	-	492.4	ab
6	240kg N/ha	12.26	-	16.36	-	498.3	ab
7	280kg N/ha	15.11	-	17.41	-	497.7	ab
8	200kg N/ha (3 split)	12.66	-	18.42	-	552.7	a
9	120kg N/ha + Manure	13.62	-	16.28	-	511.7	ab
10	120kg N/ha + Additional NPKS	15.03	-	17.56	-	511.9	ab
Mean		13.52		16.44		486.9	
P Value		0.375		0.119		0.015	
LSD P=0.05		ns		ns		75	

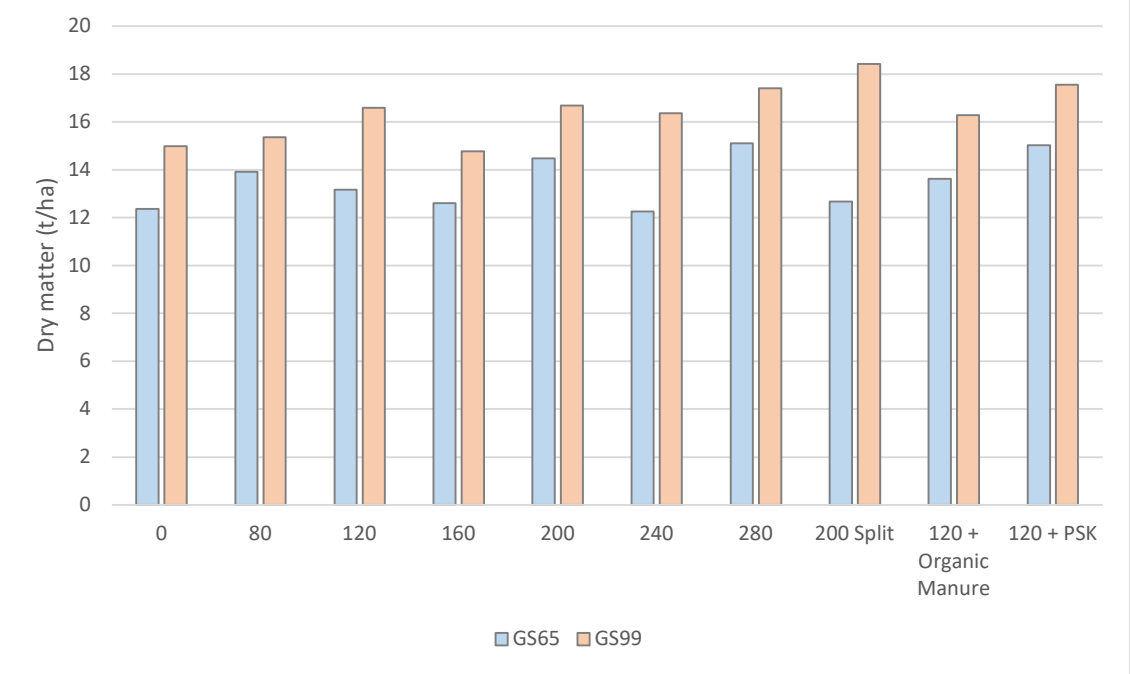

Figure 2: Influence of nutrition strategy on dry matter yield (t/ha) - GS65 (mid flower) and GS99 (harvest)

Table 4. Nutrient value of manure applied, and nutrients & products used in treatment 10.

Trt#	**Product**	**Rate**	**Nutrient Value (kg/ha)**			
		kg/ha	N	P	K	S
9	Manure (dry)	3000	**29.6**	**30**	**72**	**19.8**
10	Urea	92.9	42.8			
	MOP	124.8			74.9	
	SOA	62.5	13.1			15.0
	MAP	83.2	8.3	18.3		
	Total		**64.2**	**18.3**	**74.9**	**15.0**

Table 5. Analysis of chicken manure used at Gnarwarre 2023 (rates and nutrients reported on a dry basis except moisture).

Nutrient	Concentration in chicken manure
pH 1:5 water	5.7
Nitrate Nitrogen	960 mg/kg
Ammonium Nitrogen	8,900 mg/kg
Phosphorus	10,000 mg/kg
Potassium	24,000 mg/kg
Sulfur	6,600 mg/kg
Calcium	14,000 mg/kg
Magnesium	6,200 mg/kg
Carbon	39%
Iron	7,100 mg/kg
Manganese	530 mg/kg
Copper	74 mg/kg
Zinc	350 mg/kg
Boron	44 mg/kg
Moisture	30.8%

Table 6. Trial Input and management details

Sowing date:		**29 April 2023**
Harvest date:		16 January 2024
Seed rate:		180 seeds/m^2
Basal fertiliser:	29 Apr	100 kg/ha MAP
Nitrogen:		As per treatment list
PGR:	GS31	Moddus Evo 0.20 L/ha
		Errex 1.3 L/ha
Fungicides:	GS31	Radial 0.84 L/ha
	GS39	Aviator Xpro 0.50 L/ha
	GS59-61	Opus 0.50 L/ha

Table 7. Active ingredients and chemical loading (g/L) for products used.

Name	Active 1		Active 2		Type
Fungicide					
Aviator Xpro	Prothioconazole	150 g/L	Bixafen	75 g/L	EC
Opus	Epoxiconazole	125 g/L	---	---	SC
Radial	Azoxystrobin	75 g/L	Epoxiconazole	75 g/L	EC
PGR					
Errex 750	Chlormequat	582 g/L	---	---	SL
Moddus Evo	Trinexapac-ethyl	250 g/L	---	---	DC