Trial 3. Nitrogen Use Efficiency Trial – N Timing

Protocol Objective:
To evaluate the influence of different rates and timings of 46 %N prilled urea applied N prior to later applications of liquid N applied as fertigation applied in grain maize.

Peechelba East, Victoria

Sown: 13 November 2019
Harvested: 31 May 2020
Soil Type: Red loam over clay
Previous crop: Oaten hay

Hybrid: Pioneer Hybrid 1756
FAR code: FAR IRR M19-02-1
Irrigation Type: Overhead pivot

Key Messages:

- *With an average grain yield of 18.28t/ha there were no significant differences in header grain yield from varying nitrogen rate or timing of prilled urea (46%N).*
- *Where no nitrogen was applied early in the season a significant decrease in nitrogen content was observed in the stalk of the plants at harvest, but there no influence on grain N content.*
- *Test weight was significantly reduced when only 207kg N/ha was applied to the crop, there was no significant benefit in test weight when the highest rate of nitrogen was applied.*

Table 1. SAGI analysed grain yield (t/ha @ 14% moisture) of solid urea application rates (0, 90 & 180) at three different application timings.

	Solid Urea N Application Rate (total N applied)		
Prilled Urea N	**0kg/ha N**	**90kg/ha N**	**180kg/ha N**
	(207)	**(297)**	**(397)**
Timing	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**
Pre-Drill	18.26 -	18.65 -	19.05 -
V4	16.99 -	19.54 -	17.71 -
V6	17.91 -	18.20 -	17.49 -
LSD N Application Timing p = 0.05	NS	**P val**	0.691
LSD N Application Rate p=0.05	NS	**P val**	0.185
LSD N Timing. x N Rate. P=0.05	NS	**P val**	0.416

PV= Predicted value, SE= Standard error

** Post sowing nitrogen (207 N) was applied via fertigation with applications on V4 (46N), V8 (60N), pre-tasselling (101 N) on 10 Dec, 26 Dec, 14 Jan and Jan 15*

Available soil N assessed prior to sowing 33 kg N/ha (0-60cm)

Grain Yield

With an average grain yield of 18.28t/ha no significant differences (Table 1) were observed from varying nitrogen rate or the timing of the initial nitrogen applications (pre-drill, V4 or V6) nor was there an interaction between the two variables of rate and timing. A small increase in test weight (less than 1.0kg/hL) was evident when 297kg/ha N or more was applied to the crop (Table 2).

Table 2. SAGI analysis for grain yield (t/ha), test weight (kg/hl) and harvest index (%).

N Timing	N Rate	Yield		Test Weight		Harvest Index	
		PV	SE	PV	SE	PV	SE
4 leaf	0	16.99	+/- 0.75	80.65	+/- 0.29	50.31	+/- 1.18
4 leaf	90	19.54	+/- 0.75	81.50	+/- 0.29	52.14	+/- 1.19
4 leaf	180	17.71	+/- 0.86	81.82	+/- 0.29	50.07	+/- 1.19
6 leaf	0	17.91	+/- 0.75	81.32	+/- 0.29	48.81	+/- 1.18
6 leaf	90	18.20	+/- 0.75	81.67	+/- 0.29	50.2	+/- 1.19
6 leaf	180	17.49	+/- 0.75	81.44	+/- 0.29	51.32	+/- 1.18
Pre-sow	0	18.26	+/- 0.75	80.67	+/- 0.29	51.32	+/- 1.19
Pre-sow	90	18.65	+/- 0.86	81.03	+/- 0.29	48.71	+/- 1.19
Pre-sow	180	19.05	+/- 0.75	81.54	+/- 0.29	50.61	+/- 1.19
Mean		**18.3**		**81.3**		**50.4**	
Timing P val		0.691		0.299		0.765	
Rate P val		0.185		0.019		0.721	
Interaction P val		0.416		0.417		0.2	
LSD		2.3		0.8		3.4	
CV		8.2		0.7		4.8	

PV= Predicted value, SE= Standard error

Dry Matter and nitrogen content of plant components at harvest

Significant differences in nitrogen content of the stalks (including leaves) were observed at harvest, with a significantly less N removed in the stalks where the crop received only 207kg N/ha applied as fertigation (Figure 1). However, there was no difference in the N offtake in the grain.

Although not significant, there was a trend in total dry matter data suggesting that delaying applying nitrogen from pre-drill to V6 increased total dry matter by 3.72 t/ha (Figure 2). Total nitrogen content of all components showed a similar trend. Delaying application of N until V6 increased total N by 38 kg/ha (Figure 3).

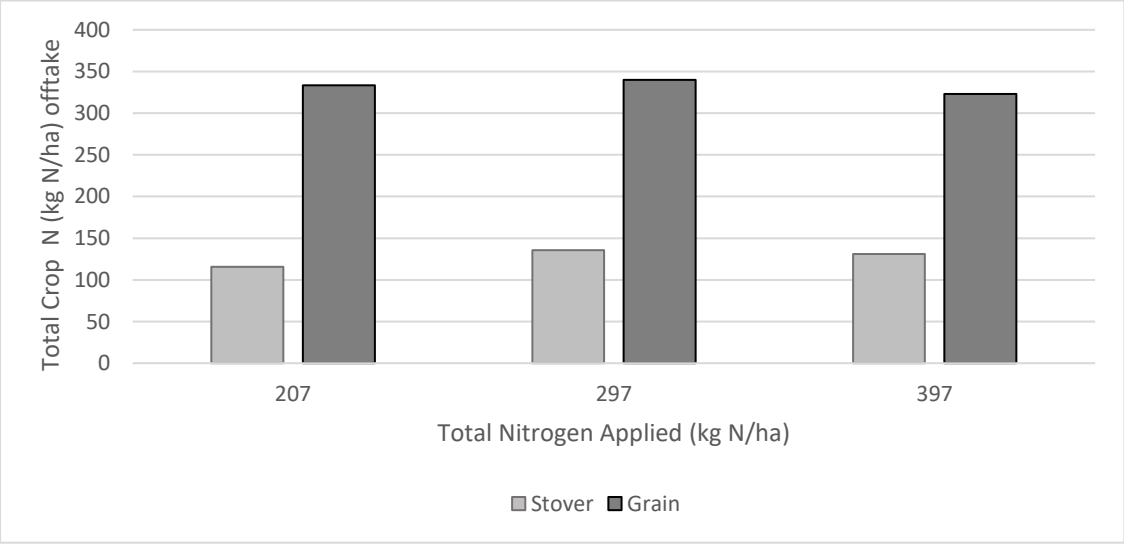

Figure 1. Nitrogen content (kg/ha) in the stover and grain at harvest with three rates of applied Nitrogen applied (mean of three timings of solid urea fertiliser N application)

Post sowing nitrogen (207 N) was applied via fertigation with applications on V4 (46N), V8 (60N), pre-tasselling (101 N) on 10 Dec, 26 Dec, 14 Jan and Jan 15

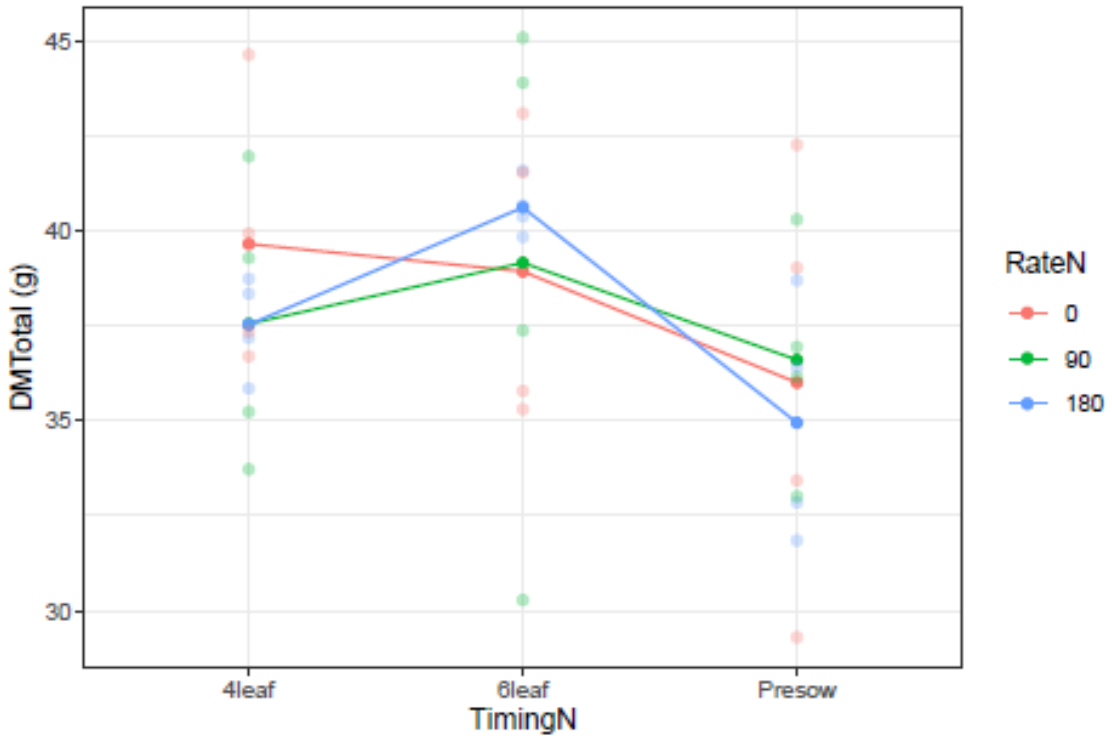

Figure 2. Total dry Matter accumulation at harvest (t/ha) in the stalk, husk and grain when varying the solid nitrogen application timing (0, 90 & 180kg N/ha).
Additional post sowing nitrogen (207 N) was applied via fertigation with applications at V4 (46N), V8 (60N), pre-tasselling (101 N) on 10 Dec, 26 Dec, 14 Jan and Jan 15. Total N applied was therefore 207, 297 and 387kg N/ha

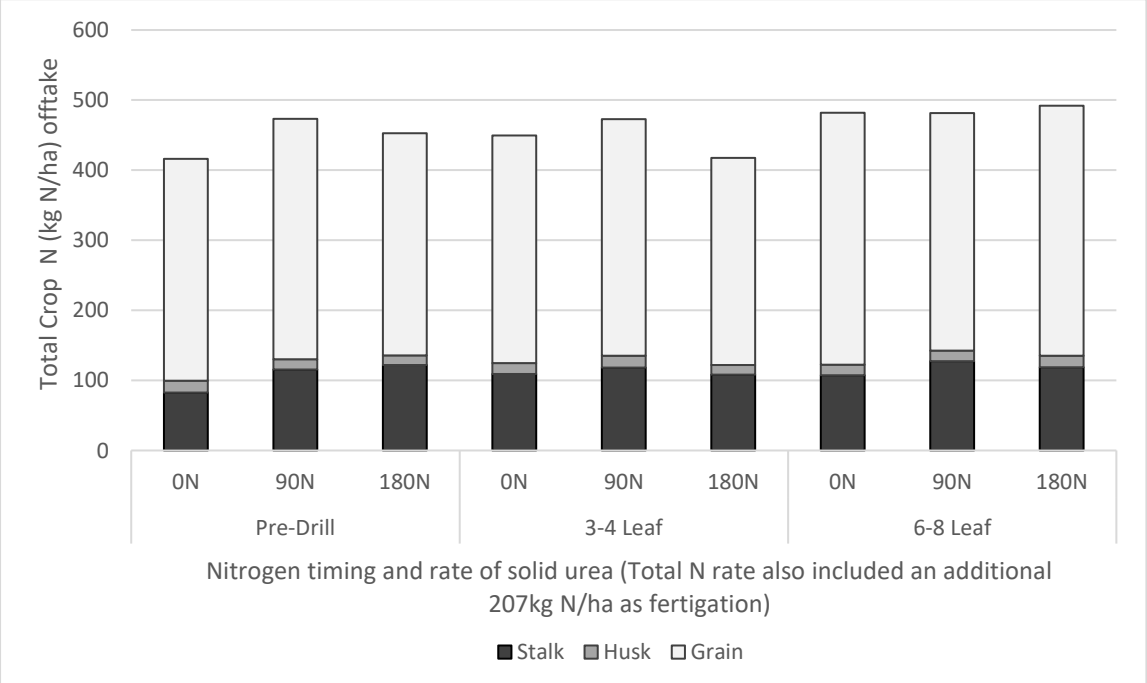

Figure 3. Nitrogen content in the stalk, husk and grain at harvest when varying the first nitrogen application timing.
Additional post sowing nitrogen (207 N) was applied via fertigation with applications at V4 (46N), V8 (60N), pre-tasselling (101 N) on 10 Dec, 26 Dec, 14 Jan and Jan 15.

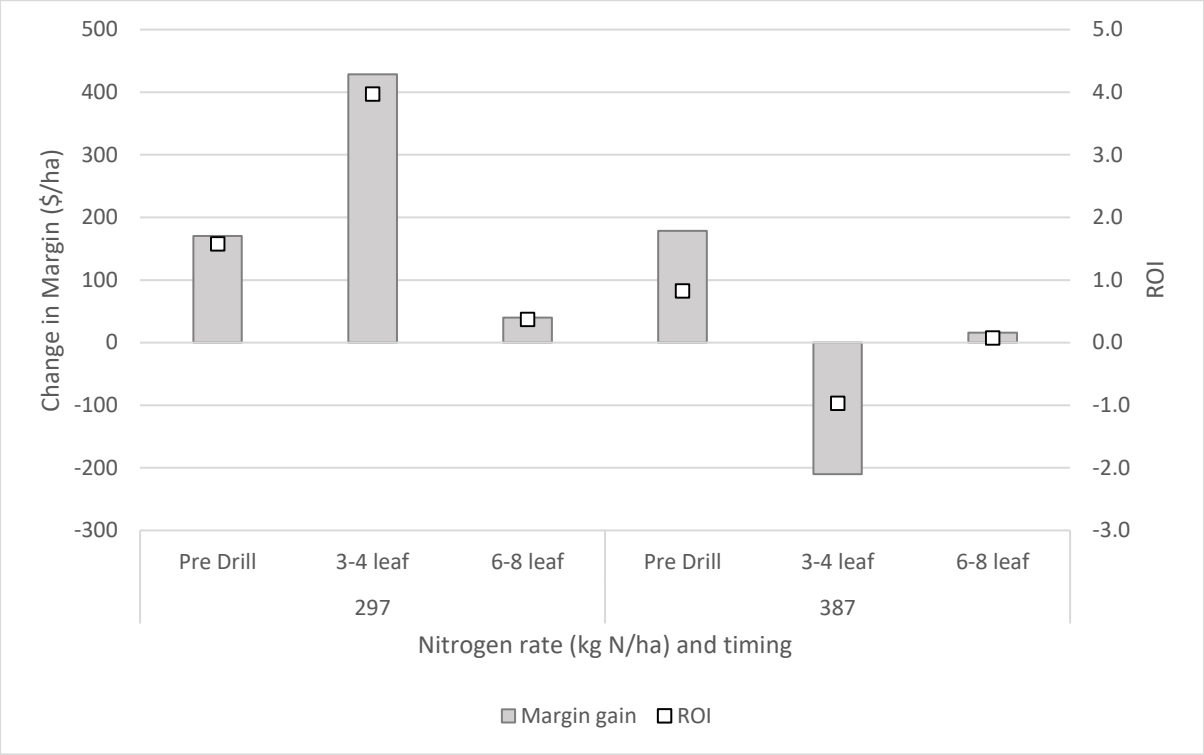

Figure 3. Influence of nitrogen rate and timing on margin over input cost compared to controls (No pre-drill N – fertigation 207N only) ($/ha – value of increased grain production minus cost of inputs) and return on investment (RIO). Based on SAGI predicted yield.
Input costs based on price of $1.20/kg N, Income based on grain value of $290/t.