Trial 4. Nitrogen Use Efficiency – Product and Timing

Kerang, Victoria

Sown: 3 November 2020
Harvested: 20 May 2021
Rotation position: Grass dominant pasture.
Previous crop: Grass dominant pasture (3 years)
Soil Type: Neutral self-mulching grey clay

Hybrid: Pioneer Hybrid 1756
FAR code: ICC M20-02-2
Irrigation Type: Border check surface irrigation

Key Messages:

- *In all treatments where N fertiliser was applied there were no statistically significant differences in grain yield.*
- *The highest yield achieved was 16.82 t/ha with the total applied N of 300 kg N/ha, applied as 100 kg N/ha at sowing, then 3 subsequent topdressings of 66 kg N/ha up to tasselling, but achieved similar yields to applying 300 kg N /ha at sowing only.*
- *The nil applied N treatment yielded 10.61 t/ha and had a dry matter of 19.58t/ha and a N content of 176kg N/ha at harvest.*
- *Soil available N prior to sowing and watering up was 44 kg N/ha (0-60cm).*
- *The nil N applied treatment contained a total of 176 kg N/ha at harvest, suggesting in-crop mineralisation resulted in 132 kg N/ha being released from the soil during the course of the season.*
- *In this trial as long as at least 100 N (and 200 kg N/ha in total) was applied beginning at sowing, product or timing did not influence yield.*

Treatment list: (kg N/ha) unless overwise stated N was applied as prilled urea (46% N))

	Applied N rate and timings (kg N/ha)				
Trt.	**Timing (1st N dose)**	**Timing 2 N dose)**	**Timing 3 N dose**	**Timing 4 N dose**	**Timing 5 N dose**
	Seedbed (sowing)	**V4 (3-4 leaf)**	**V6 (6 leaf)**	**V8 (8 leaf)**	**VT (tasselling)**
1	---	---	---	---	---
2	300	---	---	---	---
3	300 (eNpower)	---	---	---	---
4	100	66	---	66	66
5	100	100	---	100	---
6	100	66	66	66	---
7	100	---	---	100	---
8	200 (eNpower)	---	---	100	---

Grain Yield

There was no statistically significant yield differences amongst any of the N treatments applied, although all treatments gave a significant yield response over nil N control. The highest yielding treatment at 16.82 t/ha was achieved by applying 300 kg N/ha in four applications from pre-drilled (100N) through to the last application at tasselling VT (66N), however an identical yield was generated by a single application of eNpower (300N) applied prior to sowing. Reducing the rate of applied N to a total of 200 kg N/ha did not significantly reduce yield compared to treatments that received 300 kg N/ha.

Table 1. Grain yield (t/ha @ 14% moisture), test weight (kg/hl), total dry matter (t/ha) and harvest Index (HI) in response to Nitrogen timing and Product.

Treatm	Applied Nitrogen (kg N/ha)	Yield		Test Wt	Total DM		HI
1	*Nil (Zero Control)*	10.61	b	81.9	19.58	c	0.47
2	*300 at sowing (s)*	16.13	a	83.4	34.88	ab	0.40
3	*300 (s) as eNpower^*	16.80	a	82.6	35.82	a	0.41
4	*100 (s) + 66 V4 + 66 V8 + 66VT*	16.82	a	82.6	33.52	ab	0.43
5	*100 (s) + 100 V4 + 100 V8*	15.91	a	82.4	34.11	ab	0.40
6	*100 (s) + 66 V4 + 66 V6 + 66V8*	16.63	a	82.5	33.58	ab	0.43
7	*100 (s) + 100 V6*	15.99	a	83.4	32.86	ab	0.42
8	*200 (s) as eNpower^ + 100 V6*	16.43	a	82.5	32.58	b	0.44
Mean		15.7		82.7	32.1		0.43
LSD		1.17		ns	3.15		ns
P Val		<0.001		0.136	<0.001		0.186
cv%		6.1		0.9	6.8		8.4

Yield figures followed by different letters are considered to be statistically different (p=0.05)

^: eNpower™ 18:20 contains the nitrification inhibiter DMP in IncitecPivot Fertilisers patented DMP-G formulation. DMP works by inhibiting nitrifying bacteria in the soil, slowing down the conversion of ammonium N to nitrate which is more prone to loss.

N product or timing at rates of 200 or 300kg N/ha applied had little influence on total dry matter, with harvest crops ranging from 32 – 36t/ha. There was a significant difference in dry matter between the two eNpower treatments with 200kg N/ha giving lower DM than 300kg N/ha, but this did not translate to yield.

Harvest index was not influenced by any treatment.

Nitrogen content of the crop canopy of N fertilised plots at harvest ranged from 366 – 413kg N/ha with no significant differences recorded but the lower N rate of 200N registering the lowest N content of the fertilised plots. All treatments had significantly greater uptake than the unfertilised treatment, which had a total of 176kg N/ha in the crop at harvest. There was evidence that grain N content was increased in those treatments adopting later split N applications compared to single pre sowing N applications or where overall N applications were increased from 200 to 300kg N/ha applied.

Table 2: Influence of N timing, rate and product on Nitrogen content^ (kg N/ha) in maize at maturity, 23 March2021.

	Treatment							
	Applied N (kg N/ha)	Stover		Grain		Total N		
		Kg N/ha		Kg N/ha		Kg N/ha		
1.	*Nil (Zero Control)*	66.8	b	109.5	c	176.2	b	
2.	*300 at sowing (s)*	144.2	a	229.5	b	373.6	a	
3.	*300 (s) as eNpower^*	165.9	a	243.6	ab	409.4	a	
4.	*100 (s) + 66 V4 + 66 V8 + 66VT*	149.5	a	263.5	a	413.0	a	
5.	*100 (s) + 100 V4 + 100 V8*	141.7	a	245.2	ab	386.9	a	
6.	*100 (s) + 66 V4 + 66 V6 + 66V8*	146.6	a	265.0	a	411.4	a	
7.	*100 (s) + 100 V6*	144.8	a	221.3	b	366.1	a	
8.	*200 (s) as eNpower^ + 100 V6*	130.1	a	246.2	ab	376.3	a	
LSD Stover N	**(p=0.05)** 36.2	**P Val**	<0.001	**CV**	18.1			
LSD Grain N	**(p=0.05)** 30.74	**P Val**	<0.001	**CV**	9.2			

LSD Total N	**(p=0.05)**	48.14	**P Val**	<0.001	**CV**	9.0	

Yield figures followed by different letters are considered to be statistically different (p=0.05)

Crop N uptake (kg N/ha) at maturity

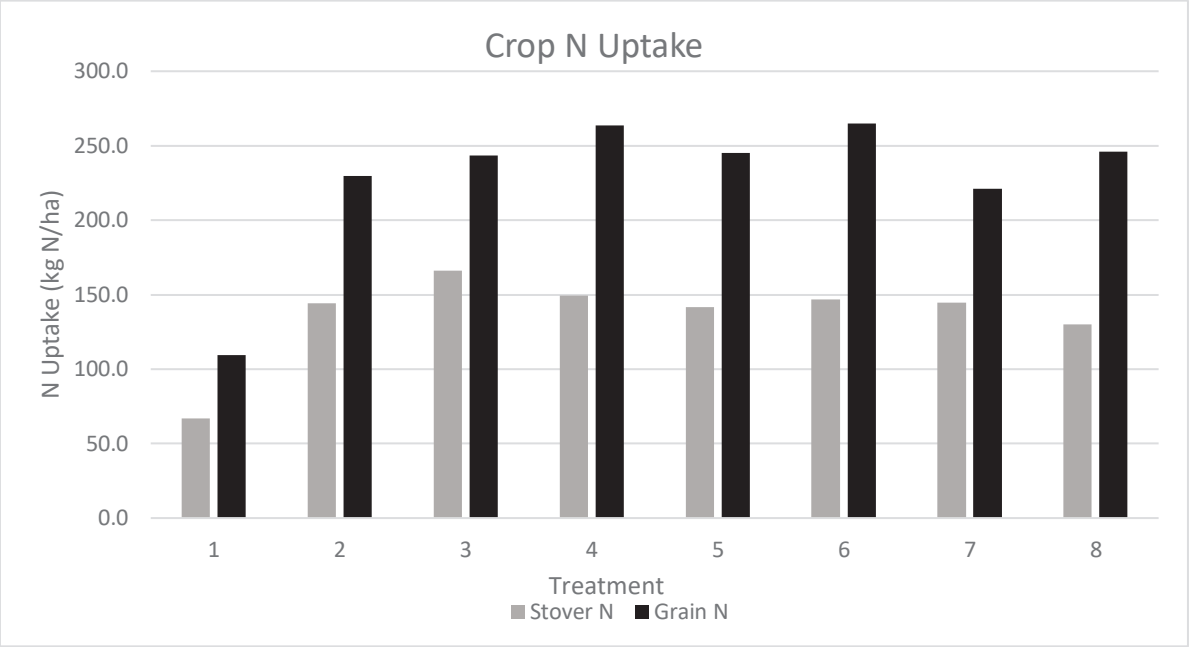

Figure 1. Influence of N timing, rate and product on Nitrogen Uptake (kg N/ha) in the stover and grain at maturity, 23 March 2021.

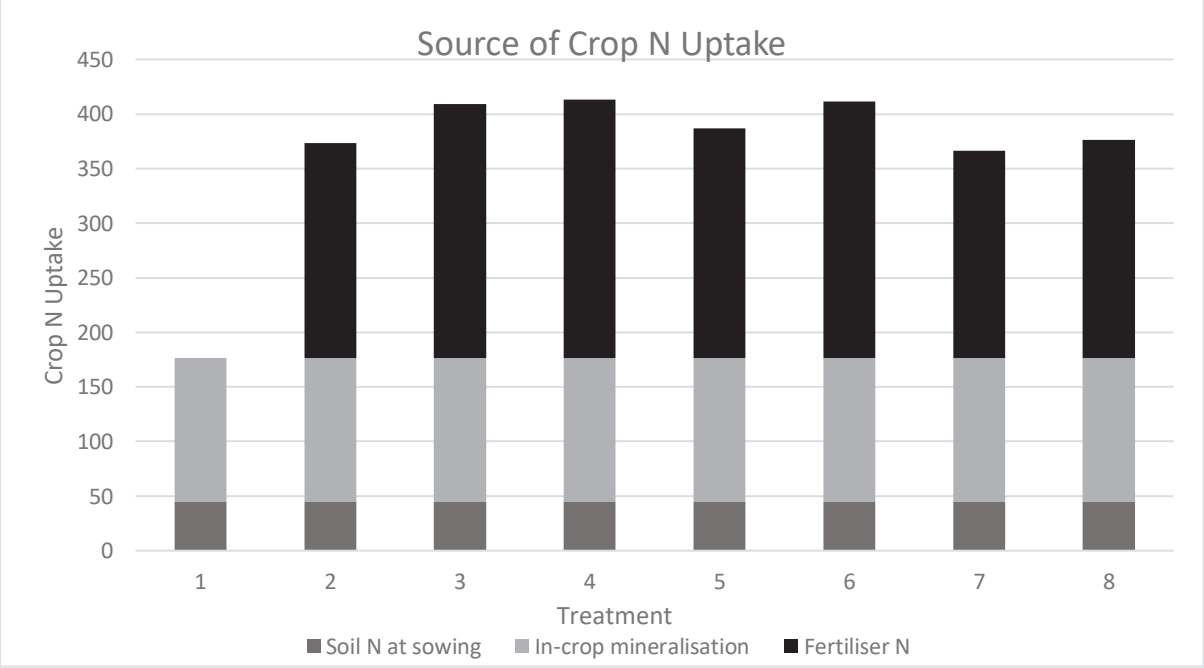

Figure 2: Assumed contribution of N fertiliser to total crop N uptake at harvest *(if mineralisation was assumed to be the same in all treatments and that there was preferential N uptake of soil N rather than bag N). Soil N available at sowing (44kg N/ha), in crop mineralisation (Min N) (kg N/ha), Fertiliser N (Fert N) applied.*

All treatments (where N was applied) were statistically similar meaning it didn't matter when the N was applied or in what proportions, as long as at least 200 kg N/ha was applied in total beginning with an application prior to sowing of at least 100 kg N/ha, yield was not affected.