Maize nitrogen application rate × hybrid under irrigation – Breeza 2014–15

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Introduction

Irrigated maize production remains a minor crop in the northern grains region. Matching optimum nitrogen (N) nutrition to irrigation water is essential to ensure the maximum efficiency from inputs is achieved.

The trial outlined below was designed to compare grain yield responses with variations in three maize hybrids and six nitrogen rates under raised-bed flood irrigation at Breeza on the Liverpool Plains. A dryland site was also planted at Gurley in the 2014–15 season.

Key findings

There was no difference in the yield performance of the three hybrids. Differences between the hybrids were evident for cob number and grain quality only.

The highest maize yields were obtained from the 150 kg N/ha, 200 kg N/ha at sowing and the 75:75 kg N/ha split nitrogen (N) treatments, which all produced similar yields.

Site details

Location:	**Liverpool Plains Field Station, Breeza**
Co-operator:	**NSW DPI**
Sowing date:	**21 November 2014**
Plant population:	**70,000 plants/ha**
Fertiliser:	**42 kg/ha Triple Super at sowing**
Harvest date:	**30 April 2015**
Planter:	**Monosem precision planter**

Starting soil water and irrigations

The site was cored pre-sowing to establish starting soil water. It was measured as 121 mm of plant available water (PAW) to a depth of 1.2 m.

Three in-crop irrigations were applied on:

1. 30 January, 2015
2. 16 February, 2015
3. 3 March, 2015

Starting nutrition

The site was cored just before sowing to determine starting soil nutrition (Table 1). The available soil nitrate N was estimated to be 145 kg N/ha to a depth of 1.2 m.

Table 1. *Starting soil nutrition at Breeza*

Depth (cm)	Nitrate (mg/kg)	Colwell P (mg/kg)	Colwell K (mg/kg)	Sulfur (mg/kg)	Organic carbon (%)	Conductivity (dS/m)	pH Level ($CaCl_2$)
0–10	16	49	562	7.4	1.17	0.211	7.7
10–30	11	23	371	8.9	0.80	0.277	7.9
30–60	4	–	–	–	–	–	–
60–90	3	–	–	–	–	–	–
90–120	2	–	–	–	–	–	–

Treatments

Maize hybrids

1. P1070
2. P1467
3. PAC606

Nitrogen rates

Nitrogen rates were selected to target a yield potential of 12 t/ha.

Treatments were applied as urea at sowing for treatments 1–5. Treatment six had urea applied half at sowing and the other half was surface spread in crop.

1. 0 kg N/ha

2. 50 kg N/ha
3. 100 kg N/ha
4. 150 kg N/ha
5. 200 kg N/ha
6. 75 kg N/ha: 75 kg N/ha split – applied at sowing and at 6–8-leaf stage.

Results

There was no difference in plant establishment across the six nitrogen application rates. However, there was a difference in the establishment of the different hybrids. The pioneer hybrid P1070 established fewer plants and also produced fewer cobs/ha than P1467 or PAC606 (Table 2).

Varying hybrid selection had no other effect on dry matter production, cobs/plant, tiller numbers or yield (data not shown).

Differences were evident between grain quality parameters though, with P1467 having a higher 1000 grain weight than PAC606; P1070 was the lowest. Screening levels were generally low, but P1467 was significantly higher than the other two hybrids. P1070 had the highest test weight, followed by P1467 and then PAC606 (Table 2).

Table 2. *Varying hybrid effect on plant establishment, cob number and grain quality*

Hybrid	Plant establishment (plants/ha)	Cob number (cobs/ha)	1000 grain weight (g)	Screenings (%)	Test weight (kg/hL)
P1070	63,190 b	62,220 b	286.0 c	1.29 b	79.32 a
P1467	70,830 a	68,330 a	326.7 a	1.96 a	78.42 b
PAC 606	73,330 a	70,690 a	317.4 b	0.96 b	75.83 c
Values followed by the same letter are not significantly different at the 95% confidence levels (P=0.05)					

Varying the nitrogen application rate had a bigger impact on plant structures and grain yield than hybrid selection. The nil nitrogen treatment produced significantly less dry matter than any other nitrogen treatment (Table 3).

The nitrogen application treatments resulted in significant differences in tillering and cob numbers, but the response did not follow a clear trend.

Final grain yields (adjusted to 14% moisture) were disappointing on the whole. However, they showed a strong response to increasing nitrogen application rate. There was no significant difference in the yield of the 150 kg N/ha, 200 kg N/ha at sowing and 75:75 kg N/ha split N treatments, which all produced a similar yield.

The same response to nitrogen application rate was measured with test weight (Table 3). Test weight was lowest in the nil N treatment, which increased incrementally up to 100 kg N/ha (Table 3).

The 1000 grain weight generally increased as the nitrogen application rate increased.

Screenings were very low on average across the site at 1.40%. Adding N resulted in lower screenings levels than the nil treatment (Table 3).

Table 3. *Varying nitrogen rate effect dry matter production, tiller and cob number, yield and grain quality*

Nitrogen rate (kg/ha)	Dry matter (t/ha)	Tiller number		Cob number		Yield (t/ha)	1000 grain weight (g)	Screenings (%)	Test weight (kg/hL)
		(tillers/ha)	(tillers/ plant)	(cobs/ha)	(cobs/ plant)				
0	7.33 b	38,890 bc	0.05 bc	562.7 bc	0.94 bc	2.28 d	267.4 e	2.68 a	75.92 d
50	10.72 a	11,110 c	0.01 c	162.1 c	0.93 c	4.42 c	285.5 d	1.52 b	77.30 c
100	10.66 a	50,000 ab	0.07 ab	740.0 ab	0.98 ab	5.31 b	298.7 c	0.91 b	78.21 b
150	11.96 a	36,110 bc	0.05 bc	510.6 bc	0.98 ab	6.05 ab	330.8 b	1.13 b	78.29 ab
200	10.69 a	55,560 ab	0.08 ab	821.0 ab	1.00 a	6.64 a	347.0 a	0.95 b	78.99 a
75:75	12.51 a	69,440 a	0.11 a	1079.1 a	1.00 a	6.36 a	331.0 b	1.22 b	78.43 ab
Values followed by the same letter are not significantly different at the 95% confidence levels (P=0.05)									

Summary

The grain yields in this irrigated maize trial were disappointing, especially considering that three in-crop irrigations were applied during the growing season. However, a significant response to nitrogen application was still evident with the 150 kg N/ha, 200 kg N/ha at sowing and 75:75 kg N/ha split N treatments all producing the highest yield.

Dry matter production responded well to N application, but this was only from adding any N over the nil treatment, with no incremental increase evident with higher application rates.

There was no difference in the yield performance of the three maize hybrids. Differences between the hybrids were evident for cob number and grain quality only.

In conclusion, this trial should be repeated in another season under irrigated conditions to try and improve overall crop performance and validate these responses across different seasons and sites.

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