Maize nitrogen rate x hybrid responses – Gurley 2015–16

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Key findings

- The starting soil nitrogen (N) at this site was 73 kg N, which was sufficient to supply the average crop yield of 2.1 t/ha, which was achieved.
- Consequently, there was no response to any of the nitrogen treatments applied.
- Hybrid selection had a major impact on plant structures, grain yield and quality. Pioneer 1467 produced more tillers than the other two hybrid maize varieties.
- Pacific 606 produced the highest grain yield at 2.65 t/ha and also had the highest 1000 grain weight and lowest screenings of the three hybrid maize varieties examined.

Introduction

Dryland maize remains a minor crop in north-western NSW. It is often considered a high risk dryland summer crop option in this environment, as favourable weather conditions (rainfall and mild temperatures) at flowering and grain fill are critical to achieving economically viable yields. Matching optimum nitrogen (N) nutrition to plant available water is essential to achieve the maximum efficiency from inputs.

Nitrogen is the nutrient required in the largest quantities and, it has been suggested, accounts for around 20% of the variable costs associated with growing maize (Scott 2012).

This experiment compared plant characteristics and grain yield responses of three maize hybrids to varying rates of N applied at sowing or in crop under dryland conditions at Gurley, south-east of Moree. An irrigated experiment was also conducted at Breeza on the Liverpool Plains in the 2015–16 season.

Site details

Location 'Kelvin', Gurley

Co-operator Scott Carrigan

Soil nutrition The site was selected for expected low starting soil N levels, however it was found to have 73.2 kg N/ha down to a depth of 1.2 m at sowing. The soil was a grey vertosol with a fairly neutral pH and generally low phosphorus levels (Table 1).

Table 1. Soil chemical characteristics.

Characteristic	Depth (cm)				
	0–10	10–30	30–60	60–90	90–120
pH (1:5 $CaCl_2$)	6.5	7.4	7.8	7.5	7.5
Nitrate nitrogen (mg/kg)	4	4	9	6	<1
Sulfur (mg/kg)	3.3	4.6	28.3	1630.8	320.2
Phosphorus (Colwell) (mg/kg)	8	3	<2	3	4
Organic carbon (OC) (%)	0.80	0.45	0.42	0.32	0.20

Starting soil water and rainfall The site was soil cored before sowing and found to have 149 mm of plant available water (PAW) to a depth of 1.2 m. Most of the PAW was in the 10–90 cm zone with a drier 90–120 cm soil layer below that. A total of 204 mm of in-crop rainfall was recorded at the trial site (Table 2).

Table 2. In-crop rainfall at 'Kelvin', Gurley in 2015–16.

Month	September	October	November	December	January
Rainfall (mm)	0	2	72.5	28	102

Sowing date	14 September 2015
Fertiliser	42 kg/ha Granulock Z applied to all plots at sowing.
Plant population & row spacing	Target 3.0 plants/m^2 (30,000 plants/ha) on 100 cm solid plant rows.
Harvest date	11 February 2016

Treatments

Hybrids (3)

Pacific 606; Pioneer 1414; Pioneer 1467

Nitrogen rates (6)

0, 50, 75,100, 75:75 split and 150 kg/ha of N applied at sowing as urea. The 75:75 split treatment had 75 kg/ha applied at sowing and 75 kg/ha surface spread at the 6–8 leaf growth stage.

Results

Establishment

Plant establishment was better than the targeted 3.0 plants/m^2 for all hybrids. Two hybrids, Pioneer 1414 and Pioneer 1467 established higher plant populations of 3.6 and 3.7 plants/m^{2}respectively than the remaining hybrid Pacific 606 which established close to the target at 3.1 plants/m^2.

Nitrogen treatments had no effect on establishment (data not shown).

Tiller production

The maize hybrids produced varying tiller numbers. Pioneer 1467 produced more tillers per square metre and per plant than the other two hybrids, which were not different from each other (Table 3). Nitrogen treatment had no effect on tiller production (data not shown).

Cob production

Nitrogen treatment had no effect on the number of cobs produced per square metre, but there was an effect from hybrid selection. Pioneer 1414 and Pioneer 1467 produced more cobs per square metre than Pacific 606 (Table 3). There was no difference though between the three maize hybrids for the number of cobs produced per plant; each produced on average 1.2 cobs/plant (data not shown).

Dry matter production

All treatments were sampled to measure the total amount of dry matter produced. On average, 6 t/ha was produced, however, there were no differences between hybrids or N treatments (data not shown).

Grain yield

Grain yield averaged 2.17 t/ha at this site in 2015–16. Nitrogen treatment had no effect on grain yield, but hybrid selection did (Table 3). Pacific 606 was the highest yielding hybrid at 2.65 t/ha, followed by Pioneer 1467, which produced a better yield than Pioneer 1414.

Grain quality

A sub sample was collected from each plot at harvest for quality testing. This data explains why Pacific 606 produced a higher yield with the same number of cobs per plant but lower cobs/m^2. The 1000-grain weight of Pacific 606 was significantly higher than the other two hybrids (Table 3) and it also had a higher kernel number when compared with Pioneer 1414, which was the lowest yielding hybrid in the experiment.

The level of screenings in Pacific 606 (0.6%) were also half those measured in the other two hybrids (1.2–1.3%).

Table 3. Maize hybrid performance at 'Kelvin', Gurley in 2015–16.

Hybrid	Plants/m^2	Tillers/m^2	Tillers/plant	Cobs/m^2	Yield (t/ha)	1000 grain weight (g)	Kernel no (/m^2)
Pacific 606	3.1	0.1	0.0	3.6	2.65	279.0	958
Pioneer 1414	3.6	0.3	0.1	4.4	1.78	233.2	762
Pioneer 1467	3.7	1.0	0.3	4.4	2.06	234.1	878
l.s.d (5%)	0.32	0.36	0.10	0.61	0.26	6.89	110

Conclusions

Grain yields at the site were average for dryland maize production in this region at 2.1 t/ha. Neither nitrogen rate nor application timing affected grain yield or any of the plant structures measured, including the amount of biomass (dry matter) produced. This result is explained by the starting soil nitrogen level of 73 kg of N/ha, which was sufficient to grow a maize crop of up to 2.65 t/ha in this experiment without additional nitrogen.

Varying maize hybrid choice had the greatest impact on all measurements at this site in this season. Pioneer 1467 produced the most tillers, but its cob production per plant was similar to the other two hybrids. Dry matter production did not vary with either hybrid or N treatments.

Pacific 606 was the highest yielding maize hybrid in the experiment. It produced the same number of cobs per plant as the other two hybrids, but the 1000-grain weight and grain size (screenings) were better.

References

Scott JF (2012). Dryland Maize (No till, Feed) – North East Budget series, NSW DPI website http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/175908/East-dryland-maize-12-13

Acknowledgements

This experiment was part of the project *Tactical crop agronomy of sorghum and maize in the northern region – NSW component* (DAN00195), with joint investment by NSW DPI and GRDC. Technical assistance provided by Delphi Ramsden, Angus Hombsch, Alice Bowler and Bronwyn Brennan (NSW DPI) is gratefully acknowledged. Thanks to Scott Carrigan, "Kelvin" Gurley for hosting the trial.