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Effect of nitrogen application and seeding rate on grain yield and protein concentration of wheat—Merriwagga 2013

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Introduction

Investment into nitrogen application can be risky for growers in lower rainfall areas, however, the rewards can be significant in certain situations. With an increase in cropping intensity and only a small area of pulse crops sown, soil nitrogen supplies are generally low across the southern region.

The aim of this experiment was to determine the effect of nitrogen application rates and seeding rates on commercially available wheat varieties.

Site details

Soil type	red sandy loam
Pre-sowing available N	96.6 kg/ha (0–90 cm)
Previous crop	wheat (2012 and 2011)
Sowing date	29 April 2013
Soil moisture	approximately 40 cm of moist soil
In-crop rainfall	186.5 mm
Starter fertiliser	60 kg Superfect
Harvest date	7 November 2013

Treatments

6 wheat varieties	EGA_Gregory, Elmore CL PLUS, Livingston, Spitfire, Suntop, Sunvale
4 nitrogen rates	0 kg, 50 kg, 100 kg and 150 kg/ha (pre-drilled)
2 seeding rates	20 kg/ha and 40 kg/ha

Key findings

- Increasing the sowing rate from 20 kg/ha to 40 kg/ha increased grain yield by 0.4 t/ha.
- The predrilled application of 50 kg N/ha increased grain yield from 1.1 t/ha (nil N) to 2.5 t/ha. The 100 kg N/ha rate increased grain yield by a further 0.4 t/ha.
- EGA_Gregory, Spitfire and Suntop were the highest yielding varieties.
- The nitrogen treatments did not increase grain protein concentration above the nil N treatment for any of the applied N rates.

Results

Grain yield

EGA_Gregory, Spitfire and Suntop were the highest yielding varieties in this experiment (*Figure 1*).

The application of nitrogen rates up to 100 kg/ha resulted in a significant increase in grain yield (averaged across all varieties). The application of 50 kg N/ha increased grain yield by 133% compared with the nil N application. The application of 100 kg N/ha increased grain yield by a further 17% above the 50 kg N/ha rate (*Figure 2*).

There was a significant grain yield response to increasing plant population, with the 40 kg/ha seeding rate (2.6 t/ha) yielding 0.40 t/ha more than the 20 kg/ha seeding rate (2.2 t/ha).

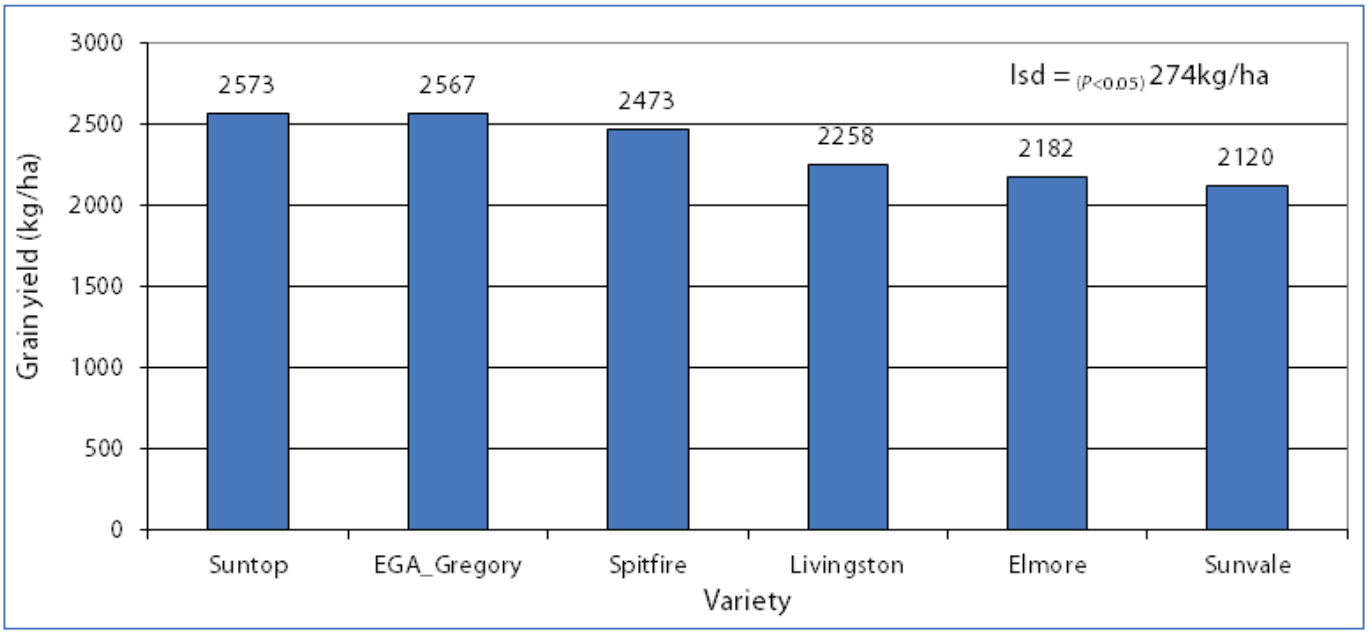

Figure 1: Grain yield of six wheat varieties averaged across four nitrogen rates and two seeding rates in an experiment at Merriwagga 2013.

The application of nitrogen at any rate did not increase grain protein concentration relative to the nil N treatment (*Table 1*). There was a significant reduction in grain protein concentration at the 50 kg N/ha rate relative to the nil N rate, however, this protein reduction was small compared with the yield increase.

Summary

Relative to the nil N treatment, the apparent efficiency of pre-drilled applied nitrogen was highest for the 50 kg N/ha rate (47%), reducing to 32% for the 100 kg N/ha rate, and 23% for the 150 kg N/ha rate. The return on investment for applied N was also highest at the lowest N rate of 50 kg N/ha, which is an important consideration in environments where responses to nitrogen fertiliser can be variable.

The application of nitrogen resulted in a significant grain yield increase but no increase in grain protein concentration. In certain seasons there may be potential to increase grain protein by delaying nitrogen application until in-crop, however, this could come at the expense of grain yield. There may also be few rainfall events that facilitate late season nitrogen applications in western environments.

Although there was no grain protein concentration increase at the 50 kg N/ha rate, the large increase in grain yield meant that the total amount of grain protein harvested on a hectare basis was significantly higher where N was applied.

Table 1: Effect of nitrogen rate on grain protein concentration of wheat averaged across six varieties and two seeding rates at Merriwagga 2013.

Nitrogen rate (kg/ha)	Grain protein concentration (%)
0	10.33
50	9.81
100	10.11
150	10.17
l.s.d. (P=0.05)	0.33

Acknowledgements

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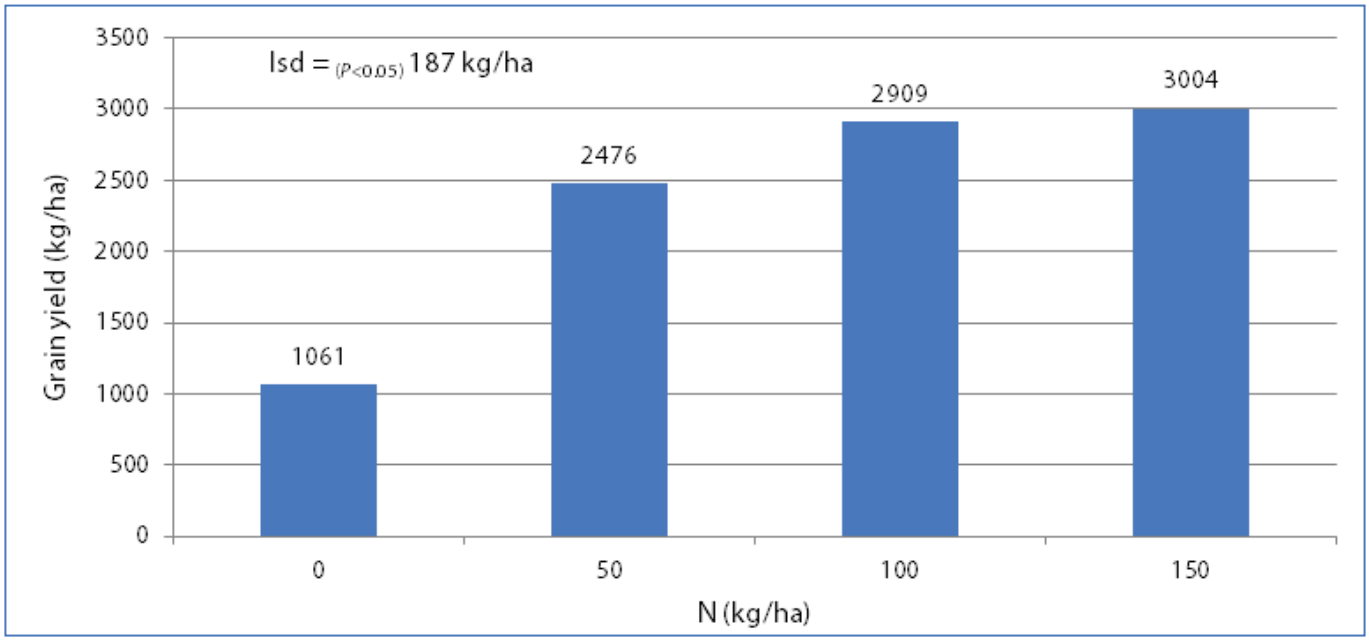

Figure 2: The effect of nitrogen rate on wheat yield averaged across six varieties and two seeding rates at Merriwagga 2013.