Low plant populations maintain yield

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- A trial in irrigated wheat at Hillston showed no significant effect on yield by varying plant populations from 125 to 345 plants/m^2
- Grain quality was not significantly affected by different plant populations either
- Wheat plants in each treatment compensated towards a common yield potential given their available resources by adding/aborting tillers and varying the numbers of grains per head

Under irrigation, wheat yields can be maintained with low plant populations, however there are certain management implications associated with such a practice. In particular, even plant establishment and early weed control must be given close attention in the early stages of crop development, when there is more bare soil than there would be with higher plant populations.

A trial was conducted at Cowl Cowl Station, north west of Hillston, to measure the effect that lower plant populations have on grain yield and quality in wheat, under lateral irrigation. This trial follows work done in 2004 by Maarten Stapper (CSIRO) who found that high yields (8 t/ha and higher) were possible under low plant populations in small research plots.

The trial

The variety H45 was planted at six sowing rates: 40, 60, 80, 100, 120, and 140 kg/ha. Each rate was replicated four times in a randomised block design.

Each treatment is the width of one swath of the air seeder (12 m), on 20 cm row spacing and 514 m in length. That equated to each treatment area being 0.62 ha. Each treatment was planted with GPS guidance.

Plant measurements were taken at emergence, tillering, and maturity.

The trial was harvested using a 20 foot (6.096 m) front, where one comb width was taken from the middle of each treatment, emptied and weighed in a calibrated weigh bin (Figure 1).

Grain quality was assessed for each treatment.

The paddock

The paddock chosen for the trial was a typical red/brown vertosol (a clay soil that shrinks and swells) that was in fallow in 2004, and sown to wheat in 2003.

The crop was sown on 20 June, and received 150 kg MAP/ha (15 kg N/ha and 33 kg P/ha) at sowing with no upfront nitrogen other than that supplied in the MAP. A total of 115 kg N/ha was topdressed as urea, split over three occasions during the season. The first 46 kg N/ha was applied at Z13 (3-leaf), the second application of 23 kg N/ha was applied at Z32 (2nd node), and the final 46 kg N/ha applied at Z49 (awn peep). NIR tissue testing was conducted to monitor the crop's nitrogen requirement and nitrogen applications were based on these results.

Due to the susceptibility of H45 to stripe rust, two triadimefon fungicide sprays were applied at flag leaf emergence and flowering, which proved timely and very successful.

The crop was watered with 2.5 ML/ha of irrigation water, in addition to 293 mm of growing season (April–Oct) rainfall.

Figure 1 *The trial was a large scale assessment of work that had previously been conducted on small plots. Yield from the 0.62 ha plots was measured using a portable weigh bin.*

The results

Figures 2 and 3 show the differences that were *observed* in plant establishment, tiller counts, head counts and grain yield between the different treatments. The statistical analysis, however, suggests that there were no significant differences between any of the treatments, even though some treatments actually yielded slightly higher than others. Table 1 shows the grain quality comparisons between treatments. Again no significant difference was evident.

Yield maintained with low population

The results from this trial suggest that under the conditions experienced in this field, no yield loss was apparent by lowering plant populations to 125 plants/m^2. At the standard sowing rate for the district (90–110 kg/ha) a plant population of 180–250 plants/m^2 would be expected.

The advantage of lower plant populations is that initial moisture and nutrient reserves/application last longer. Therefore, irrigation and nitrogen management may be delayed until later in the season when irrigation allocations/availability and crop returns are better understood, ie less up-front investment when crop profitability is less certain.

As also suggested by John Lacy (DPI) and Maarten Stapper, lower plant populations can reduce early crop canopy development, allowing resources such as nutrients and soil water to be saved for critical growth stages later in the season, which is more important for setting high yield potential than earlier in the season. Lower plant populations will also decrease the risk of lodging.

On the down side, lowering plant populations increases the risks associated with getting a good, even establishment (because of soil crusting, low seed germination, seed bursting following waterlogging) , and lessens the plants' ability to compete against weeds.

The conclusion

Yields can be maintained by lowering plant populations, however there are certain management implications (good and bad) that may be associated with such a practice.

Acknowledgements

Thanks to ICM Cowl Cowl Station for the paddock and sowing resources for such a large scale trial, and Dion and Jody from Radford Harvesting who allowed time to harvest the trial.

Further information

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Table 1
Grain quality analysis for various treatments, including protein, screenings, test weight, 1000 grain weight and yield

Measurement	Sowing rate - kg seed/ha 40	60	80	100	120	140	Average
Screenings %	2.23	2.32	2.71	2.73	2.93	2.83	2.62
Test weight g	81.58	82.15	81.70	82.48	81.03	81.93	81.81
1000 grain weight g	33.85	33.74	32.40	32.10	32.50	32.25	32.82
Protein %	11.93	11.85	11.77	12.25	11.60	11.70	11.85
Yield t/ha	5.6	6.1	5.7	5.3	5.4	5.6	5.6

The results are the average of four replications.

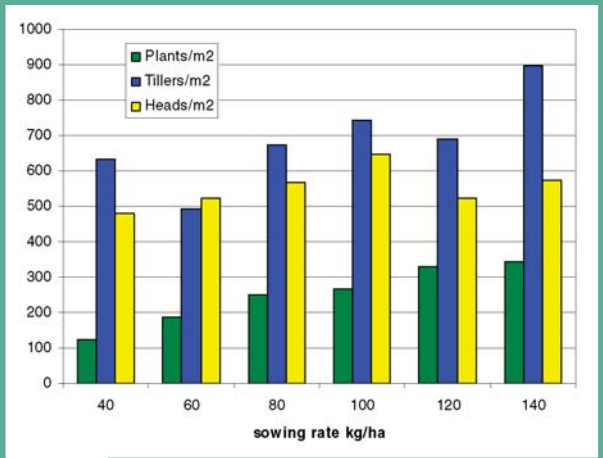

Figure 2 *Establishment (plants), tiller and head counts for the trial. There was a general trend for counts to increase with increased sowing rate, however the trend was not statistically significant.*

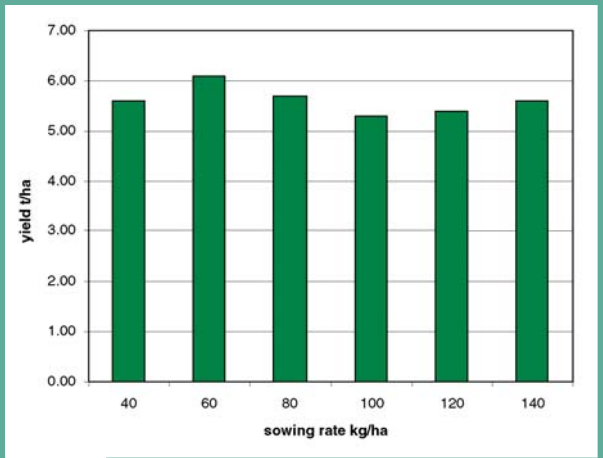

Figure 3 *Yields from the different sowing rates. Statistical analysis showed there was no significant difference between the treatments.*