Variety interactions with wheat row spacing and seeding rate

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Abstract

The aim of this work was to establish the effect of row spacing on optimum seeding rate for some of the newer wheat varieties grown on the South Coast of Western Australia. Three wheat varieties such as Westonia, Cascades and Camm (i.e. early, medium and late maturity) were sown at five target plant populations on three row spacings (180 mm, 240 mm, 360 mm) on Sandplain and Mallee soils at Gibson and Salmon Gums during 2000.

Narrow row spacing of 180mm consistently produced the higher wheat yield as compared to wider row spacing of 240mm and 360mm on both Sandplain and Mallee soils. On average, higher seeding rates (over 70 kg/ha or 150 plants/m^2) had no beneficial impact, or reduced yield, at the wider row spacing. Similar effects were recorded for weed competition. The yield decline in wider rows was greater in wheat varieties like Westonia and Cascades than in Camm. This effect was consistent across both sites. The response of Camm at wider row spacings can be partially explained by its higher green leaf area and dry matter production. This may also help to explain the observed advantage of weed competition at all row spacing and plant populations. Protein and screenings increased with wider rows in both experiments.

Key Words

Wheat agronomy, plant density, row spacing, plant population

Introduction

Research and field experience indicate that an optimal crop population plays a fundamental role in optimising crop yield and grain quality, and ultimately profitability, particularly in dryland agricultural environmnets. Research results reviewed and reported by Anderson and Garlinge (1) have shown the yields of cereals increase as the spacing between row is decreased. On average 8 % increase in wheat yield for each 9cm decrease in row spacing from 54 cm to 9 cm was observed in field experiments from 1988 to 1993 in Western Australia. Whereas, no decrease in lupins yield was experienced at wide row spacing up to 36 cm (2).

Generally cereal can compensate for poor stand by more tillering and thick stand by less tillering. However it cannot compensate ununiform and patchy crop stand. As plant densties continue to increase, it is important to understand the variety responses to plant population and row spacing.

The aim of this work was to establish the effect of row spacing on optimum seeding rate for some of the newer wheat varieties grown on the South Coast of Western Australia.

Methods

The sites selected in 2000 were a Sandplain at Gibson (average annual rainfall 675mm with 513mm falling in the growing season March to October) and an Alkaline Grey Sandy Duplex (Mallee soils) at Salmon Gums (average annual rainfall 340mm with 204mm falling in the growing season from March to October). The experimental layout was a randomised complete block design with row spacing as main plots. There were 90 treatments with three replications in three banks:

- 3 row spacing (180 mm, 240 mm, 360 mm) and
- 3 varieties - Westonia, Cascades, Camm (i.e. early, medium and late maturity)
- 5 target plant populations (50, 100, 150, 200, 250 plants/m^2)
- 2 Nitrogen rates (23 kg N, 46 kg N for Mallee and 37 kg N, 60 kg N for Sandplain soils).

All plot were marked 1.65 m x 20 m. Plots were sown 20 m x 1.44 m using 6 row Cone Seeder. Individual plots were 8 rows for 180mm row spacing, 6 rows for 240mm row spacing and 4 rows of 360mm row spacing. All plots were mechanically harvested by using Plot Harvester. Out side rows of the each plot were excluded from harvesting. Data was collected on plant emergence and growth, leaf area index and disease ranking, grain yield and yield components; grain protein, screenings and hectolitre weight.

Results

Wheat variety responses to plant population and row spacing were similar on both sites of Sandplain at Gibson and Mallee soils at Salmon Gums. There were no significant interactions of N rate with variety, row spacing or seed rate. Higher seeding rates (over 70 - 120 kg/ha with target plant population 150 – 250 plant/m^2) only increased yields at the narrowest row spacing (180 mm). On average, higher seeding rates (over 150 plants/m^2 or 70 kg/ha) had no beneficial impact, or reduced yield, at the wider row spacing. Similar effects were recorded for weed competition.

The yield decline in wider rows was greater in Westonia and Cascades than in Camm. This effect was consistent across both sites. The response of Camm at wider row spacing can be partially explained by its higher green leaf area and dry matter production. This may also help to explain the observed advantage of weed competition at all row spacing and plant populations (data not shown). Protein and screenings increased with wider rows in both experiments.

Conclusion

Variety interaction with plant population and row spacing is a complex issue and needs to be considered in the scenario of current farming systems where it may be desirable to increase row spacing and plant population to improve soil, weed and stubble management. New wheat varieties may be responsive to higher seeding rate but may also be sensitive to wider row spacing. The long season variety Camm was found to be better suited to wide row spacing at five seeding rates compared to the short season variety Westonia and the mid-season variety Cascades. This result has implications for seeding systems that use wider rows as a tool to improve stubble and weed management.

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References

(1) Anderson, W. and Garlinge, J. 2000. The Wheat Book: Principles and Practice. Department of Agriculture Western Australia. Bulletin No.4443 (Agdex 112/01).

(2) Amjad M., Green AHS, Riethmuller, G. P. and Jarvis R.J. 1997. Effects of range of seeding systems on lupin establishment and yield. Highlights of Lupin Research and Development in Western Australia. Edited by G. Shea, UWA, February 20, pp 3-8.