Row spacing impacts on dryland wheat yields in central Queensland.

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Abstract

Wheat plays an important role in central Queensland (CQ) farming systems by providing a weed and disease break for other crops as well as by producing valuable stubble cover, aiding water infiltration and protecting against soil erosion in this summer dominant rainfall environment. Sorghum is the main summer crop in CQ, however row spacings used in wheat have not traditionally been compatible with those used for sorghum. To better integrate wheat into a summer dominant cropping system, growers have been interested in widening the row spacing used in wheat to 50 cm to be compatible with sorghum planting configurations (normally multiples of 1 m).

To investigate the impact of wide row spacing on wheat yield, 24 grower participatory on-farm and small plot trials were conducted during the 2002, 2003 and 2004 winter seasons. Treatments included 25 cm, 37.5 cm and 50 cm row spacings. Results indicate that for yields less than 2.5 t/ha, the risk of yield reduction from wide row spacings is low. When yields are greater than 2.5 t/ha a yield loss of 0.3 – 0.5 t/ha is likely with rows wider than 25 cm, and the yield loss is likely to be greater for 50 cm than for 37.5 cm row spacings. Ultimately, growers need to assess all implications of using wide rows in their own farming system. A number of issues need to be assessed on an individual farm basis, as each grower has different risk profiles and each farm has different resource constraints.

Key Words

Wheat, row spacing, grain yield, central Queensland.

Introduction

Central Queensland farmers practice opportunity cropping, with increasing use of zero-till controlled traffic farming methods. Although there is a predominance of summer cropping, wheat is a profitable and important crop in the rotation, particularly for its stubble cover. Farmers have adopted wide rows in summer crops to improve dry-season reliability and stubble-handling capability of zero-till planters, and to reduce the capital outlay and power requirements. They also use their summer crop planters to plant wheat, which means planting in rows as wide as 50 cm. Wide rows are considered essential when using moisture-seeking planting techniques, which is an important crop establishment practice in some seasons.

Many wheat row spacing studies were undertaken in Queensland between 1960 and 1980 (none were conducted in central Queensland), however only one investigated row spacings wider than 36cm. This study found a yield penality when row spacing was widened past 36cm to 54cm (Woodruff and Mawhood 1978). Before work described here was conducted, central Queensland farmers assumed there would be a yield penality with wide rows, but wanted to quantify the actual yield penalty over a range of seasons. The impact of plant population and variety (maturity length) with wide rows were also important issues.

Methods

The CQ Sustainable Farming Systems Project worked with groups of farmers from 2002 to 2004 to investigate these issues. Replicated trials were conducted on farmers' properties throughout the region

and on DPI&F Research Stations. Some trials were conducted in conjunction with the Department's wheat breeding evaluation program. These were replicated and planted with small-plot machinery. During dry winter season's irrigation was used to ensure sowing on the Research Station trials, and to obtain a range of planting dates and yield levels during the three-year period. The amount of irrigation applied simulated an above average yield when rainfall in that year was average or below.

The 2002 trials compared three varieties (Kennedy, Baxter and Strzelecki) at two row spacings (25 and 50 cm). Based on the outcome of these trials, the 2003 trials compared two plant populations (600,000 and 1 million plants/ha) and two varieties (Kennedy and Baxter) at three row spacings (25, 37.5 and 50 cm). The research station trials in this year also included low yield (dryland) and high yield (irrigated). The 2004 trials compared three plant populations (500,000, 800,000 and 1,100,000 plants/ha) with the same varieties and row spacings as in 2003. One trial at the Emerald Research Station also included 2 planting dates. A total of 24 trials were conducted in the three-year period.

Results

At yields less than 2.5 t/ha widening rows from 25 to 37.5 cm affected yield in a minority of instances (2 of 7 trials), when it reduced yield by an average of 0.3 t/ha (Table 1). Widening row width from 25 to 50 cm caused a yield loss more often (4 of 9 trials), but the average loss was small (0.1 t/ha) (Table 1).

At yields between 2.5 and 3.5 t/ha, widening rows from 25 to 50 cm appeared to provide a more consistent yield reduction of 0.4 t/ha, and 0.5 t/ha when the yield exceeded 3.5 t/ha (Table 1)

Plant populations greater than 700,000 plants/ha maximised yield. Row spacing effects were independent of plant population, planting date and (in most cases) variety (data not shown).

Table 1: Row spacing impacts at 3 yield levels across all plant populations and varieties.

Yield level.	**Yield (t/ha)**	**Widening row width from…..**	
		25 to 37.5 cm	**25 to 50 cm**
<2.5 t/ha			
No. trials		7	9
25 cm yield average	1.73		
25 cm yield range	0.87 – 2.39		
No. trials with significant difference (% of total no. trials)		2 (29%)	4 (45%)
Av. yield loss in trials where differences were significant		0.3 t/ha	0.1 t/ha
2.5 – 3.5 t/ha			

No. trials		2	6
25 cm yield average	3.08		
25 cm yield range	2.6 – 3.3		
No. trials with significant difference (% of total no. trials)		1 (50%)	5 (83%)
Av. yield loss in trials where differences were significant		0.3 t/ha	0.4 t/ha

>3.5 t/ha			
No. trials		6	9
25 cm yield average	4.7		
25 cm yield range	4.1 – 5.2		
No. trials with significant difference (% of total no. trials)		3 (50%)	7 (78%)
Av. yield loss in trials where differences were significant		0.3 t/ha	0.5 t/ha

Conclusion

- When yield is below 2.5 t/ha, the risk of yield reduction with rows wider than 25 cm is low;
- When yield is in the range 2.5 to 3.5 t/ha, both 37.5 and 50 cm rows are likely to incur a yield loss of 0.3-0.4 t/ha compared with 25 cm rows, with 50 cm rows likely to incur slightly more loss than 37.5 cm rows;
- When yield is above 3.5 t/ha, losses from rows wider than 25 cm will be greatest. If a farmer chooses to use a spacing wider than 25cm, 37.5 cm is preferred to 50 cm. However the compatibility with row spacings of other crops sown should also be assessed.

In evaluating these results, farmers need to consider the relative importance of wheat in their farm program, and their yield expectation. Yield losses with wide rows would be expected to affect farm profitability most on farms where wheat is an important crop and yield expectations are high. Each farmer should weigh up the relative importance of a potential yield loss with wide rows, against the advantages that they offer in their own farm program.

References

Woodruff, D.R. and Mawhood, R.P. (1978). Effects of Row Spacing and Phosphorus Fertiliser Application on Wheat Yields. *Queensland Wheat Research Institute – Biennial Report 1976 – 1978*. QDPI.