WIDE ROW SPACING IN ARRINO WHEAT

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AIM

To evaluate the effectiveness of wide row spacing in Arrino wheat in a low rainfall environment with limited inputs.

BACKGROUND

This trial is an On-farm demonstration for the Liebe Groups GRDC funded adoption project '**Growers critically analysing new technologies for improved farming systems**'. The site was randomly selected by the farmer late in the season for an opportunistic crop. The paddock had a good medic pasture history and considering the conditions at the start of the season and predictions for low rainfall, the grower decided to take advantage of the site and trial the potential for wide-row seeding on his property. The paddock was sown with a small budget, as the grower intended the crop to utilise the nitrogen supply from the previous medic pasture.

Very wide rows or skip rows in wheat is a concept that is being tested to reduce the level of screenings without a large sacrifice to yield in situations where a dry finish to the season is often experienced. On shallow soils that have limited rooting depth and relatively high fertility, wide rows have also resulted in significant yield improvements over standard row spacing. Improved grain size can be obtained from reduced tillering or greater tiller survival bought about by lower plant density and increased availability of stored soil moisture.

At crucial stages of crop growth, plants rely heavily on the availability of stored soil moisture. This can be a major issue on soils that have limited rooting depth through either physical or chemical constraints i.e. shallow rock or 'wodjil' soils, on soils with low water holding capacity and in situations where crops experience extended dry periods through the growing season.

Research conducted in 2006 by Paul Blackwell at Tardun indicated that the high competition between plants seeded in wide rows with narrow knife points impedes plant establishment and inevitably yields. Rows sown with narrow knife points, wide rows (600mm) yielded 3.7% lower than 300mm row spacing.

However, in the same study, implementing 'ribbon sowing' (increasing width of seeding within the row) in wide rows (600mm spacing) reduced crowding between cereal plants, therefore, minimising competition and increasing tiller survival of the crop. Ribbon sowing achieved 14% higher yields and 0.6% less screenings at the end of the season. The higher yield may have also been helped by higher soil disturbance, thus mineralization of nitrogen to assist tillering, by the wider winged point used for ribbon sowing. See report page (85-86):
Blackwell, P, Edgecombe, S and McKenna, I. (2007) Ribbon sowing helps wide rows of wheat, Liebe Group Research and Development Book 2007, 85-86.

In addition, a study conducted by Mohammad Amjad and Wal Anderson, namely 'Managing yield reductions from wide row spacing in wheat' observed similar responses to wide row sowing and the effectiveness of increasing seed width within a row. The study found that yield was increased at the widest row spacing (360mm) by using the wider row spreads of 50 or 75 mm. Another point the research identified was that yield reductions due to wide row spacing can be minimised by using a long season cultivar when sown in May, by using adequate N fertiliser and by increasing the spread of seed across the row. For more information please see the following journal article:
Amjad, M. and Anderson W. K. (2006) Managing yield reductions from wide row spacing in wheat. Australian Journal of Experimental Agriculture 46(10) 1313–1321.

TRIAL DETAILS

Property	Gary and Kerry Butcher, Pithara
Plot size & replication	Plots 0.593 ha x 5 reps
Soil type	Heavy Clay
Sowing date	29th June 2006
Seeding rate	40 kg/ha Arrino Wheat
Fertiliser (kg/ha)	Nil.
Paddock rotation	2002: Pasture Medic, 2003: Pasture Medic, 2004: Wheat, 2005: Pasture, 2006: Wheat.
Herbicides	2 L/ha Glyphosate
Growing Season Rainfall	111mm (April - October)

RESULTS

Table 1: Yield, quality, grain size and number of filled and unfilled heads for 250mm and 500mm sown Arrino wheat seeded on 29th June at Pithara on a heavy clay soil.

Row spacing	Yield (t/ha)	Protein (%)	Screenings (%)	Hectolitre (g)	Small grain (<2.5mm) %	Filled Heads (m^2)	Unfilled heads (m^2)	Seed weight (g)
250mm	0.54a	14.9	10.15	376.0	79.8	188.0	6.2	0.423
500mm	0.45b	14.4	7.81	382.5	76.4	144.0	3.8	0.460
LSD (5%)	0.03							

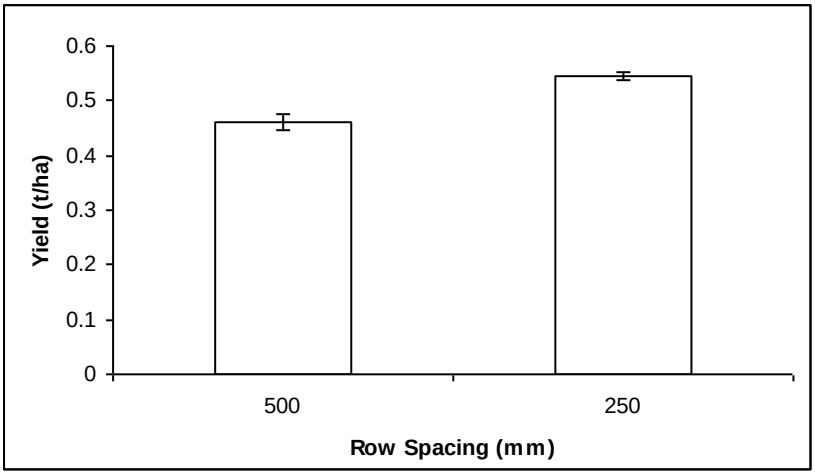

Figure 1: Mean yields and standard errors for 500mm row spacing compared to 250mm row spacing.

ECONOMIC ANALYSIS

Table 2: Economic Analysis ($/ha)

Treatment	Yield (t/ha)	Gross Return	Variable Costs	Gross Margin	Payment Grade
250mm	0.55	85.84	63.6	22.24	AGP
500mm	0.46	77.57	63.6	13.97	ASW

Based on EPR for 21/12/2006 for AGP, base rate $167/tonne and ASW, base rate $172/tonne

There is a significant difference ($P<0.05$) in yields between 250mm row spacing and 500mm row spacing (Table 1). The main difference in yield may have been due to poor tillering in the 500mm spaced crop. The entire crop was reliant on the soil nutrition from the pasture as no fertiliser was applied to the paddock prior to and following seeding. Subsequently, the plants on the 500mm rows are in a more competitive environment than the 250mm spacing for nutrient acquisition in the seedling stage, having to search for nitrogen in less soil volume than the same number of plants spread over the 250mm rows. Tiller survival therefore benefited in the 250mm rows and inevitably the number of filled heads and yield also benefited by 44g and 15.8% respectively (Table 1).

The 250mm rows had 2.3% more screenings than the 500mm rows, 3.4% more small grain between the 2 and 2.5mm sieve than the 250mm crop and double the amount of unfilled heads as the 500mm rows. The improved grain size in the 500mm crop may therefore reflect the better water supply available to the wide row plants. However, it is important to note, there was a significant rainfall event in September 2006 which allowed grain in the 250mm crop to fill, thus reducing screenings. Without the September rainfall event, screenings and unfilled heads may have been considerably greater than that found in the 500mm rows. In addition, if nutrition was not more limiting in the 500mm crop, the water supply from the wide row may have increased yield to similar or better than the 250mm crop.

One theory is that wide rows significantly benefit from early seeding rather than later, as competition in wide rows have a significant impact on tillering in the initial crop growth phases. These reductions in tillering can cause substantial determent to the yield of a crop, another potential reason for the lower yield found in the 500mm rows.

In addition to early sowing time and adequate nutrient supply at seeding time, another way to reduce the effects of competition within wide rows may by implementing 'ribbon sowing' as discussed previously, where increasing width of seeding within the row can significantly reduce crowding and therefore competition for soil resources.

COMMENTS

- The main difference in yield may have been due to poor tillering in the 500mm spaced crop.
- The entire crop was reliant on the soil nutrition from the pasture as no fertiliser was applied to the paddock prior to and following seeding.
- Later sowing of the trial may have jeopardised the wide row's yield capacity therefore it would be encouraged that when considering sowing in wide rows early seeding is preferable.
- It may be noted that if nutrition was not a limiting factor for the 500mm crop, the water supply from the wide row may have increased yield to similar or better than that of the 250mm crop.

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