WHICH ROW SPACING YIELDS BEST?

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In 2005-06 we began investigations comparing the yield and maturity response of 38 cm (15") row spacings and conventionally spaced cotton while attempting to manage the two row spacings for Pix and nitrogen management separately. The 38 cm row spaced cotton did not need to be managed differently to the conventionally spaced crop in any of the three experiments for this season. In one of the three experiments the 38 cm spaced cotton had higher yield than conventionally spaced cotton. Research is continuing to understand how 38 cm row spaced cotton systems can be managed to give yield or maturity benefits.

Introduction

There is significant industry interest in the development of ultra-narrow row (UNR) cotton production systems for the Australian cotton industry. Detailed experiments in 2001-02, 2002-03 and 2003-04 comparing UNR and conventionally spaced cotton in Hillston, Breeza and Narrabri gave no significant differences in yield, maturity or fibre quality using existing production practices (Roche et al. 2004a; Roche et al. 2003a; Roche et al. 2003b; Roche et al. 2004b). However, numerically higher yield and boll numbers in UNR systems suggest that there is some potential and new management options need to be explored to optimise this system.

Previous work into narrower row spacings has suggested that UNR spacing (25cm) at three times the density of conventionally spaced cotton may not allow enough light into the canopy to support early boll growth, leading to delays in maturity (Roche et al. 2003a). Those experiments primarily focused on 25 cm UNR spacings and more work is needed to look at 38 cm UNR spacing to see if the slightly wider row spacings and lower populations respond differently. It is important to maintain a balance between a plant population which maximises resource use, and one that is too high causing over-crowding and insufficient carbon resources for fruit to achieve consistent yields. Previous work into UNR productions systems applied the same management to both row spacings to allow physiological comparisons without the effects of differences in management. Research into how these systems respond when separately managed for water, nitrogen and Pix according to crop growth is needed to gain a better understanding on how the crop behaves on a commercial scale.

We compared 38 cm spaced cotton with conventionally spaced cotton side-by-side and managing each separately for nitrogen and Pix in order to identify any differences in yield or maturity between these two systems.

Methods

In 2005-06 the same experiment comparing 38 cm spaced cotton and conventionally spaced (1 m) cotton was repeated at three sites with different soil types, the Australian Cotton Research Institute at Myall Vale, "Brooklyn" (Lachlan Farming Ltd) near Hillston and "Ravensworth" (Ramps Ridge Rural) near Hay. Each row spacing treatment was monitored separately for nitrogen and Pix. Monitoring of all experiments showed that for this season neither treatment needed extra nitrogen or any Pix applications during the season in any of the experiments. A late cut-out Pix application to all treatments was applied to the Brooklyn and Ravensworth experiments.

At ACRI and Brooklyn all plots were sown into 2 m beds, at Ravensworth all plots were sown into 1 m spaced hills, with two rows sown 19 cm from the centre of the hill for the 38 cm spaced treatments. Standard on-farm sowing and crop management practices were used.

At the end of the season crop maturity (60% bolls open) and yield were determined from weekly hand picks. The experiments at Brooklyn and Ravensworth were also machined-picked by a John Deere 9976 spindle picker with modified heads for picking 38 cm spaced rows. For these experiments harvest efficiency and machine picked gin out-turn were also measured. Fibre quality measurements on ginned lint samples were performed using a high volume instrument (HVI) to obtain fibre length and micronaire. Final fruit distribution was determined by plant maps.

Results and Discussion

ACRI

Lint yield at ACRI was not statistically different between the conventionally spaced and 38 cm spaced cotton, however the average yield in the conventionally spaced cotton was higher (Table 1). Seed cotton yield was significantly higher in the conventionally spaced cotton but a lower gin out turn meant that lint yield was not different. This lower hand picked gin out turn is likely to be due to fewer seeds per boll in the 38 cm spaced cotton. Constable (1977) found that there were smaller bolls in narrow row (18 cm row spacing) treatments in his experiments and this was due to fewer seeds per boll compared to conventionally spaced rows. This indicated that conditions at flower bud formation and ovule fertilization were important in the narrower row crops as these stages determine the number of seeds per boll (Constable 1977).

Brooklyn

Neither the hand picked or machine picked lint yields at Brooklyn were statistically different between the conventionally spaced and 38 cm spaced cotton, however the average yield in the conventionally spaced cotton was numerically higher (Table 1). There were also no statistical

differences in machine pick gin-out turn or harvest efficiency although the conventionally spaced cotton was numerically slightly higher.

Ravensworth

Lint yield at Ravensworth was significantly higher for the 38 cm spaced cotton, yielding 15% higher than the conventionally spaced cotton (Table 1). As with the trial at Brooklyn, there were no statistical differences in gin-out turn or harvest efficiency, although the 38 cm spaced cotton had slightly higher gin out-turn and the harvest efficiency of the conventionally spaced cotton was numerically slightly higher.

Table 1. Summary of Yield, gin out-turn (GOT) and harvest efficiency of 38 cm spaced rows and conventionally spaced rows at ACRI, Brooklyn and Ravensworth in the 2005-06 season. (Significant differences – *P* < 0.05 indicated by *)

Row Spacing	Bales/ha	Seed Cotton (g/m^2)	Lint (g/m^2)	GOT	Harvest Efficiency
ACRI	Hand pick	Hand pick	Hand pick	Hand pick	
38 cm	10.70	571	242.8	42.5	N/A
Conventionally Spaced	12.99	716	294.9	41.2	N/A
LSD	2.75	*138.5	62.41	*1.00	N/A
Brooklyn	Machine pick	Hand pick	Hand pick	Machine pick	
38 cm	10.98	662	249.3	37.7	92.2
Conventionally Spaced	12.16	714	276.1	38.7	93.5
LSD	1.68	96.6	38.15	2.99	5.6
Ravensworth	Hand pick	Hand pick	Hand pick	Machine Pick	
38 cm	12.15	698	281.7	39.5	93.8
Conventionally Spaced	10.24	596	236.5	39.0	96.3
LSD	*1.79	103.6	*44.51	1.87	3.38

Conclusion

These experiments investigated yield and maturity response of 38 cm spaced cotton and conventionally spaced cotton while monitoring the crop for Pix and nitrogen management separately for each row spacing. The 38 cm spaced cotton did not need to be managed differently to the conventionally spaced crop in any of the three experiments for this season. While the experiments at Narrabri and Hillston showed no significant difference and in fact numerically reduced yield in the 38 cm spaced cotton, at Ravensworth near Hay the 38 cm spaced cotton had 15% higher yield than the conventionally spaced crop. Other previous studies had shown a consistent trend to numerically higher yields using narrower row spacings. These initial experiments show that in some conditions 38 cm spaced cotton production can out-yield conventionally spaced cotton production systems, whereas in others they give no yield benefit. Research is continuing to examine why narrower row spacings do not always achieve theoretical yield and maturity benefits; under what conditions do they perform better than conventionally

spaced systems; and whether careful manipulation of crop growth through nutrition, irrigation and growth regulators may help realise their potential.

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