Which cotton row spacing is the better option for southern NSW?

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in a nutshell

- There is burgeoning interest in cotton growing in southern NSW as a result of better adapted varieties to the cooler climate
- Cotton is traditionally grown on 1 m row spacings however there are alternative row spacings such as 38 cm (15 inch), which are increasingly popular
- Current research is aiming to determine the most appropriate row configuration for southern NSW growing conditions – early results indicate that the suitability of each configuration may be site specific or linked to soil type or climate
- Research is continuing to determine under what conditions narrower row spacings give a yield or maturity benefit

As a result of better adapted cotton varieties to southern NSW growing conditions, there is increasing interest in the inclusion of cotton into summer cropping programs in the Murrumbidgee Valley. For irrigation farmers already experienced with row cropping the transition into the field configuration for cotton is quite simple. However there are decisions to be made in regard to appropriate row configuration for cotton, dependent on locality, agronomic management and machinery/contractor availability.

The row spacing options available for cotton include 25 cm and 38 cm (10 inch and 15 inch – Ultra Narrow Row or UNR), 75 cm (30 inch), 90 cm (36 inch) and 100 cm (40 inch – conventionally spaced). The predominant row spacing options currently used in southern NSW are either 100 cm (conventionally spaced) or 38 cm (15 inch) UNR configuration.

Ultra-narrow row cotton (rows spaced less than 40 cm apart) has long been seen as a potential alternative system for cotton, especially in regions with shorter growing seasons. The main emphasis of the reduced spacing has been on reduced harvesting costs and achieving earlier maturity without substantial yield loss. Recent advances in harvesting technology by John Deere to allow spindle picking of 15 inch cotton crops has generated further interest in these systems, with claims of improved yield and earlier maturity while avoiding discounts for fibre quality associated with stripper harvest.

A recent cotton extension survey highlighted that research into narrow row and plant population studies (especially with the advent of Bollgard II and increased emphasis on improved fibre quality) was a priority in most cotton valleys.

CSIRO Plant Industry scientists in collaboration with growers and NSW DPI extension staff are conducting detailed physiology/agronomic studies to quantify the physiological basis of different plant spacings on cotton growth, yield and fibre quality. This research is partly funded by the Cotton Research & Development Corporation and the Cotton Catchment Communities CRC.

Previous research

In the past there has been significant industry interest in the development of 25 cm UNR cotton production systems for the Australian cotton industry. These systems can be stripper harvested which is much cheaper than using spindle pickers, but can lead to problems with fibre quality. Detailed experiments in 2001–02, 2002–03 and 2003–04 comparing UNR and conventionally spaced cotton at Hillston, Breeza and Narrabri gave no significant differences in yield, maturity or fibre quality using existing production practices. 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 narrow row spacings has suggested that 25 cm UNR, at three times the density of conventionally spaced cotton, may not allow enough light into the canopy

to support early bolls leading to delays in maturity. Those experiments primarily focused on 25 cm UNR spacings, and consequently more work is needed to look at 38 cm (15 inch) 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, but doesn't cause over-crowding and insufficient carbon resources for the plant to achieve consistent yields and retain fruit. Research into how these systems respond when managed for water, nitrogen and Pix separately, according to crop growth, is needed to gain a better understanding of how the crop behaves on a commercial scale.

In 2005–06 investigations were initiated into the yield and maturity response of 15 inch cotton and conventionally spaced cotton. The 15 inch cotton did not need to be managed differently to the conventionally spaced crop in any of the three experiments for this season. These initial experiments show that in some conditions 15 inch cotton production can out-yield conventionally spaced cotton production systems, whereas in others they give no yield benefit. These results may be due to soil type, geographical location or some other factor. In the United States it has been found that UNR systems (whether 25 cm or 38 cm) are better suited to areas where growth is limited and planting at higher plant populations or narrow row spacings essentially allows the crop to "fill in the space". Further research is needed to determine what influences yield and maturity in UNR production systems, under what conditions they can give yield or maturity benefits to growers and how to best manage these systems.

New research

In 2005–06 an experiment comparing 38 cm (15 inch) cotton and conventionally spaced (100 cm) cotton was repeated at three sites, the Australian Cotton Research Institute at Myall Vale near Narrabri, *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 the 2005–06 season neither spacing treatment needed extra nitrogen or any Pix applications during the season in any of the experiments. A late cut-out Pix application was made to both treatments at the *Brooklyn* and *Ravensworth* experiments.

At ACRI and *Brooklyn* all plots were sown into 2 m beds and 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 (15 inch) 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 machine-picked by a JD 9976 spindle picker with modified heads for picking 15 inch spaced rows.

At the *Brooklyn* and *Ravensworth* 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 (these samples

Figure 1: 15 inch (38 cm) cotton at full maturity ready to be picked

Figure 2: Cotton picker in 15 inch (38 cm) configuration at Ravensworth Hay

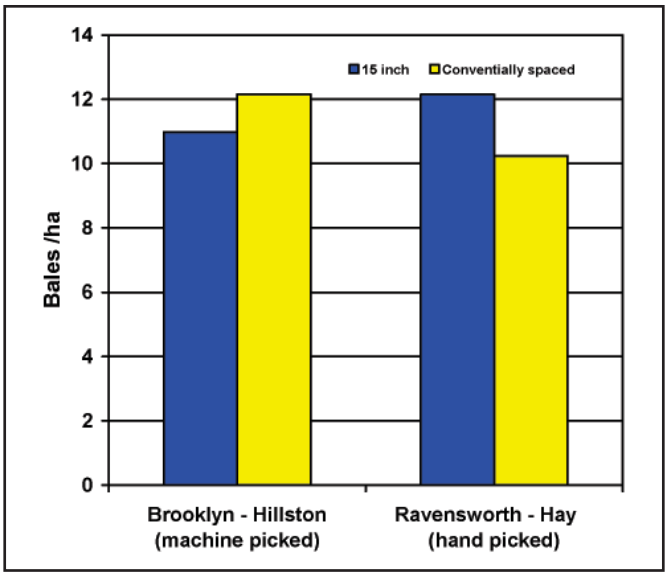

Figure 3: Yield of cotton on 15 inch row compared with conventional spacing, at Hillston and Hay

are still being processed). Final fruit distribution was determined by plant maps.

2005–06 results

ACRI

Lint yield at ACRI was not statistically different between the conventionally spaced and 15 inch spaced cotton, however the average yield in the conventionally spaced cotton was higher (Table 1). At ACRI 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 15 inch cotton. Previous research reported in 1977 found that there were smaller bolls in narrow row (18 cm row spacing) treatments and this was due to fewer seeds per boll compared to conventionally spaced rows. These results indicated that conditions at flower bud formation and ovule fertilisation were important in the narrower row crops as these stages determine the number of seeds per boll.

Brooklyn

Lint yield at *Brooklyn* was not statistically different between conventionally spaced and 15 inch cotton, however average yield in the conventionally spaced cotton was higher (Table 1). There were also no statistical differences in machine pick gin out-turn or harvest efficiency although conventionally spaced cotton was numerically slightly higher.

Ravensworth

Lint yield at *Ravensworth* was significantly higher for the 15 inch cotton, which yielded 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 15 inch cotton had slightly higher gin out-turn and the harvest efficiency of the conventionally spaced cotton was numerically slightly higher.

Conclusion

These experiments were initial investigations into the yield and maturity response of 15 inch cotton and conventionally spaced cotton, while monitoring the crop for Pix and nitrogen management separately for each row spacing.

The 15 inch 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 ACRI at Narrabri and *Brooklyn* at Hillston showed no significant difference and in fact numerically reduced yield in the 15 inch cotton, at *Ravensworth* near Hay the 15 inch cotton had 15% higher yield than the conventionally spaced crop. Although there has not been full analysis of the plant mapping data from the trials, there was a marked difference in maturity between the 15 inch and 100 cm systems in the *Ravensworth* trial, as the 15 inch system was ready for harvest two weeks earlier.

These initial experiments show that in some conditions 15 inch 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 and whether careful manipulation of crop growth through nutrition, irrigation and growth regulators may help realise the theoretical benefits of alternative narrow row systems.

Acknowledgements

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Further reading

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R Roche, M Bange, S Milroy and G Hammer (2003) Crop growth and maturity in ultra narrow row and conventionally spaced cotton. In Proceedings of the 11th Australian Agronomy Conference. pp http://www.regional.org.au/au/asa/2003/c/2005/roche.htm. Australian Society of Agronomy, Geelong, VIC.

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Table 1: Summary of yield, gin out-turn and harvest efficiency of 15 inch 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	Yield (bales/ha)	Seed cotton (g/m²)	Lint (g/m²)	Gin out-turn	Harvest efficiency
ACRI	Hand pick	Hand pick	Hand pick	Hand pick	
15 inch	10.70	571	242.8	42.53	N/A
Conventionally spaced	12.99	716	294.9	41.20	N/A
LSD	2.749	*138.5	62.41	*1.004	N/A
Brooklyn	Machine pick	Hand pick	Hand pick	Machine pick	
15 inch	10.98	662	249.3	37.68	92.21
Conventionally spaced	12.16	714	276.1	38.68	93.49
LSD	1.68	96.6	38.15	2.99	5.60
Ravensworth	Hand pick	Hand pick	Hand pick	Machine pick	
15 inch	12.15	698	281.7	39.52	93.82
Conventionally spaced	10.24	596	236.5	38.98	96.34
LSD	*1.79	103.6	*44.51	1.867	3.376