

# Does Bollgard II perform differently in dryland systems?

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One of the management techniques that dryland cotton growers have at their disposal is being able to modify row configuration. The intention behind skip row configurations is to provide slowly available soil water to the planted rows to allow continued growth during dry periods between rainfall events. But in practice, the benefits lie primarily in:

- A reduced risk of negative effects of water stress on fibre quality;
- Reduced yield variability; and,

- Better economic returns due to production costs being reduced more than the yield relative to solid planted cotton.

In Australia, cotton growers have access to Bollgard II cotton that can result in early and higher fruit retention through better insect control. Generally, a cotton plant with higher early fruit retention will be smaller with less vegetative growth and may mature earlier than a plant with lower retention.

A smaller plant with higher, early boll load may not be able to exploit the soil wa-

ter provided through skip configurations. Increased assimilate demands associated with early fruit growth may limit the potential for root exploration into the skip and so reduce the capacity of the plant to utilise moisture in the skip. Also, the time for rain-fed crops to utilise the moisture contained in skip rows may be reduced as Bollgard II crops may mature earlier.

In this article we will highlight research investigating the impact of high fruit retention Bollgard II on yield and fibre quality of dryland cotton grown in different row configurations.

Two field experiments in two different seasons were grown under dryland conditions with varied row configurations and conventional (non-Bollgard) and Bollgard II (high fruit retention) varieties were used to ascertain:

- Whether the response of Bollgard II to row configuration was the same as that of the conventional variety; and,
- The performance of a premium fibre variety in dryland conditions to assess whether its relative performance is similar to other varieties when grown under stress.

## FIELD EXPERIMENTS

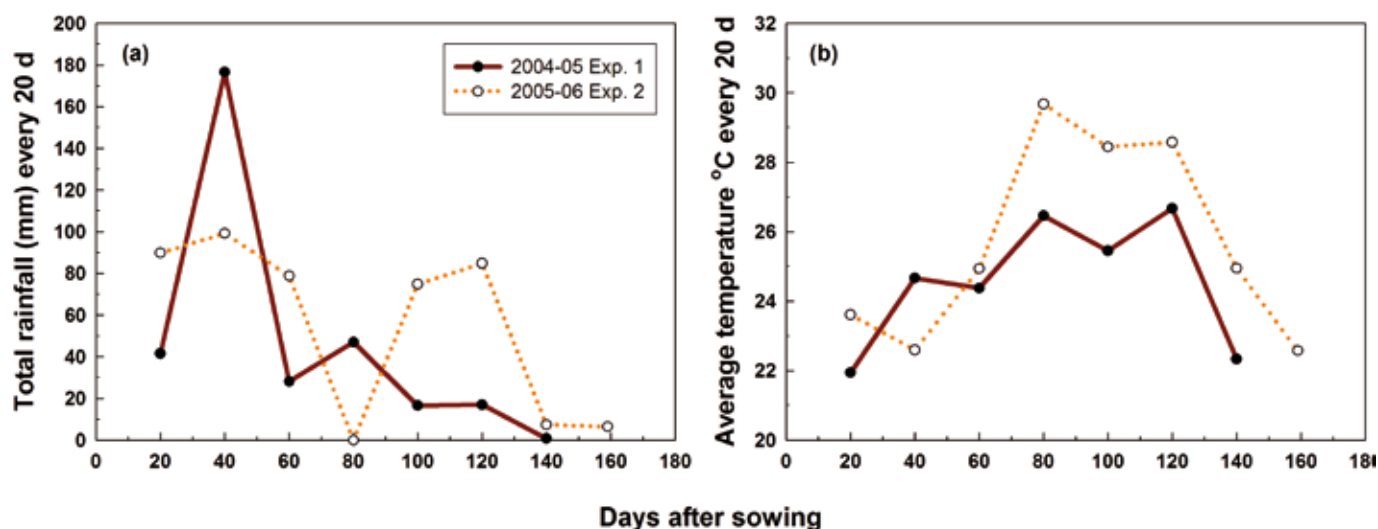
Two field experiments were conducted at Narrabri in the 2004–05 and 2005–06

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## AT A GLANCE

- Skip configurations are used to: reduce the level of variability or risk associated with production through increasing the amount of soil-water available for the crop, which can influence the potential lint yield, enhance fibre quality, and reduce input costs.
- There are concerns that Bollgard II may limit the relative benefits of using skip configurations. Earlier and higher fruit retention in Bollgard II may mean smaller and earlier crops, reducing the potential for root exploration into the skip, and time for the crops to exploit the skipped rows.
- Insect resistant Bollgard II cotton was compared with conventional (non-Bollgard II cotton) grown in three row configurations (solid, single, and double skip) over two seasons.
- Results showed that Bollgard II had the same response to row configuration as conventional cotton and growers should consider skip row configurations with Bollgard II crops in the same manner as conventional cotton when considering potential yield and quality.
- The performance of a premium fibre variety was also assessed and while its yield was less, fibre length was significantly better. There was no evidence that the performance of this premium fibre variety differed in its response to stress compared with other varieties.

**FIGURE 1: (a) Accumulated rainfall and (b) average temperature experienced every 20 days during both field experiments**



seasons. Each experiment included the Bollgard II variety Sicot 289BR and the related non-Bollgard II variety Sicot 189RR. In the 2005–06 experiment the premium fibre variety Sicala 350B was also included. The experiments were grown with three row configurations – solid, single and double skip using one metre row spacing. A randomised complete block design with four replicates was used. Experiment 1 was planted on November 10, 2004 and Experiment 2 was planted on October 25, 2005.

**Maturity**

Crop maturity (number of days after sowing (DAS) to 60 per cent open bolls) was affected by row configuration in both experiments while variety affected maturity only in the 2005–06 season. In the 2004–05 season, double skip matured five days later (133 DAS) than solid and single skip (129 DAS). In the 2005–06 season, double skip (mean 142 DAS) was 11 days later than solid (mean 131) but not significantly different than single skip (mean 140). Solid and single skip were not significantly different to each other in either experiment. In 2005–06, Sicot 189RR (mean 149) was 20 days later than Sicot 289BR (mean 129) and 11 days later than Sicala 350B (mean 137).

**Yield**

Yield results of both experiments are presented in Figure 2. In the 2004–05 season lint yield was affected by row configuration but not variety. The solid configuration was the highest yielding which was significantly greater than the single and



double skip configurations. In the 2005–06 season, lint yield was also affected by row configuration but this time single skip was higher than the solid but not different to double. Solid and double skip were not significantly different.

In 20005–06, lint yield was also different between varieties. The non-Bollgard II variety Sicot 189RR was the highest yielding followed by Sicot 289BR, then Sicala 350B. Reductions in yield of Sicala 350B compared with Sicot 289BR were 30 per cent in solid, 26 per cent in single skip, and 10 per cent in double skip.

**Quality**

Fibre quality attributes for both experiments are presented in Figure 3. There were no significant differences in micronaire between row configurations in either experiment. The only significant difference in micronaire was higher micronaire for Sicot 189RR than Sicot 289BR and Sicala 350B in the 2005–06 season.

289BR and Sicala 350B were not different for micronaire. But fibre length was significantly affected by row configuration in both experiments.

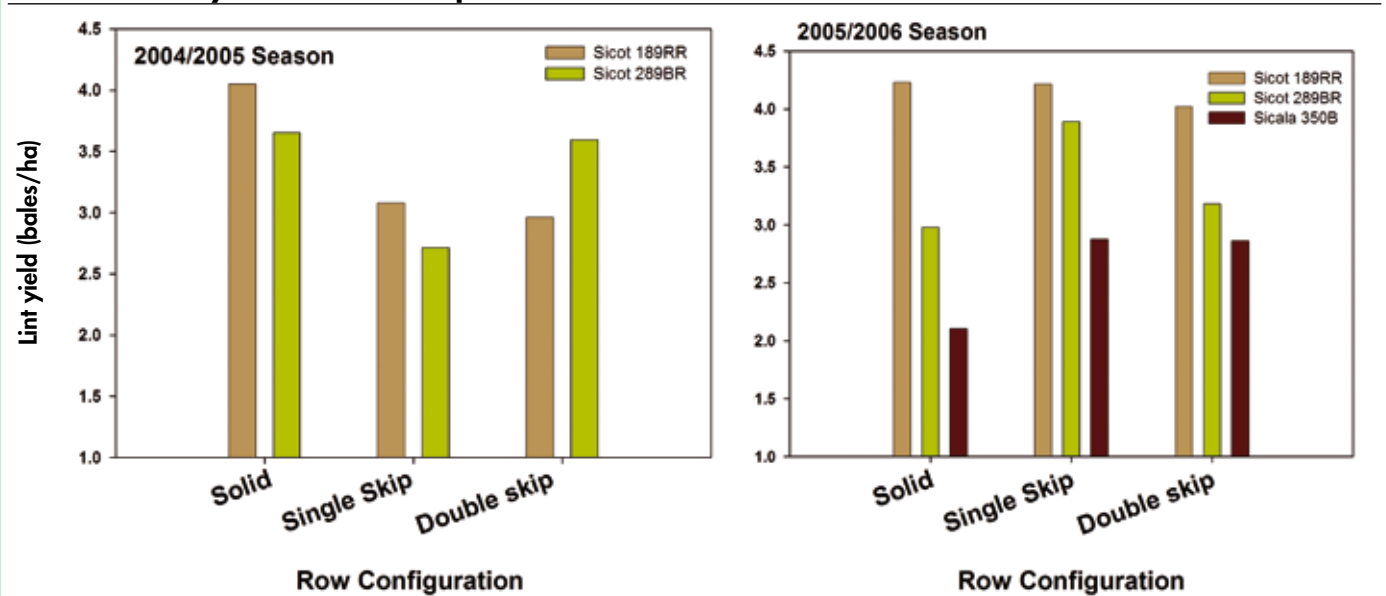
In the 2004–05 season the fibre length of double skip was significantly longer than both single skip and solid configurations which were not different from each other. In the 2005–06 season while double skip and single skip were not significantly different from each other, both had longer fibres than solid. In both experiments there were no significant differences in fibre length between Sicot 189RR and Sicot 289 BR. In the 2005–06 season Sicala 350B clearly had longer fibres than both other varieties across all row configurations.

**IMPLICATIONS FOR DRYLAND COTTON MANAGEMENT**

**Performance of Bollgard II yield**

In these studies only in the second experiment did the Bollgard II variety Sicot 289BR yield less than the non-Bollgard II

**FIGURE 2: Lint yields for field experiments conducted at Narrabri**



variety Sicot 189RR. Earlier maturity was measured in the Bollgard II treatments in this experiment. This reduction in yield was most likely associated with earlier and higher fruit load afforded by improved pest control, followed by a significant period of extreme hot and dry weather (days after sowing 60–80 Figure 1) causing the crop to cease production of new fruiting sites (cut-out).

Earlier cut-out causes crops to mature earlier and can be associated with reductions in yield. The non-Bollgard II treatment may have had greater fruit loss earlier and so the fruit demands on the crop during the hot dry period experienced were less.

When rainfall occurred later in the season, if the Bollgard II crop had already cut-out, the demand from the developing bolls may have prevented further vegetative and reproductive growth, but the conventional crop with lower demand from fruit may have been able to continue both vegetative and reproductive growth, delaying cut-out. Some evidence of the better growing conditions later in the conventional crop is highlighted by the increased micronaire in Sicot 189RR. Higher micronaire in cotton crops can indicate improved growing conditions during boll development.

There was no evidence in these experiments that Bollgard II reacted any differently to conventional non-Bollgard II cotton across row configurations. If earlier and higher fruit loads in Bollgard II had significantly affected the resources of the plant so as to limit root exploration into the skip, as well as limiting the time to explore the skip, the analysis of results would have shown a significant interaction reflecting a lowered yield of the Bollgard II variety in skip row configurations.

This was not the case. In neither experiment was an interaction found – Sicot 289BR followed the same trend in yield across the different configurations as Sicot 189RR.

### Performance of Bollgard II quality

In these experiments the Bollgard II treatments did not cause any changes in fibre length. As expected, the skip row configurations provided some insurance against reductions in fibre length for both varieties. Across both experiments the double skip configuration had the longest fibre length. In these experiments the Sicot 289BR treatments did not cause any changes in fibre length but was lower than Sicot 189RR in micronaire in Experiment 2.

Based on 2006 price discounts (averaged across merchants), the non-Bollgard II Sicot 189RR would have incurred a very

small penalty for micronaire while Sicot 289BR fell within the optimum range. The higher micronaire of Sicot 189RR would have been associated with a greater number of later bolls growing in warmer conditions. Superior gross margins from skip row cotton can be achieved due to savings in variable costs, and by maintaining fibre quality through the extra soil water available for developing bolls.

### Performance of premium fibre variety

Sicala 350B yielded less than the other varieties. This was expected as commercial yields of Sicala 350 are reported to be 10–15 per cent less than similar variety types under irrigation. The large difference in yields between Sicot 289BR and Sicala 350B in solid and single skip may have been due to differences in the growth of the crop and the stage of the crop when the stress occurred, and increase in the degree of water stress compared to double skip. Boll numbers and boll size were both smaller for Sicala 350B in the solid and single skip configurations compared with Sicot 289BR suggesting that stresses were greater.

Sicala 350B had better fibre length across all configurations. For this variety to

be an attractive financial proposition to a grower it would need to attract a significant premium in price that would outweigh the losses in yield. In this experiment as there were no discounts associated with the other varieties for fibre length the improved fibre quality of Sicala 350B was not necessary. There was no evidence from this investigation that the performance of this premium fibre variety differed in its response to stress compared with other varieties.

### FURTHER RESEARCH

Further research is being conducted exploring a range of different row configurations to further develop guidelines that will help growers select the best option for their own situation. Further development of the Ozcot crop simulation model to simulate fibre quality and to compare more row configurations will assist this outcome.

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**FIGURE 3: Fibre length and micronaire for field experiments at Narrabri**

