How do cluster plants perform in UNR systems?

By Rose Roche, Michael Bange, Stephen Milroy and Graeme Hammer*

Previous research into UNR cotton production systems in Australia and the US has raised the question of whether there is a need for cotton varieties better suited to UNR production systems. It has been suggested that varieties with different morphological traits may be needed to optimise the performance of UNR cotton.

These could be determinate varieties that are compact with short fruiting branches and few or no vegetative branches — so called 'cluster varieties' (see photo this page). But recent field studies in Australia exploring the performance of UNR systems have shown no advantages in using cluster fruiting habit varieties.

Our research forms part of larger studies into narrow row spacing — exploring the growth and development of plants in these systems compared with conventionally spaced systems. Ultra narrow row (UNR) cotton production is considered to have the potential for earliness and cheaper harvesting in areas with shorter growing seasons.

Since this earlier maturity can be difficult to achieve in UNR trials, we aim to measure clearly how the crop responds, so we can manipulate agronomy (such as varieties, water, growth regulators and nutrition) to maximise any benefits that UNR may offer.

Testing the cluster plant type

To determine whether using a cluster plant type gave any yield or maturity advantage in a UNR system, a cluster breeding line and its conventional sister line (Sicala 40) were grown in both UNR and conventionally spaced production systems in an experiment at Narrabri, in the 2002–03 season. The cluster line contained both short fruiting branches and a high frequency of adventitious fruiting branches.

UNR plots consisted of six rows spaced at 0.25 metres and conventionally spaced plots of two rows spaced one metre apart on 1.8 metre beds. Established plant populations for these two systems were 260,000 plants per hectare and 97,000 plants per hectare respectively.

The trial was sown on October 11, 2002. Full irrigation and commercial insect control were used.

The crop was monitored over the season and time to first square, first flower and number of nodes above the first position white flower (NAWF) were recorded. The light intercepted by the canopies was measured weekly.

At the end of the season, maturity picks were conducted weekly to determine time to crop maturity (60 per cent open bolls) and yield. At maturity, plants were harvested for plant mapping and fruit retention per plant. Fibre quality measurements on ginned lint samples were performed using a HVI to obtain fibre length, strength and micronaire.

No advantage

The cluster plant type did not confer any yield or maturity advantage compared with the normal variety (Figure 1) in the UNR system. It also did not perform better in the conventional row spacing compared with UNR. Although not statistically significant, Sicala 40 (the normal variety) in the UNR system was the highest yielding of all the treatments.

Boll size was smaller in the cluster line compared to the normal variety but a significant difference between the varieties in gin turnout (which changes the lint yield per boll) may compensate for changes in boll size and account for the lack of difference in lint yield.

The UNR crop did not exhibit earlier maturity or increased yield compared to the conventionally spaced cotton crop for both plant types (Figure 1). The lack of differences may be attributed to lower retention in the UNR crops compared to conventionally spaced cotton (Figure 2).

The UNR crop reached canopy closure earlier and had greater light interception over the season (Figure 3). This characteristic is one of the reasons that UNR cotton production is considered to have potential earlier maturity.

But early canopy closure in the UNR crop and the competition between plants for light would have meant less light was available for fruit lower in the canopy, causing shedding of fruit and contributing to the lower retention in the UNR crop.

Sicala 40 (left) and the cluster sister line (right). Short fruiting internodes and a high number of adventitious branches give it "clusters" of fruit rather than a normal fruiting habit. (PHOTO: Warwick Stiller)

This is consistent with other studies of UNR crops.

The number of second position fruit was also significantly (statistically) lower in the UNR crop compared with the conventionally spaced crop (Figure 2). UNR spacing usually results in a reduction of second position fruit. But this reduction was only apparent in the normal variety with a 75 per cent reduction in the number of second position fruit compared to a four per cent reduction in second position fruit for the cluster line in UNR spacing.

The lack of an impact on the number of second position fruit could potentially be an important advantage of cluster lines in UNR systems in terms of yield and may need to be further explored. It is important to note these are the results of a one-season trial and the cluster line used had considerable variation in the length of fruiting internodes. A more uniform cluster line may perform better in a UNR system and warrant further exploration.

Conclusion

This study has shown no advantage in using a variety with a cluster fruiting habit in a UNR system either in terms of yield or maturity. This is consistent with the majority of previous studies which show no difference in the relative performance of varieties under UNR and conventionally spaced systems.

To maximise the potential of UNR systems it is imperative to continue research into the key physiological processes of narrow row production systems to provide the understanding needed to appropriately tailor management strategies.

***CSIRO Plant Industry, Australian Cotton CRC, Queensland Department of Primary Industries and The University of Qld.**

Thanks to Dr Greg Constable for provision of seed and helpful discussion on the article. Thanks also to Jane Caton, Daniel Kirk, Jo Price, Graeme Rapp and Suz Greig for assistance in the field. This work was partially funded by the Cotton Research and Development Corporation.

FIGURE 1: Average yield, maturity, boll size and gin turnout of cluster plant type and normal plant type in UNR and conventionally spaced systems

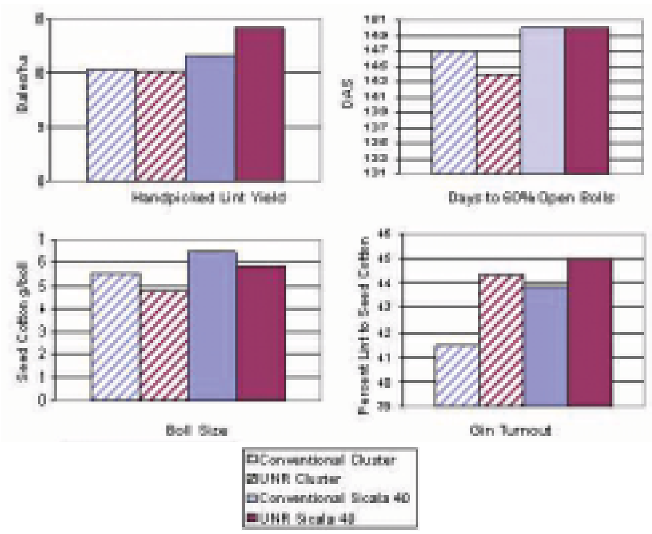

FIGURE 2: Average total retention, first position retention, number of first position fruit and number of second position fruit of cluster plant type and normal plant type in UNR and conventionally spaced systems

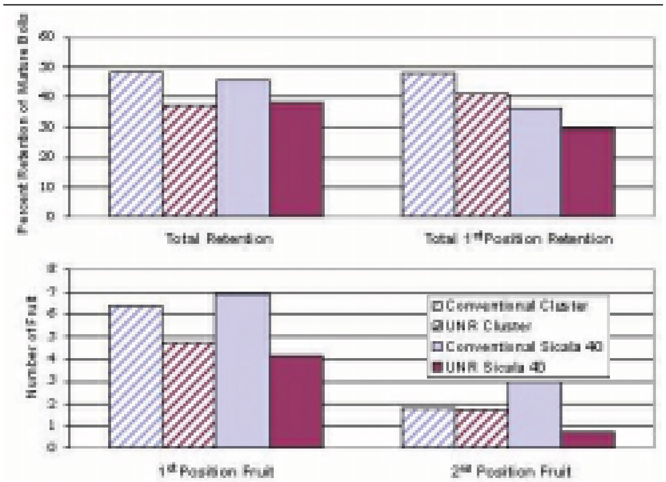

FIGURE 3: Time to canopy closure and total intercepted light over season of cluster plant type and normal plant type in UNR and conventionally spaced systems