ACE RESEARCH PROJECT

High Density Planting (PFR)

Importance

The high-density planting trial has been designed to test growing systems with different tree planting densities. The approach has been to take a fresh look at almond orchard design and i) increase the planting density by reducing the row and tree spacing; ii) plant new cultivars with architectural attributes that are more suited to closer planting; and iii) adopt new pruning/training systems.

Features

The combination of these three objectives has resulted in a 1.6-ha block, established in July 2018 with the new self-fertile cultivars ‘Shasta’ and ‘Vela’ on ‘Nemaguard’ rootstock. These two varieties were chosen based on their different growth habits: Shasta has an upright, narrow growth habit and ‘Vela’ a spreading and weeping growth. Four planting densities are compared: 513 (6.5 x 3 m), 769 (6.5 x 2 m), 741 (4.5 x 3 m) and 1,111 trees per ha (4.5 x 2 m). Trees are grown as tall, narrow “slender pyramid” shaped trees with minimal pruning to maintain a 2.0-m wide gap between the rows for machinery access. Pushing densities to as high as 1,111 trees/ha in a large-scale experimental planting is intended to demonstrate and assess the limits of intensification and the challenges associated with canopy management, rootstock/scion combinations, machinery access and resource requirements.

Results (Last Updated, July 2023)

Yield results (Figure 1) so far show that Shasta produced a small crop already in 2020 (planted in 2018). For this variety, when grown in 4.5-m rows, there was an increase in yield over those in 6-m rows from 2022 onwards. The 2023 yield results took the cumulative yield of Shasta to values as high as 7.9 t/ha for the 4.5-m rows and 5.2 t/ha for the 6.5-m rows.

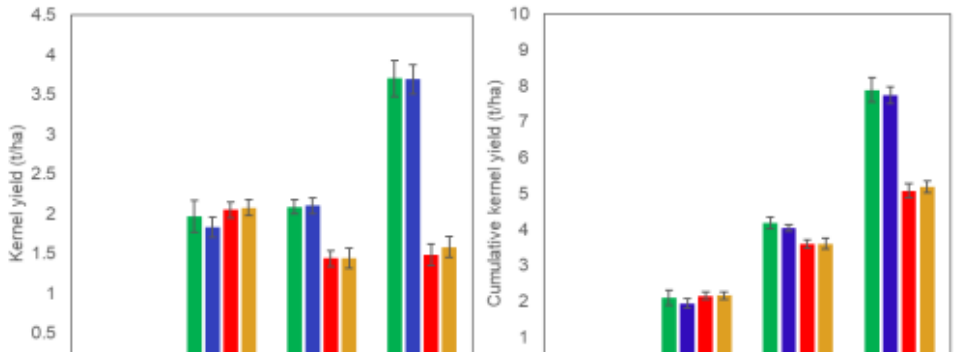

Figure 1. Yearly yield (left) and cumulative yield (right) of Shasta® almond trees planted at the Almond Centre of Excellence (ACE) orchard in Loxton, Australia, at four densities: inter-row spacings of 4.5 and 6.5 m and within-row tree spacings of 2 and 3 m. Trees were planted in winter 2018. Error bars represent the standard errors of the means.

Unlike Shasta, 'Vela' did not produce a yield in 2020. Only in 2022 did yield differ between planting densities, when the 6.5 x 3-m spacing produced a lower yield. The average cumulative yield of 'Vela' in 2023 (8.7 t/ha) was higher than that of Shasta (6.5 t/ha) (Figure 2); however, there were no yield differences between planting densities.

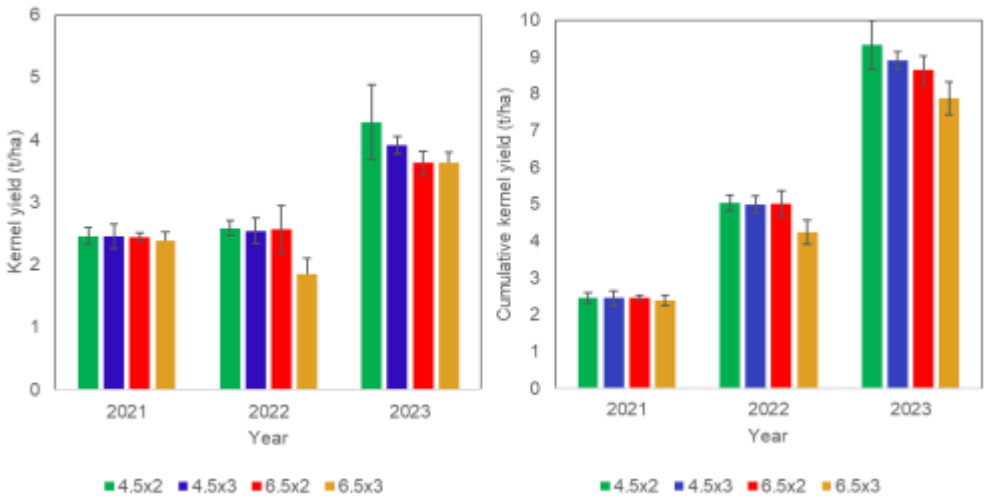

Figure 1. Yearly yield (left) and cumulative yield (right) of 'Vela' almond trees planted at the Almond Centre of Excellence (ACE) orchard in Loxton, Australia, at four densities: inter-row spacings of 4.5 and 6.5 m and within-row tree spacings of 2 and 3 m. Trees were planted in winter 2018. Error bars represent the standard errors of the means.

Although higher yields were expected from the higher-density treatments, there was no difference in the yield per ha among the four spacings in 2021 for either variety. Since the irrigation design was based on the amount of water applied per ha (ML/ha) rather than per tree (kL/tree), trees in the 6.5-m wide rows received more water and hence more fertiliser than trees in the 4.5-m rows. It was probably this difference that negated the benefit of having more trees per ha in the 4.5-m rows. To test this hypothesis, irrigation was adjusted from the 2021/22 season so that each tree received approximately the same amount of water. With the new irrigation design, yields showed a positive trend with irrigation rates per tree. Results so far indicate that irrigation rates per tree are more important than rates per ha in terms of orchard yield for these young, high-density blocks where trees are not crowded and thus not light limited.