

Choosing mango tree spacing

In the early years of the Australian mango industry (1960s – 1980s) mango trees were regularly planted at low density spacings of 9m x 9m (30ft x 30ft) or greater. These wider spacings were required to accommodate vigorous mango tree growth and minimise overcrowding over the orchard lifetime. Almost all mangoes grown at this time were the vigorous Kensington Pride (KP) variety. The development of mechanised hedging equipment, the breeding of less vigorous varieties, the registration of plant growth regulators (PGRs), and improvements in orchard nutrition, irrigation and pruning practices have since enabled growers to maintain mangoes as smaller trees. Row and intra-row spacings have gradually reduced, resulting in increases in orchard tree densities per hectare.

Tree spacing is usually described as low, medium, and high density as follows:

Low density plantings (<200 trees/ha)

- Typically, of size: 9m x 9m = 123 trees/ha
- This spacing used in most Australian mango orchards established during the 1960s – 1990s
- Mature trees are usually tall (>4m) and have wider canopies (>6m)
- Lowest canopy surface area to volume ratio
- Lowest establishment and annual input costs per hectare
- Takes the longest to reach full production
- Lowest yields



Medium density plantings (200 – 500 trees/ha)

- Typically, of size: 8m x 6m = 208 trees/ha or 7m x 4m = 457 trees/ha
- Spacing used in most Australian mango orchards established 1990s to present
- Mature trees are usually <4m tall and canopies 4-6m wide
- This density can be managed with common farm equipment and systems
- Canopy growth managed using well-known techniques (hedging, PGRs)



High – Ultra-high density plantings (500+ trees/ha)

- Typically, of size: 6m x 3m = 555 trees/ha; 5m x 3m = 666 trees/ha; 4m x 2m = 1250 trees/ha
- This spacing is uncommon, with highest densities only seen in some smaller commercial farms and research trials
- Mature trees are often short (<3m) and have narrow canopy width (<3m)
- Highest canopy surface area to volume ratio
- Highest establishment and annual costs per hectare
- Quickest to reach full production
- Highest yields
- Canopy growth is difficult to manage (particularly in vigorous varieties such as KP)



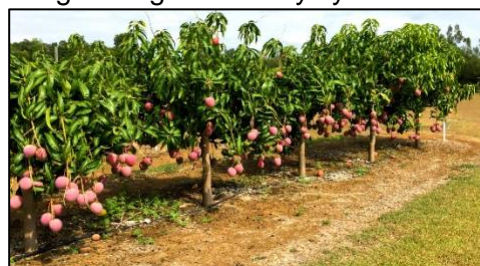
Before you start – spacing rules of thumb:

- Individual mango trees at mature size will often grow up to 50cm tall and 50cm wide every year after hedging, so allow for annual growth
- Farm machinery commonly requires a minimum 2 – 2.5m accessible inter-row space at harvest time for reliable and unhindered access
- To prevent excessive shading in fruit tree orchards, the desired tree height at harvest time should not be greater than 75% of the desired inter-row distance (e.g., if trees are expected to grow to 3.5m tall, then the minimum inter-row spacing should be 4.7m).

The decision on tree spacing is determined by four important considerations:

1. What is the mango variety?

Vigorous varieties such as KP have been difficult to manage in higher density systems due to their excessive vegetative growth rates. Plant growth regulators (PGRs), may help control tree vigour. Higher density systems suit less vigorous varieties such as Calypso®, R2E2, Honey Gold and Keitt, which may still grow up to 50cm tall and 50cm wide every year after hedging.



2. What is the target inter-row machinery width?

Farm machinery commonly requires a minimum of 2 – 2.5m accessible inter-row space at harvest time for reliable and unhindered access. Inter-rows may need to be even wider in cases where farm equipment has extra space requirements (e.g., certain orchard sprayer set-ups). Allowances should be made to allow for annual lateral canopy growth, from hedging to harvest time, which makes the inter-row progressively narrower over the season.



3. What is the target tree harvest height?

If harvesting is to be conducted via hand-picking from the ground or by only using short picking sticks, then a harvest height of <3.2m is necessary. Harvesting trees >3.2m requires different picking practices which are generally slower and more expensive. These include the use of longer picking poles, cherry pickers or elevated harvest aid platforms. Taller trees require wider inter-rows to minimise shading.

4. What is the target tree harvest width?

The width of the tree is a more complex decision and is greatly influenced by the tree intra-row distance. If the trees are planted at wider distances along the tree row, then trees need to be allowed to grow to a greater width to ensure that they fill-out the hedge faces sufficiently to enable optimum fruiting. Trees planted at wider spacings (e.g., 5 – 6m) will need to be allowed to grow to wider widths/diameters to fill-out these hedge faces. Trees planted at close intra-row spacing (e.g., 2 – 3m) may only need to grow to 2 – 3m width/diameter to reach optimum fruiting dimensions.



Current Australian industry trends

New mango orchards in Australia are being primarily established as medium density systems usually between 200 – 400 trees/ha. Most of the new plantings include less vigorous varieties such as R2E2, Keitt, Honey Gold™ and Calypso®. The target tree heights at harvest within these new orchards are becoming increasingly shorter (often now around 2.5 – 3m) due to the economic and workplace efficiencies of harvesting low-hanging fruit. The target inter-row machinery access widths are fairly wide, often around 4 – 5m, which accommodates traditional

wider spaced machinery, spray equipment and harvest aids. Target tree widths at harvest are also fairly wide, often around 3 – 4m.

Spacing opportunities

The trend towards much smaller tree heights provides new opportunities for increased planting density and the potential for increased orchard profitability. The first opportunity is through reductions in the target inter-row machinery access widths, which has been made possible by world-wide trends in the adoption of smaller and narrower orchard machinery and equipment for fruit tree management. The second opportunity is to reduce target tree widths at harvest by planting trees more closely within the row. Mango trees are quite cheap to purchase from the nursery (~\$20/tree) and planting at closer spacing reduces the time it takes for orchards to reach their optimum size, and hence maximum fruit production capacity. Research and farmer trials with varieties such as R2E2, Keitt and Calypso® have found with careful management, mature orchards can be maintained continuously and with high productivity, at narrow tree widths (2 – 3m).

More information

For more information on high density mango orchards visit the Queensland Agriculture's YouTube channel to view the video '[High-density mango orchards: slim hedges](#)'.