

Nutrition: Fertiliser application methods

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Broadcast under and near the canopy

In most cases, fertiliser should be spread evenly under the tree canopy area and out to about one metre beyond the drip line. The reasons for this are:

- Most of the feeder roots are situated in this area (especially in the area wetted by the irrigation emitters).
- To encourage the feeder roots to extend beyond the drip line so that a greater volume of soil is exploited for nutrients and moisture.

In mature trees, roots generally extend into the middle of the inter-row unless these areas are badly compacted. However, the fertiliser spreader should be set up to place most of the fertiliser under the tree canopy.

Broadcast entire orchard floor

It is recommended that products such as lime and dolomite should be spread across the entire orchard floor irrespective of the tree size. An exception to this would be if you were trying to alter the pH of the wetted area under the sprinklers using micro-fine lime, for example.

Banding

For nutrients such as phosphorus and zinc which tend to be fixed by certain soil types banding is recommended. Soil types such as krasnozems, red earths and podzols are known to fix phosphorus. Soils containing a high clay content tend to fix zinc. By concentrating the fertiliser in a relatively narrow band a greater proportion of the nutrient remains available for plant uptake. Banding is usually done in one of two ways:

- Spread the fertiliser by hand in a 30 cm band around the dripline of each tree.
- Apply it in straight 30 cm bands parallel to the tree row along the drip line on each side of the row, either mechanically or using a boom spray (see below).



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Boom spray onto ground

This method is often used for applying low rates of trace element such as boron where fertigation is not available. The size of the granule and the low dose make it impractical to broadcast. It could also be used for banding. Typically, a weedicide boom or similar is used to spray the fertiliser under the canopy or along the dripline from a tank of dissolved nutrient. The correct rate is achieved by considering the amount of the fertiliser dissolved in the tank, the delivery rate of the nozzles on the boom and the speed of the tractor.

Fertigation

- Most Australian mango farms have now incorporated a fertigation system into their nutrition management practices. The fertigation system should be designed so that:
- Most of the under-tree area is wetted.
- The distribution across the block is even so that each tree receives the same dose.
- The sprinkler type chosen gives an even distribution pattern.

Note: A fertigation system with a very limited wetted area, such as one using a single drip line with few emitters, is generally unsuitable as it restricts effective nutrient distribution and uptake.

Provided your irrigation system wets a large proportion of the under-tree area and delivers water evenly across this wetted area, then fertigation has many advantages as a means of distributing fertilisers to the orchard. It uses less labour, there is more efficient nutrient uptake and fertilisers can be applied more regularly and conveniently. With efficient fertigation, annual rates of nitrogen and potassium can generally be reduced by about 25 per cent. Fertigation is a complex system, seek professional advice before designing and operating your system. Irrigation water should also be fully analysed, making sure iron and boron are tested as well as pH, hardness, bicarbonate and salinity.

Fertiliser is dissolved in water in a drum or tank and sucked or injected through the watering system. The preferred equipment is a venturi injection pump or a pressure differential system. Fertilisers used must be highly soluble to avoid pump damage and pipe blockages. Mixtures of fertiliser must also be compatible to avoid the development of precipitates, which can block sprinklers and cause root damage. Other major requirements are good filtration and a uniform irrigation system that delivers similar amounts of water to all trees in the orchard.

In planning a fertigation system, pay attention to the area of ground wetted by the irrigation system. If it is relatively small (20 per cent or less of the orchard floor), fertiliser application may be too concentrated and affect root health. This is particularly important for potentially toxic nutrients such as boron. If the wetted area is too large (80 per cent or more of the orchard floor), much of the fertiliser may be out of reach of the roots, particularly in the case

of younger trees. Some irrigation systems are designed so that the sprinklers can be adjusted to wet a bigger diameter once trees have grown.

Some suitable straight fertilisers for fertigation are listed in the table below. Not all of these are compatible with each other. You should seek advice on compatibilities with the supplier. Many fertiliser companies also manufacture a range of propriety blends of different nutrients suitable for fertigation.

Table 1. Soluble fertilisers suitable for fertigation

Fertiliser	Main nutrients supplied
Urea	Nitrogen
Calcium nitrate	Nitrogen, calcium
Potassium nitrate	Nitrogen, potassium
Potassium sulphate ('K spray')	Potassium
MAP (technical grade)	Nitrogen, phosphorus
Magnesium sulphate (Epsom salts)	Magnesium
Solubor®	Boron
Boric acid	Boron
Zinc sulphate heptahydrate	Zinc
Iron sulphate	Iron
Iron chelate	Iron
Manganese sulphate	Manganese
Copper sulphate heptahydrate	Copper

One of the potential problems with fertigation is that it can result in the pH of the wetted area dropping significantly below that of the non-wetted area through the acid forming action of the fertilisers. It is important to regularly monitor soil pH in both the wetted area and outside of it, as most fertilisers acidify the soil. Sample both the surface soil (0 to 15 cm) and deeper soil (up to 30 cm). Applications of micro-fine lime, which can be applied through the fertigation system (provided there is sufficient agitation) help to keep soil pH within the desired range.

Foliar application

The foliar application of nutrients is becoming increasingly popular in mango orchards, helping to supplement nutrients taken up from the soil. Foliar sprays are most frequently used during peak demand periods or to provide quick responses to nutrient deficiencies. They are particularly useful for the strategic application of trace elements (boron) or macro-elements (potassium, nitrogen, calcium) at key growth stages including flowering and early fruit development. Foliar sprays should only be applied to soft tissues (young leaves, flowers, young developing fruit), as most nutrients are not readily absorbed by mature leaves or advanced fruit. There still remains some industry debate about the effectiveness of foliar nutrient applications to mangoes for certain nutrients (e.g. calcium), so it is important to seek professional advice before initiating a foliar spray program. Care should also be taken to accurately calculate spray concentrations and mister application volumes before the commencement of foliar spraying, to avoid issues with excessive application rates causing foliar burn or ineffective application rates not meeting plant requirements.

Key references

Litz, R. E. (1997). *The mango: botany, production, and uses*. New York: CAB International