TECH SHEET 5

ROOT HEALTH MANAGEMENT

Avocados have a relatively inefficient root system with little or no root hairs and poor water uptake. The roots have evolved to efficiently intercept and recycle minerals released from the decomposition of organic matter. The root system is shallow with a much-branched feeder-root system that requires a well-aerated, well-drained soil for healthy root growth. The roots have a high oxygen requirement and even short periods of waterlogging result in reduced shoot growth, altered mineral uptake and root death. The root system is very susceptible to attack by a number of fungi, especially Phytophthora.

Healthy root function is essential for water and nutrient uptake. Shoot and fruit growth only occurs with an adequately functioning root system. Heavy crops impose additional stress on the tree and the root system. Although trees may appear healthy, they are not necessarily free of root infection. The key to maintaining root heath is to provide a soil environment conducive to root growth. This provides the tree with a degree of tolerance to root rot, as root regeneration outstrips damage to the young feeder roots.

The following factors are essential to create conditions conducive to avocado root growth:

Soil moisture

Maintain adequate, but not excessive, levels of soil moisture by applying supplementary irrigation. Application rates need to be carefully monitored to avoid excessive soil water levels. Irrigate sufficiently often to prevent the surface mulch from drying out. Use low-trajectory, under-tree sprinklers.

Drainage

Select sites for planting with open, free-draining soils, avoiding tight subsoils or clay close to the surface. Hump and hollow contouring or supplementary tiles and drainage coil can be used to improve surface and subsurface drainage, respectively.

Organic matter

Buildup the soil organic content by maintaining a layer of mulch around the trees extending 0.5m beyond the drip line. Use coarse woody material. Compost alone does not make good mulch. Do not use sawdust.

Nutrition

Soil activity of P. cinnamomi is inhibited by the calcium ion (Ca^{2+}) and stimulated by high concentrations of potassium (K^{+}) and magnesium (Mg^{2+}). Apply agricultural lime or dolomite to achieve high levels of exchangeable calcium and a soil pH in the range 5.5 – 6.9. Target leaf tissue levels for Ca are 2% dry weight. If more calcium is required without further increasing pH levels use gypsum.

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Chemical and biological control of root diseases

Several fungi attack avocado roots the most important of which is Phytophthora root rot.

• Phytophthora cinnamomi is a soil fungus which causes the rotting of avocado feeder roots. It causes a gradual decline in growth, with leaves reducing in size with a pale green to yellow colour.
• Leaves wilt and fall prematurely, creating a sparse canopy especially at the top of trees. There is little new growth, except for a few weak growth flushes.
• Fruitset is light or absent, or alternatively the tree produces a heavy crop of small, unmarketable fruit. Pronounced branch dieback eventually leads to the death of the tree
• A number of rootstocks such as Duke 7 show good tolerance to P. cinnamomi. (P. cinnamomi does not develop in soils below 12 degrees Celsius) Fungal activity is favoured by heavy rainfall with severe outbreaks of following periods of heavy autumn rain.

Biological control

• Natural suppression of P. cinnamomi populations in the soil is achieved by microbial competition from high populations of soil bacteria and beneficial fungi including competing Phytophthora species.
• High microbial activity in the soil is facilitated by organic amendment, Fertilisers and supplementary irrigation.

Chemical Control

• Chemical treatment is used to protect the actively growing root system from attack. Injecting the tree trunk with phosphonate produces dramatic recovery of trees even from an advanced stage of decline.

Tree Injection

• Best administered in early spring or during summer, between late December and early March. Where it is used to rejuvenate diseased trees, two annual applications are recommended
• Do not inject within three to four weeks of active shoot growth.
• Only trees with trunks 5cm or greater in diameter should be injected
• Trees should not be pruned or the canopy cut back either before or after injecting, as leaf burn on new growth may occur.
• Trees should be actively transpiring at the time of injection ie sunny, breezy conditions. They should not be under heat or moisture stress.
• They should be well irrigated before injection, which should be done before the heat of the midday sun.
• Injection should be made at points in a spiral around the trunk. Crotch areas, where branches join the main trunk, and previous injection sites should be avoided.
• Injection holes need not be sealed, as natural callousing will occur
• Always follow the instructions on the label for the product you are using.

The following chemicals have phosphorous acid as the active ingredient and are registered for use on avocados: Foli-r-fos 400, Foschek, High PK, TreeDoc, Fosfonate, Phosgard.

Verticillium wilt

Verticillium wilt is a minor disease caused by the fungus Verticillium dahliae. Infection occurs via the roots and affects the water-conducting tissues in the trunk and branches. The first visual symptoms are a sudden wilting and browning of the leaves which do not fall from the tree. There is no cure for verticillium wilt, but in most cases regrowth will appear at the base of an affected limb, which should be cut back to a well-placed new shoot. If repeated symptoms appear, remove the tree and do not replant in the same hole.

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