Managing citrus orchards affected by wet weather

Inundated orchards

Fibrous root death of citrus can commence within seven to 14 days of thorough water logging. Root death leads to the production of stress symptoms in the canopy such as leaf yellowing and drop. Temperatures exceeding 25°C promote symptom development.

When safe to do so, inspect the orchard as soon as possible and mark (e.g. with coloured pegs) areas that are affected by poor drainage. If possible, immediately take steps to improve the drainage of these areas so that the water can get away, eg dig drains to let water get away quicker. Flowing water will reduce the impact of anoxia, and draining flood levels by 10-15cm per day will reduce root damage.

Most citrus rootstocks are generally considered moderately' tolerant to flooded soils, such as the widely used Troyer citrange and rough lemon.

Poncirus trifoliata and Troyer citrange.

Stocks such as Cleopatra mandarin and sweet orange rough lemon, sour orange and Rangpur lime are considered prone to flood-related damage.

Phytophthora root rot

When soils are thoroughly waterlogged, the long term survival spores of *Phytophthora* will not be highly active. However, as the soils begin draining and become better aerated, yet still moist, the *Phytophthora* will thrive.

Whilst commercial citrus rootstocks are generally selected for *Phytophthora* tolerance, the roots are likely to be vulnerable to attack following water logging. The elevated production of root exudates into the soil environment by living, but damaged or stressed roots, strongly attract the swimming *Phytophthora* spores to susceptible infection sites.

In general, good rootstocks tolerance has been reported for Troyer, Benton and C-35 citranges and for trifoliate orange, C-35 citrange, C-32 citrange, and Swingle citrumelo. Poor tolerance has been reported for most scions, sweet orange, Cleopatra mandarin and rough lemon.

The decision to treat with phosphorous acid can be made with the assistance of inspecting the roots for signs of root rot. This can be done by simply digging up feeder roots and looking for sloughing-off of the root cortex (ie layers of tissue peeling off the root surface) leaving behind the thread-like stele of the root.

Phosphorous acid application

Phosphorous acid applications to citrus are most effective as foliar sprays during a root flush. Sprays during a peak in foliar flush will result in most of the phosphorous acid accumulating in the leaves, rather than the roots where it is needed. Aim to treat fully expanded, but not yet hardened off foliage. However, the luxury of ideal timing may not exist; sub optimal sprays may need to be considered in order to start accumulating some phosphorous acid in the roots. Keep in mind that leaves covered in

silt are unlikely to take up phosphorous acid effectively. In these cases it may be necessary to wait until a clean flush is produced.

WARNING: Young and/or stressed trees are very sensitive to phosphorous acid-induced phytotoxicity (e.g. leaf spotting and defoliation). Experience has found rates exceeding 1.9g/L active ingredient to induce phytotoxicity in container grown citrus and stressed field trees. 1.3g/L active has been safely used for container grown citrus. This corresponds to a rate of 2.2mL/L for formulations of 600g/L phosphorous acid.

The best approach for stressed trees is to apply the lowest of the label rates, judging the need to reapply by inspecting root health after 2 to 4 weeks. Alternatively, the effectiveness of applications can be determined by analysis of phosphite levels in the roots (greater than 30ppm are required) – analytical companies such as SGS provide this service.

Phosphorous acid and copper fungicides

Phosphorous acid application in the presence of copper fungicide residues increases Cu ion release, increasing the risk of copper phytotoxicity – particularly if the pH of the phosphorous acid is not adjusted to >7.2. Risk depends on copper type (in order of decreasing risk): hydroxide > oxychloride> oxide.

Check thoroughly with the phosphorous acid manufacturer before attempting to tank mix with other chemical. As a general rule, phosphorous acid should not be tank mixed with any other fungicides.

Foliar and fruit diseases

Under prolonged wet and warm conditions foliar and fruit diseases are likely to be prevalent. Diseases likely to be problematic in the field include:

- brown spot (*Alternaria alternata*)
- melanose (*Diaporthe citri*)
- scab (*Elsinoe fawcettii*)

and possibly less common diseases such as:

- brown rot *(Phytophthora sp.*)
- black pit *(Pseudomonas syringae pv. syringae*)

Conditions are likely to also suit infection for latent postharvest diseases such as:

- black spot (*Guignardia citricarpa*)
- anthracnose (*Colletotrichum gloeosporioides*)

(the latter being particularly important for any fruit to be degreened).

Protectant fungicides (eg copper and mancozeb) will assist to reduce future infections, but good coverage is essential. Existing infections will not be affected by protectant fungicides. As an industry, emergency use permits have already been obtained for iprodione (eg Rovral Aquaflo) for brown spot (Permit PER12582), and azoxystrobin (eg Amistar) for brown spot and black spot (PER12721). Follow all label and/or permit guidelines.

In addition to fungicides, all efforts should be made to alleviate any tree stress from water logging or *Phytophthora*. Air drainage and spray penetration should be improved by lifting tree skirts and selective limb removal to open the canopy.

Lifting skirts will also help to avoid brown rot in low hanging fruit and foliage, and reduce the chances of *Phytophthora* trunk cankers developing due to prolonged trunk dampness.

If pruning, ensure cuts are clean and smooth to minimise the potential for infection by wood rotting fungi. Wounds may also be protected with a plastic paint.

Mulching

Whilst prolonged wet weather has several disadvantages for citrus production, it does provide the opportunity for access to organic mulch sources that are otherwise difficult/expensive to obtain in normally drier irrigation areas.

The addition of organic mulch can be beneficial to managing *Phytophthora* and black spot. In the case of *Phytophthora*, the microorganisms that break down the cellulose in the organic matter can also break down the cellulose in the cell walls of *Phytophthora*. A mulch layer also assists in reducing the availability of black spot inoculum. High organic matter levels in the soil also help soil structure and improve drainage.

Leached nutrients

Bearing trees

Heavy rainfall and flooding can cause nutritional problems. However, applying additional fertiliser to compensate can exacerbate these problems, resulting in poor fruit quality and yields.

Leaf analysis is essential to determine if any adjustments (such as additional foliar nutrient applications) are required. Leaf samples should be taken in February/March and the results interpreted by a local citrus consultant.

Non-bearing trees: These need to be fertilised regularly (every 1-2 months) with small amounts of nitrogen and potassium, and this should recommence as soon as orchard conditions permit.

Foliar applications (particularly of nitrogen and zinc) will assist recovery where root uptake has been affected by waterlogging.

More information

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For essential information on important diseases affecting fruit crops grown across Australia, pick up a copy of Diseases of fruit crops in Australia, available for purchase from CSIRO at www.publish.csiro.au

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