Extension Note - Managing Nursery Stock After Flooding

March 2023

Following extensive flooding in the Hawkes Bay area, the following action plan was developed to help producers with recovery efforts. In the short term the focus should be on plant recovery and the key areas to consider include:

- Water removal
- Silt (sedimentation) management
- Plant nutrition
- Plant protection

Water removal

Prolonged periods of waterlogging will lead to anaerobic conditions and after 72 hours, fine, white feeder roots will begin to die.

Silt management

Silt management varies according to the depth of sediment deposited.

Nursery trays and container stock

- Wash silt off foliage and from underneath trays.
- Manually remove all silt as well as the top 0.5 cm layer of potting mix (as feeder roots will be dead in this zone) from trays and containers.
- Re-dress with clean potting mix.

If any silt is left behind, this will wash down with subsequent irrigation and re-create an impervious, anaerobic layer upon which water will pool when wet and will form a concrete-like barrier when dry. If the barrier completely covers the individual plug, subsequent irrigation water will pool on top of the silt and not get to the roots, which will then be deprived of water and oxygen, resulting in death of the feeder roots.

Field grown stock/stooling beds

For silt deposit layers less than 10 cm, these should be rototilled to mix the silt deposit with the previous topsoil. This will introduce organic carbon, nutrients and soil microbes into the silt, which are currently lacking.

All excess silt above 10 cm MUST be removed from the site. If silt is scraped away from stooling beds, and creates ridges in the inter-rows, these should also be removed as quickly as possible.
Having ridges in the inter-rows by default means that the trees in the intra-rows are now in furrows, which will flood with subsequent rain and irrigation. Furthermore, silt will wash off ridges back into the intrarows.

Silt deposits currently have no structure, which means there are no air pockets or macropores to allow drainage and oxygen to the roots. The best way to recreate soil structure is to add organic matter (carbon) which in the presence of nitrogen will stimulate soil microbes, other invertebrates and earthworms. Soil organisms produce the sugars and acids needed to rebuild soil structure (clods).

Ways to introduce organic matter include:

1. Adding fully composted materials ideally with a C:N ratio of between 20:1 and 25:1 (eg: bark-based potting mix) would be the ideal situation.
2. Where un-composted, high carbon content material (C:N ratio of 100:1) eg: sawdust, wood chips, paper, cardboard, straw etc. are used, these will lock up whatever nitrogen has not been leached out of the soils as it decomposes in the soil. Keep an eye on yellowing of older leaves on plants and consider a nitrogen dressing on the soil as well as a foliar application.
3. Also consider green manuring to add additional carbon to the soils. Careful seeding of grain sorghum, mustards and other brassicas in the inter-rows will help suppress water moulds eg: *Phytophthora*, *Pythium*, *Aphenomyces* etc. as the roots of these cover crops produce isothiocyanates, which kill detrimental fungi, nematodes and prevent weed seeds from germinating.

Nutrition

1. Where the oldest leaves on plants are yellowing, consider a foliar spray of 0.5% calcium nitrate to help with nitrogen deficiencies.
2. Incorporation of triple superphosphate or double superphosphate is essential as this will provide a water-soluble form of calcium and phosphate, both of which are essential to plant root recovery.
    - For nursery trays, a granular hand-held applicator can be used to apply 2-3 granules of superphosphate per plug.
    - For container stock you will need to apply approx. 10-12 granules per pot.
    - For stooling beds, broadcast both intra and inter-rows at a rate of 30kg/ha.
3. Consider sending a representative soil sample of the new rototilled soil horizon for chemical analysis as preliminary analyses are showing that the silt is deficient in phosphorus and potassium and is alkaline, but incorporating the silt with the topsoil will help mitigate some of the high pH.

Protection

Below is high level guidance for managing disease pressure for plants after prolonged waterlogging. Always work with your plant protection advisor when making decisions about plant protection formulations.

It is imperative that plant producers apply phosphorous acid as a foliar spray to all affected plants, including nursery stock, mother stock and stool beds. Phosphorous acid is a fungicidal elicitor that breaks down into phosphite (PO_3^{2-}) in the plant. The PO_3^{2-} attaches to a sucrose molecule and gets translocated to the roots where it will suppress water moulds such as *Phytophthora*, *Pythium*, *Aphenomyces* etc.

Zoospores of these water moulds will have spread throughout the waterlogged production areas and soils due to flooding and will be attacking feeder roots of susceptible plants.

When applying a foliar spray of phosphorous acid, it is best to apply it at a balanced pH of around 7.2 as that is the natural physiological pH of cells and at that pH will cause the least phytotoxicity in the plants. Do not exceed 1% of active ingredient (10 g/L in the spray tank) at that pH or you may cause an osmotic burn on sensitive plants.

Different phosphorous acid products are available but check the pH of the SDS as pH may be buffered from 5.5 to 6.3 in some formulations, where other formulations are buffered between 7.5 to 8.0.