



Flooding symptoms include wilted leaves, chlorosis, leaf drop, thin canopy and dieback.



By Mongi Zekri

# What to do when groves flood

**D**uring heavy rains in the summer, excess water must be removed from the root zone. Flooding injury can be expected if the root zone is saturated for three days or more during extended summer rains at relatively high soil temperatures (86 to 95 degrees). Flooding during the cooler December–March period can be tolerated for several weeks at low soil temperatures (below 60 degrees).

Flooding stress is usually less damaging when water is moving than when water is stagnant. The use of observation wells is a very reliable method for evaluating water-saturated zones in sites subject to chronic flooding injury.

Short-term estimates of flooding stress can be obtained by digging into the soil and smelling soil and root samples. Sour odors indicate an oxygen-deficient environment. The presence of hydrogen sulfide (a disagreeable rotten egg odor) and sloughing roots indicate that feeder roots are dying. Under flooded conditions, root death is not exclusively

associated with oxygen deficiency. Anaerobic bacteria (the kind that can grow only in the absence of oxygen) develop rapidly in flooded soils and contribute to the destruction of citrus roots.

## IDENTIFYING DAMAGE

Symptoms of flooding injury may occur within a few days or weeks, but usually show up after the water table has dropped and the roots become stranded in dry soils. Leaf wilting, leaf drop, dieback and chlorosis patterns may develop, and tree death may occur. Trees subjected to chronic flood damage are stunted with sparse canopies and dull colored, small leaves. These trees produce low yields of small fruit. New flushes of growth will have small, pale leaves due to poor nitrogen uptake by damaged root systems.

With acute water damage, foliage wilts suddenly followed by heavy leaf drop. Trees may totally defoliate and eventually die. But more frequently, partial defoliation is followed by some recovery. However, such trees remain in a state of decline and are very susceptible to drought when the dry season arrives because of their shallow, restricted root systems. Moreover, waterlogged soil conditions are conducive to the proliferation of soilborne fungi such as phytophthora root and foot rot. These organisms cause extensive tree death, especially in poorly drained soils.

Water damage may usually be distinguished from other types of decline by a study of the history



of soil water conditions in the affected areas. Areas showing water damage are usually localized and do not increase in size progressively as do areas of spreading decline. Trees with blight or tristeza are usually randomly distributed within the grove. Diagnostic tests are available to distinguish diseased trees from water-damaged trees.

Citrus trees respond physiologically to flooding long before morphological symptoms or yield reductions appear. Photosynthesis and transpiration decrease within one day of flooding and remain low as flooding persists. Water uptake is also reduced, which eventually translates to decreased shoot growth and yields.

## WHEN TO CONSIDER DRAINAGE

It is both difficult and costly to improve drainage in existing groves, so drainage problems should be eliminated when the grove area is prepared for planting by including a system of ditches, beds and/or tiling. Growers

should not depend on the slight differences in rootstock tolerance to flooding to enable trees to perform satisfactorily under such conditions.

Trees, irrespective of scion and rootstock cultivars, should be planted under the best drainage conditions possible. Drainage ditches should be kept free of obstruction through a good maintenance program that includes chemical weed control. Tree recovery from temporary flooding is more likely to occur under good drainage structure maintenance conditions.

## RECOVERY RECOMMENDATIONS

Do not disk a grove if trees were injured by flooding. Irrigation amounts should be reduced, but frequencies should be increased to adequately provide water to the depleted, shallow root systems.

Soil and root conditions should be evaluated after the flooding has subsided. Potential for fungal invasion should be determined through soil



Sloughing roots indicate that feeder roots are dying.

sampling and propagule counts. If there is a phytophthora problem, the use of certain fungicides can improve the situation.

The nature of the soil, the rootstock, root condition, duration of flooding, soil and air temperature, soil pH and the presence of sulfur and organic matter in the soil are all factors that need to be considered when trying to evaluate flooding damage and manage tree recovery. 🍊

*Mongi Zekri is a University of Florida Institute of Food and Agricultural Sciences multi-county citrus Extension agent in LaBelle.*



# UNLOCK THE SECRETS OF PLANT HEALTH, DISEASE CONTROL & PEST MANAGEMENT



Scan the QR Code for More Information on Crop Solutions, Research and Knowledge - Based Articles or Visit [KeyPlex.com](http://KeyPlex.com)



**Booth #125**