

**H**urricanes occur in Florida from June through November of each year, and can result in severe damage to citrus trees due to high winds and flooding. The most recent hurricanes were Charley (August 2004), Frances and Jeanne (September 2004), and Wilma (October 2005). Commercial fruit production has been reduced following recent hurricanes.

Pre-hurricane planning and post-hurricane actions can reduce the destructive effects of hurricanes. While a hurricane has the potential to inflict heavy damage on any grove, growers who have developed hurricane plans prior to the event have the best chance of minimizing losses. Little can be done to protect trees and fruit from hurricane velocity wind, but growers can take steps to protect the people, equipment and supplies that will be needed in the recovery process.

Wind from hurricanes may cause fruit loss, almost complete defoliation, severe twig and limb damage, severe trunk twisting and breakage, tree uprooting and toppling. Wind gusts are generally 30 percent stronger than the sustained winds in hurricanes, and there is increased threat of tornadoes. Any tropical storm poses a threat to South Florida's shallow-rooted citrus trees. Strong winds blow fruit off trees with larger fruit being most susceptible.

Damage from wind and 12 inches to 20 inches of rain could cause the most lasting injury. The amount of rainfall from a tropical storm is dependent on the speed of storm movement and a rule of thumb is to divide 100 by the forward movement speed of the storm (in mph). For example, the maximum amount of rainfall from a 10 mph moving storm would be 10 inches, and for a 5 mph moving storm, 20 inches.

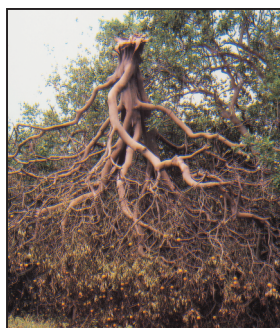
## PRE-HURRICANE PREPARATION AND PRACTICES

### PERSONNEL ASSIGNMENTS:

A major part of the hurricane plan is ensuring that all managers know their

# Hurricane preparation and recovery for Florida citrus groves

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*Hurricane Charley turned these Central Florida trees topsy-turvy.*

responsibilities prior to, during and after a hurricane. Make a list of all tasks that will need to be performed so there are no last-minute, unanticipated problems. Identify and maintain an updated list of the members of a damage inspection team. Make sure you know how to contact workers at their place of safety, and that they have a way to call in after the storm.

**SAFETY TRAINING:** Workers should be trained in the safe operation of unfamiliar equipment they may have to use, e.g., chain saws and backhoes.

**INSURANCE:** Infrastructure such as buildings, roads and equipment — including tractors, irrigation, and supplies — should be insured against damage.

**LIQUID TANKS:** Tanks containing fuel, fertilizer and other materials should be kept full so they don't move in the wind and to ensure sufficient fuel is available for the recovery efforts.

**ROADS AND DITCHES:** Roads should be secure and ditches kept clean and pumped down to help maximize water removal after the storm. Flooding, downed trees and electrical poles may block roads; growers should

consider making prior arrangements for a helicopter or flying service to transport the grove manager to survey grove damage. Aerial surveillance can also determine routes of passage through the grove.

**EMERGENCY EQUIPMENT:** Make sure that all emergency equipment — including generators, chain saws, torches and air compressors — are on hand and in good repair. Shovels, slings, fuel, paint and equipment parts should be available. Emergency generators should be available for use in

headquarters and equipment maintenance shops. Have knowledge of where to obtain backhoes, front-end loaders and other large machines.

**COMMUNICATIONS EQUIPMENT:** Ensure that radios are in good working order. Have hand-held portable radios with extra charged battery packs available for workers who will need them in the field. Direct truck-to-truck radio communication is most reliable when phone lines are down, and cellular phones with radio capability and standard cellular phones can help workers save valuable time during the recovery.

**HAZARDOUS MATERIALS AND ELECTRIC:** Hazardous materials should be secured prior to a storm, and gasoline pumps should be shut down. The electric power should be shut off prior to the storm as downed live wires are extremely dangerous.

**EMERGENCY CONTACTS:** Have a list of phone numbers you might need in an emergency, including numbers for the phone and electric companies.

**CULTURAL PRACTICES:** Tree size control by regular pruning can

### Saffir-Simpson hurricane storm rating scale and expected damage to citrus trees

Category	Wind (mph)	Expected damage*
1	74-95	Some loss of leaves and fruit, heaviest in exposed areas
2	96-110	Considerable loss of leaves and fruit with some trees blown over
3	111-130	Heavy loss of foliage and fruit, many trees blown over
4	131-155	Trees stripped of all foliage and fruit, many trees blown over and away from property
5	over 155	Damage would be almost indescribable, groves and orchards completely destroyed

\*Saturated soil from high rainfall will increase the number of trees toppled and uprooted.

reduce broken limbs, trunks snapped and/or twisted off or trees toppled or uprooted. During hurricane Andrew, less trees were toppled in groves where height control was practiced and trees were no more than 12 feet to 22 feet tall. Windbreaks are gaining interest for reducing movement of the citrus canker bacterium. The benefit of windbreaks depends on whether they can remain upright and mostly intact during a storm. Observations from previous hurricanes show that few windbreaks have withstood winds of 100 mph and large Australian pines and eucalyptus were damaged and broken, falling to the ground, damaging trees they were supposed to protect. Artificial windbreaks constructed of wood or metal poles with shade cloth suspended on cables did not survive category 3 winds of hurricane Wilma or category 5 Andrew.

## POST-HURRICANE PRACTICES

**DAMAGE INSPECTION:** The first task after a hurricane is to make a visual assessment of the damage and determine priorities for repairs and equipment needed. If roads are passable, inspection of trees and equipment may be conducted from trucks.

**PRIORITIZE DAMAGE:** A check list will ensure that all essential damage assessment and recovery operations are carried out. A priority plan can quickly determine where to begin recovery operations.

**EMPLOYEE CALL-IN:** As soon

as it is safe to do so, call in those who will be needed for damage inspection and grove recovery work.

**CLEAR ROAD ACCESS:** Have crews clear all roads leading to parts of the grove where trees must be reset or recovery activities must be conducted. Having a clear path for workers will speed the recovery effort.

**WATER REMOVAL:** Remove excess water from tree root zones as soon as possible. It is essential to accomplish this task within 72 hours to avoid feeder root damage due to insufficient oxygen.

**TREE REHABILITATION:** Resetting of trees to an upright position should be accomplished as soon as possible after the storm. Ensure that employees know how to properly upright toppled trees and that appropriate equipment is available. The amount of root damage and root system remaining in the ground should determine the priority for resetting.

Mounding soil or providing shade to exposed roots should be done on trees that can't be reset immediately.

Toppled trees should be pruned back to sound wood. Removing part of the canopy reduces the weight of the tree, making resetting and stabilizing easier, and reduces transpiration.

Based on the amount of damage, it may be necessary to cut the tree back to main scaffold limbs (buckhorning). Spraying or painting the tree trunks and branches with diluted white latex paint will help prevent sunburn to exposed cambium.

**IRRIGATION:** Check the irrigation system and ensure emitters are working around reset trees. Rehabilitation is a long process and water is most critical.

**FERTILIZER:** The major fertilizer elements should be applied to the grove when new growth begins. Although reset toppled trees will require less fertilizer due to reduced root system (use a slow-release material when resetting), the remainder of the grove will require 20 lbs. to 30 lbs. of N depending on leaf loss. The following year, trees may require slightly more than normal rates of fertilizer as they re-establish their canopy. Micronutrients should be applied in nutritional sprays to the leaves.

**WEEDS:** With leaf loss, more soil surface will be exposed to sunlight, allowing weeds and vines to thrive. Row middles should be mowed and herbicide applications should be resumed on a normal schedule.

## PREPARATION LEADS TO SUCCESS

Prepared management can deal with a hurricane and its consequences. By having a plan and following it, grove managers can greatly increase the odds of a grove being productive in the long term following a hurricane.

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