

DRAFT Fruit Tree Producers Guide to Preparing for and Recovering from Hurricanes in the Southeast U.S.

This is a draft of guidance being developed by the USDA SE Climate Hub to help fruit tree and pecan nut producers prepare for and recover from hurricane damage.

This section will focus on:

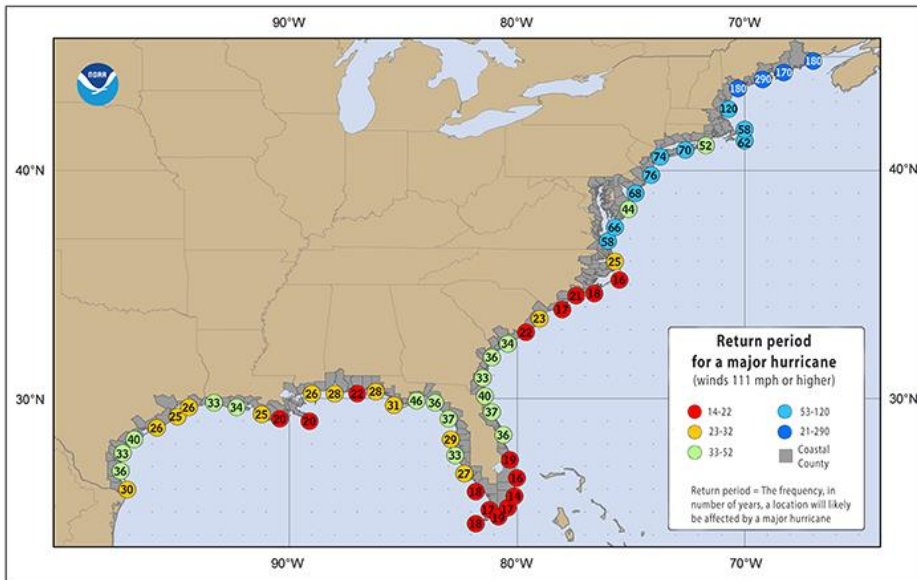
- Tree fruit (apples, peaches, and pecans) orchard establishment considerations where hurricanes and tropical storms are a potential threat.
- Annual orchard management considerations and locales where hurricanes and tropical storms are a potential.
- Orchard management options when hurricanes and tropical storms are imminent.
- Orchard management practices after hurricanes or tropical storm damage.

I. Pre-Hurricane Planning – Long-term Preparedness

The portion of the U. S. exposed to greatest risk of Hurricane/Tropical Storm damage is a ~100 km (60+ miles) band from the Texas-Mexico border to the northwest coast of Florida and along the South Carolina, North Carolina, and Virginia coasts. Historical records indicate that orchards within this zone are 60-100% likely of being hit by a land-falling hurricane over a 10-year period. The potential for inward progression of the hurricanes, although somewhat weakened possibly to a tropical storm, can be several hundred miles. Orchards throughout the Southeastern U.S. have always been vulnerable to the degenerate tropical storms, small tornadoes, and microbursts evolving out of hurricane-associated storms as they move inland. Because tree fruit orchards may exist for many years, those within this zone are likely to be hit with several hurricanes, or associated tropical storms, over their lifetime.

Initial Site Planning

The National Oceanic and Atmospheric Agency (<https://www.noaa.gov/>) publishes tables and charts illustrating the probability that areas of the country have in receiving multiple hurricanes expressed as the number of years between storms. However, there is no tool that will be able to determine when and where hurricanes will strike along the East Coast. It is also important to realize that most data show where the hurricanes come ashore, however lower level hurricanes and significant tropical storms can move hundreds of miles inland causing significant wind damage and/or flooding.



<https://www.noaa.gov/stories/what-are-chances-hurricane-will-hit-my-home>

Site and Orchard Establishment

When establishing orchards in hurricane prone areas it is ideal to prepare the site to encourage optimal root development. Pre-plant practices such as nutrient soil testing to correct soil pH and nutrient levels throughout the soil profile before planting is advised. In addition, using a subsoiler to deep till the soil down the tree rows and then perpendicular to the tree rows and where these tillage lines intersect is where the trees will be planted. This will distribute lime and nutrients deeper in the soil and eliminate and break up any existing compacted layers that may limit root distribution both laterally and vertically. It is also important to understand the drainage profile within the orchard. With hurricanes and tropical storms large quantities of rains are usually experienced. Modifying the orchard site to allow for proper drainage would be advised whether using passive raised beds in the tree row or active drainage with tilling the orchard. Some tree fruit crops, such as peaches and many of the stone fruit, have a very limited tolerance for saturated soils with leaves on the tree. With leaves on a peach tree and saturated soils for as little as three days can result in significant tree death. Establishment of an irrigation system that will wet a larger pattern would also be encouraged. Roots do not grow towards water but rather grow where the environmental conditions, such as soil moisture content, are ideal.

Proper tree planting is also essential. Most tree fruit crops that are planted will be on grafted trees. Understanding where the graft union is located and ensuring that the graft union will be at least 3-4 inches above the soil after planting and soil settling is required for optimal tree growth, strength, and integrity. For high density apples on dwarfing rootstocks, a support system is required in all environments. In areas where hurricanes are a potential the support system must be adequate to allow for saturated soils and heavier winds. In addition, where a support system has been put in place it is imperative that the trees are attached to that support system.

Pecan trees should be planted only on well-drained soil with three to four feet or more between the soil surface and water table under normal conditions. Trees planted on sites where the water table is excessively high develop a horizontally spreading, shallow root system. Such trees are especially susceptible to up-rooting by winds because a robust, extensive tap root and large brace roots are required

for strong anchorage of the tree. Lowering the water table to 3-4+ feet improves tree resistance to wind damage.

Trees planted excessively deep are much more prone to blow-over by wind than those planted at appropriate depths. Trees with root collars >2 inches below the soil surface are usually planted too deep. The deeper the root collar beyond 2 inches, the greater the likelihood of suppression of brace root development. Such trees are recognizable in orchards by a sizeable crack in the soil at the soil-trunk interface. This crack is often up to roughly 1 inch in width around the interface, resulting in trees wobbling in the wind. These trees survive and produce fairly well for many years, but are typically the first trees in an orchard uprooted or blown over by major storms. It is therefore important to ensure that the depth at which transplants are established is appropriate. Ensure that the upper-most lateral root is even with or no more than 1" below the soil surface at planting. Digging trees holes at approximately 24" and pruning the tap root to the same depth will ensure the trees do not settle too much, which may also lead to trees being planted too deep. Another indicator that trees are planted too deep is evident with trees going straight into the ground with no root flaring at the soil surface.



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Pecan tree planted too deep (note absence of brace roots)



Pecan tree planted at appropriate depth with proper brace root development

The choice of cultivar also affects pecan tree susceptibility to wind damage. Cultivars with strong (i.e. wide) limb angles and central leaders are more likely to resist windfall. Additionally, selection of cultivars with “open” canopies, rather than dense, “closed” canopies, confers considerable protection from wind when grown at standard orchard spacing. Possibly selecting cultivars that mature earlier may be an option as well (i.e. Pawnee).

After planting it is necessary to train and prune the trees for proper structure and training system. Many of the pome fruit (apples and pears) and nuts (i.e. pecans, walnuts, etc.) are trained to a central leader, whereas many of the stone fruit (peaches, plums, etc.) would be trained to an open center. Independent of the system chosen, eliminating sharp crotch angles, the angle at which the branches meet the main trunk, should be initially as wide as possible. Publications and videos on producing and training tree fruit can be found at: <https://horticulture.ces.ncsu.edu/comprehensive-resources-for-fruit-trees/>.

Seasonal Considerations Outside of Hurricane Season

Optimizing tree growth throughout the season is also encouraged. Practices such as maintaining a vegetation free strip underneath the tree, annual fertilization based upon soil and foliar analysis, annual training and pruning for optimal and proper tree structure, and annual insect and disease management is crucial.

Pruning strategies that reduce tree height and open canopies reduces limb breakage and uprooting. Mechanically hedge pruning pecan trees could potentially reduce the potential for wind damage, as the practice keeps trees relatively small and limbs relatively short, thus minimizing tree exposure to winds and the associated leveraging side-effects on root systems. Hedge pruned pecan trees in Georgia suffered 60% less damage to tropical storm force winds during Tropical Storm Irma in 2017. Under a hedging management system, the relatively small size of orchard trees reduces the time required to refill vacated space with transplants when trees are destroyed. In fact, the increasing popularity of large-tree transplanting allows for refilling orchard space within a few years thus, accelerating orchard recovery.

Tree limb breakage commonly occurs during the late water stage of fruit development and during kernel filling of pecan, which happens to coincide with the peak of hurricane season in August and September. Storms during this period can devastate orchards because of the immense weight being supported by long limbs carrying heavy nut crop loads. Associated fruit are especially heavy due to the volume of water contained to ensure proper kernel filling. Reducing excessive crop loads in late July or early August via timely mechanical fruit thinning can greatly increase tree resistance to wind damage.

Monthly Considerations During Hurricane Season

See Above

Annual Considerations

See Above

II. Pre-hurricane Planning – Short-term Preparedness

When a Hurricane Is Forecast to Impact Your Area (1 to 7 days before)

Depending on the crop, harvest as much as possible that is of marketable maturity. If support systems are in place, assess support structure and make sure trees are securely attached to the support structure.

Do not remove a portion of the trees canopy, either through aggressive pruning or chemical defoliants, to try to and reduce the wind drag on the tree. These practices further complicate any potential damage that may occur and reduce the potential for any harvest if the storm changes course or causes less damage than anticipated, which is the case in many instances.

Since heavy rainfall is often associated with hurricanes/tropical storms, all irrigation systems should be shut off as soon as possible following forecasting of the weather event to allow soils to dry out. This will help to stiffen soils and help minimize wind-throw of trees as soils become more saturated. In addition, if time permits checking drain lines and cleaning ditches if present would also be ideal.

One Day Before a Hurricane is Forecast to Impact Your Area

Take all precautions to evaluate the potential for injury to management and field workers and take appropriate action. Move equipment undercover and if flooding is a potential, move to higher ground.

III. Post-hurricane Recovery

Measures taken to assess and repair damage after a hurricane

Immediately After the Hurricane has Passed

Going into an orchard immediately after a hurricane or tropical storm must be done carefully. Safety issues from damaged or weakened trees is crucial as well as causing significant ruts within the orchard that can cause management and harvest issues. It will be necessary to document the damage as detailed as possible. Although most insurance policies will not cover the lost trees there may be coverage for the lost crop and income. Digital photos of the trees and crop loss will be needed, especially if disaster payments may be an option. Although the initial inclination is to pull the trees up as soon as possible, realize that the damage has already been done, making the trees look “better” will not result in increased tree survival. When a tree is blown over it has damaged roots all around the tree and pulling the tree upright causes more damage. The root system is not fluid within the soil and does not have a “give-and-take” flexibility. Extensive experience in North Carolina and Georgia with storm damaged pecan trees has led to the conclusion that pulling up established trees and staking is of little benefit. Although the trees will look better, they are usually the first trees to blow over again when a nor’easter or tropical storm moves through. For smaller trees of other fruit types, which ultimately have a much smaller tree, the same is true. Newly planted trees with less than 30% lean could be staked up and held with a trunk support.

Within a Week Following Hurricane Impacts

Maintain optimal management and minimize competition from vegetation. Hurricanes and tropical storms typically move through later in the season and fertilizing at this time could result in making the trees more susceptible to cold damage from an early winter cold event. Removing fallen debris from the orchard is a task that should be conducted when permissible. Hanging branches are usually encouraged to be left until the dormant season realizing that carbohydrates will be translocated from the green leaves to the tree as the trees go dormant, although it may not look well-managed for several months.

Within a Month Following Hurricane Impacts

With perennial tree fruit crops, damage from a tropical storm or hurricane may not be evident for a much longer period of time. Trees experiencing heavy winds can have damage in below ground roots resulting in weakened tree growth, limb die-back, and reduced production in future years. Monitoring the trees for the next year or two would be crucial for pathogens and insects that thrive on compromised trees, especially for Ambrosia beetles which tend to key in on weakened trees.

This draft guidance was developed by subject matter experts from North Carolina State University and the University of Georgia

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