How will the Hurricanes affect next years crop?

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The beginning of this hurricane season seems like a lifetime ago. Since the notorious Friday the 13th in August, Florida has suffered four hurricanes in a six week period. Only Texas has received four hurricanes in one season, over 100 years ago. The Florida citrus industry took the one, two, three combination of punches from hurricanes Charley, Frances, and Jeanne. The paths of these three hurricanes intersected in south Polk County and caused both wide spread and severe localized damage. Early estimates indicate over two-thirds of the Florida citrus acreage was impacted by these hurricanes. The damage to fruit crops and trees from these hurricanes is unprecedented. The normal cycle of fruit production and tree growth has been disrupted up to three times in some blocks!

The Citrus Research and Education Center (CREC) formed a hurricane task force in response to hurricane Charley. Since then, members of the task force have been working to address new problems as a result of hurricane damage. No one has experienced multiple hurricanes in a grove during the same year, so accurately predicting how trees will respond is difficult at best. Nevertheless experienced horticulturists on the hurricane task force have provided some best estimates and answers to questions about management practices and the current / future fruit production. Our recommendations are for trees that have been damaged but are otherwise healthy trees that will recover. Uprooted trees or those with main scaffolding and trunk damage may not recover and are not included in these assessments.
Will the loss of leaves and subsequent regrowth affect the remaining fruit growth or quality?

The greatest impact of the hurricane(s) on this year’s crop was the direct loss of fruit numbers from the wind. In addition, where over 50% of the leaves were lost, the fruit soluble solids may not reach their potential. The acid content in fruit should remain the same, so if lower solid content occurs then Brix:Acid ratios will be lower. CREC scientists studying the effect of mechanical harvesting on trees have manually defoliated trees during the spring for the last 3 years. After removing less than 50% of leaves for three consecutive years, the growth and quality of fruit was not reduced. Although these trees lost some stored nitrogen (N) in the removed leaves, trees recovered with normal fertilization rates. Thus, healthy well managed trees can replace 50% of their leaves without loss of future yield, if leaf removal occurs early in the season.

Will new leaf flushes require more crop protection material and fertilizer?

The new flush is very important for future fruit production (see next question for additional details). When possible, proper irrigation and fertilizer practices that ensure healthy and rapidly developing leaves should be enacted. Any tree with a large proportion of new leaves may be susceptible to citrus leaf miner and psyllids as the new flush develops. For more information on controlling these pests contact your county agent or visit www.crec.ifas.ufl.edu. Trees that were productive and healthy prior to damage will most likely not need abnormally high additional nutrients. Grapefruit trees, which typically exhibit nutrient deficiencies before other citrus varieties, should be monitored closely. If roots are healthy or have healed, normal nutrient application methods will be effective after a hurricane. The rate and placement of fertilizer may need
to be adjusted if tree damage has occurred. If nutrients are applied to the foliage, then
apply N-P-K in 100-125 gallons per acre only after enough leaves have flushed and fully
expanded to absorb nutrient applications. More information on fertilizer placement and
recommended rates for hurricane damaged trees can be found at [www.crec.ifas.ufl.edu](http://www.crec.ifas.ufl.edu).

**How have the three hurricanes impacted the potential of trees to flower next spring?**

Flowering normally occurs on 5 month old twigs and on one year old woody branches.
Young vigorous shoots on trees that were in the swath of all three hurricanes had finger-
sized limbs with significant rubbing damage to the bark and some one year old shoots
were shattered, particularly in the tops of trees (Fig. 1). The shattered shoots will
obviously not flower this spring. Buds usually protrude past the stem surface and some
were damaged by rubbing (Fig. 2). These buds also may not be able to flower. Some
areas, such as the Indian River district endured multiple flooding conditions which may
have damaged the root system. Damage to the roots would become evident in wilted
leaves and may occur some time after the water is removed. Although damage to the root
system will delay the development of new shoots, hedging and topping may be a way to
rebalance the shoot to root ratio as discussed on CREC website at [www.crec.ifas.ufl.edu](http://www.crec.ifas.ufl.edu).

Unfortunately no one has researched the minimum bud age required for flowering
under Florida conditions. Any year old or less wood that produces a leaf flush late in the
fall can decrease the potential for flowering by reducing the number of buds available to
flower normally. The heavy leaf loss has resulted in new flush and their buds may not
mature in time to produce flowers. Knowing when your trees flushed after any of the
hurricanes is important in predicting if and how much your trees will flower this spring.
Many trees began to flush 1 to 2 weeks after hurricane Charley and Frances. Trees that only experienced damage from hurricane Charley and flushed within 2 weeks will have 3½ month old flush by the first week of December. A flush 3½ to 4 month old by the first week of December will probably be old enough to flower as normal. Any flush that started after hurricane Jeanne (about October 4th) will be only 2 months old by the first week of December, so they may not be old enough to flower. Flushes stimulated after Frances may not be mature enough by December for the buds to flower. These predictions assume that flower induction temperatures will be consistently low by the second week of December. Abnormally warm temperatures during December will reduce the buds ability to flower. A warm December will prolong shoot development and increase the likelihood of the shoots maturing sufficiently to have buds which will flower. Earlier cool temperatures in December or late November will shorten the time for new shoots to mature, but will provide greater levels of induction that may help bring induction of marginally developed buds (This possibility is not known for sure).

Another factor that could impact the flowering this spring is the additional wind stress from hurricanes Frances and Jeanne on the new flush after hurricane Charley. In some areas the flush that started between August 14th and August 27th survived hurricanes Frances and Jeanne. Any strong winds may slow the leaf expansion and aging process of surviving flushes. The areas enduring hurricane force winds experienced total loss of leaf blades on the newest flushes. The potential of these buds to produce flowers is probably lost for this season. The best strategy to obtain a normal bloom and fruit set this spring is
to support the leaf flushes with good management, protecting them against water stress, nutrient deficiencies, or pests.

**What about alternate bearing?**

Fruit and leaf loss from these three hurricanes has the potential to reduce yields next year and start an alternate bearing cycle. As we enter the winter months the CREC website at [www.crec.ifas.ufl.edu](http://www.crec.ifas.ufl.edu) will provide weekly flowering advisories under flower induction advisories. These advisories will include evaluation of flowering potential under the unusual circumstances this year and assess the flowering potential from the flowering model. We can expect that it will be more important than usual to delay any stimulation of early growth due to warm periods in December. Use of interrupted irrigation to cause drought stress during December and early January will aid the trees potential to have increased flowering. This hurricane season has been the worst in Florida’s history, and this year’s fruit loss can’t be undone. Sound management practices that supports bud aging along with shoot and root regrowth, where necessary, will restrict future negative impacts from storm damage.