

# Impacts of herbicides on young citrus trees

By Ramdas Kanissery, Nirmal Timilsina and Mongi Zekri



**Figure 1.** Dieback in a young citrus tree was caused by herbicide injury.

**W**eed control is crucial for the growth and establishment of young citrus trees. Chemical weed control with herbicides is an efficient and cost-effective method for managing weeds in newly planted groves.

However, before applying herbicide products, care must be taken to avoid damaging young trees and newly planted resets. Every so often, incorrect herbicide application can lead to injury or even dieback of young trees (Figure 1). Also, herbicide injury in young trees

can reduce their vigor, delay successful establishment and lead to other problems like increased disease and pest infestations. Herbicide damage can cause a growth setback in newly planted trees, resulting in lost money and effort for growers.

## INJURY SOURCES

Understanding how trees absorb herbicides is essential to avoiding damage. There are two primary routes for herbicides to enter trees.

The first is foliar or bark absorption,

where herbicide sprays come in contact with leaves or stems. Trunks transplanted less than one year ago may still have bark that is immature and green. Spray contact of herbicides with tissues other than matured brown bark can result in severe damage.

The second route for herbicide entry is soil uptake, where the tree roots absorb the herbicide residues from the soil. This type of uptake from the soil is more prevalent while applying pre-emergent or residual herbicides.

Pre-emergent herbicides provide



weed control through soil residual activity and can remain active in the soil for a period of time depending on the product's half-life (time for herbicide breakdown). These herbicides tend to be more active in the soil than post-emergent products and can potentially be absorbed by the tree roots from the sprayed area.

Applying higher rates of pre-emergent herbicides to suppress weeds in the tree rows can damage the trees. This is a fairly common occurrence. Young trees will absorb the herbicide, resulting in severe injury. Observable symptoms typically appear slower in trees with roots that have absorbed soil-active herbicides than trees with damage from spray contact causing foliar or bark absorption.

## DAMAGE SYMPTOMS

The effect of a herbicide on citrus trees varies with the type, extent of exposure, tree age and areas contacted with the sprays. Due to their relatively low tolerance to herbicides, young trees will have severe symptoms compared to mature trees. While some herbicides produce distinct symptoms, others result in injuries that resemble damage from different causes, like pests and diseases. Some of the common injury symptoms caused by herbicides in young citrus trees are described below.

### Leaf Discoloration

Some herbicides discolor (chlorosis) tree foliage. This is more or less typical of root uptake of residual herbicides. Some examples include diuron (Karmex) and bromacil (Hyvar X). The leaves will turn slightly yellow after diuron root uptake, followed by the chlorosis of veins (Figure 2a, page 20). Contact with the foliage or stem from certain residual herbicides can harm the trees. For instance, spray contact of diuron can cause a bleached appearance on the leaves of young trees (Figure 2b, page 20).

Similarly, although a residual herbicide, foliar contact with indaziflam (Alion) will cause white or yellow spots on the leaves (Figure 2c, page 20). The root uptake of norflurazon (Solicam) causes midrib chlorosis of the leaf, followed by vein chlorosis as the exposure increases. White spots

# This Beautiful Land

By Rick Dantzler, CRDF chief operating officer

In early October I traveled to Visalia, California, to attend the California Citrus Research Board's (CRB) annual research conference. From the plane's window, I saw amber waves of grain give way to orange-topped trees on the crests of deep gorges, which turned back to a checkerboard of crops as I neared my destination.



When I landed in Fresno, the heart of the Central Valley, I found myself in one of the largest, most productive and diverse agricultural areas in our country. I drove through Selma, the "Raisin Capital of the World," then past miles and miles of peaches, plums, nectarines, almonds, chestnuts and table grapes.

And then I hit citrus country and was blown away.

We forget how pretty HLB-free citrus trees can be with their deep green leaves, full canopies and abundant fruit. My "tour guide" was Justin Brown, chairman of CRB, and I marveled at the bounty and number of fresh fruit crops of the area he showed me. The flatness of the ground surprised me, too. Most of the region was as flat as day-old beer.

California is not without its problems. Water scarcity, labor shortages and regulation are among the most serious. But commercial groves are free of HLB, and that makes all the difference.

When I spoke at the conference, I explained the state of Citrus Research and Development Foundation (CRDF) projects, progress we are making and our path forward. I made it clear that HLB was our mutual enemy, not one state vs. the other, and that CRDF fully supports California's effort to keep the Asian citrus psyllid (ACP) out of the state's commercial groves. Anything we have learned will be made available to CRB.

Other speakers spoke on themes familiar to Florida growers: the biology of the ACP, early detection, removing HLB-positive trees, quarantines and the need for accelerating citrus breeding. Regarding breeding, there were presentations on developing tools such as CRISPR-Cas9 genetic engineering to facilitate new variety selection.

Hailing Jin made a presentation on the finger lime peptide we've heard so much about and noted that she believes it is possible to make the peptide at a much lower price than it currently costs. That was good news because CRDF bought \$114,000 of the peptide for Megan Dewdney of the University of Florida Institute of Food and Agricultural Sciences to treat trees of fruit-bearing age and it didn't cover many trees.

Casey Creamer of California Citrus Mutual outlined citrus issues at the state and national levels. In some ways, it was a talk that could have applied to Florida, which made me realize how important it is that our states work together.

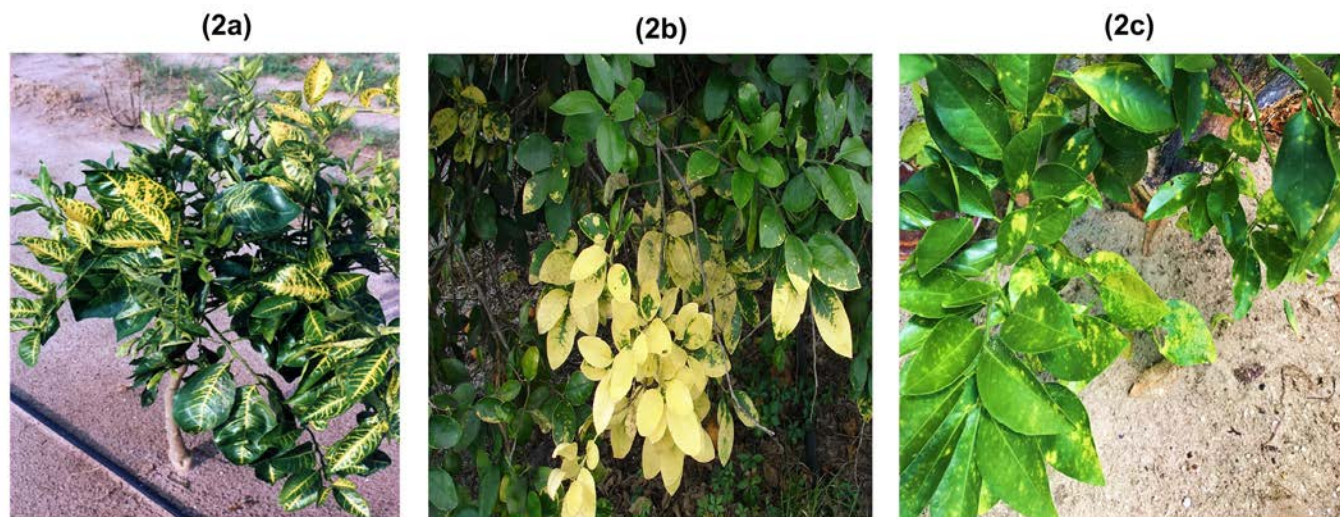
Thank you, CRB, for the chance to attend the conference and discuss ways we can work together. I'm looking forward to the next steps on the matters we identified. I thoroughly enjoyed my visit.

Sooner or later, Florida trees are going to be HLB-free, and we will again marvel at how beautiful they can be. I'm sure of it.



Column sponsored by the Citrus Research and Development Foundation





**Figure 2.** Injury symptoms on young citrus trees were produced by diuron root uptake (2a), diuron spray contact (2b) and indaziflam spray contact (2c).



**Figure 3.** Injury symptoms on young citrus trees resulted from spray contact by paraquat (3a), glyphosate (3b) and 2,4-D (3c).

on the leaves and, in some cases, leaf distortion are typical symptoms of damage from direct spray contact from this herbicide.

#### Brown Spots

Certain herbicides damage only the parts of the trees that come in contact with the spray. Paraquat (Gramoxone) and carfentrazone (Aim) are two examples. A minor spray drift causes brown necrotic spots or speckles on the foliage (Figure 3a) and green bark tissues with no distinctive pattern. However, a significant spray coverage can severely damage the affected tree. Similarly, injury symptoms of glufosinate (Rely, Scout, etc.) include sudden onset of

leaf yellowing, wilting and tissue death in the contacted areas.

#### Distortion

Typical examples of herbicides that cause distortion of immature leaves and growing points are products containing glyphosate, 2,4-D, etc. Glyphosate spray injury on trees starts with yellowing (chlorosis) in the growing points and needle-shaped immature leaves (Figure 3b). Direct spray contact with glyphosate on the green bark will cause burning, lesions and tissue damage in the stem. Spray contact with products containing 2,4-D (e.g., Landmaster) results in the cupping of leaves (Figure 3c). Similarly, sprays of fluzafop (Fusilade)

and sethoxydim (Poast Plus), the post-emergent herbicides used to control annual and perennial grasses, cause dead growing points in young trees.

#### TIPS FOR SAFE USE

“Prevention is better than cure” holds up in cases of herbicide-related injuries to young citrus trees. The product labels have to be thoroughly followed before selecting and applying herbicides in young groves and new plantings. Labels typically provide application rates and a list of safety considerations for use in young and non-established trees.

Growers can access the labels at [www.cdms.net](http://www.cdms.net) for most herbicide products used in citrus. If there are not



rate suggestions for young trees specified on the label, consider using a low range of labeled rates during the initial years of tree establishment.

While applying herbicides, avoid spraying stems and foliage. Using non-porous wraps or tubes around the trunks of young trees and resets with green stems helps protect them from direct spray hits.

*Growers can access the labels at [www.cdms.net](http://www.cdms.net) for most herbicide products used in citrus.*

Newly planted trees and resets also can be affected during establishment by residual herbicides in the soil from previous weed-control applications in the grove. It is worthwhile to refer to the product labels for such plant-back intervals on all the herbicides used over the last two to three years before planting new trees. See [edis.ifas.ufl.edu/publication/HS316](http://edis.ifas.ufl.edu/publication/HS316) for more information about these restrictions.

Once herbicide has been absorbed into the tree, the options are somewhat limited. It is then a waiting game to see how the young tree reacts to the herbicide. This waiting period can range from a few days to several weeks, depending on the herbicide type and exposure dosage.

If root uptake of the herbicide is suspected, activated charcoal may be incorporated into the soil to help chemically bind and remove the residues. The activated charcoal should be incorporated into the soil immediately after herbicide application. However, the activated charcoal application may not effectively prevent the injury once extensive root uptake occurs. 🍊

*Ramdas Kanissery is an assistant professor and Nirmal Timilsina is a graduate research assistant, both at the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Southwest Florida Research and Education Center in Immokalee. Mongi Zekri is a UF/IFAS multicounty citrus Extension agent in Labelle.*



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