



Image courtesy of Steve Futch, UF/IFAS

This citrus dropped due to glyphosate spray injury.

# How to handle glyphosate-related fruit drop

By Ramdas Kanissery, Fernando Alferez and Ozgur Batuman

**H**erbicides are one of the key inputs necessary for effective management of a wide diversity of weed infestations in citrus crop production. Most weeds in citrus could be controlled by adopting a weed management program that utilizes a combination of herbicides based on their selectivity and compatibility with the crop. This would be considered more cost-effective than present mechanical and cultural methods of weed management.

After introduction in the 1970s, glyphosate (example trade name: Roundup), became very popular among citrus growers for its broad-spectrum weed control under trees and in row middles. The use of glyphosate as a “burn-down” application, alone or in combination with other herbicides, became a standard practice in citrus groves.

Glyphosate, because of its non-selectivity and relatively low cost, is used extensively for post-emergent weed management in Florida citrus. A National Agricultural Statistics

Service report from 2010 reveals that 72 percent of orange and 63 percent of grapefruit groves received glyphosate treatments, underscoring the importance of glyphosate as a major herbicide option for citrus growers.

Glyphosate, with its broad-spectrum of activity, is very effective at controlling a wide range of weeds, but many recent scientific reports suggest a relationship between extensive glyphosate application and adverse impacts on non-target plants. As glyphosate use has increased in various crop production systems, several concerns have arisen associated with this herbicide’s interaction with available nutrients, phytotoxicity and passive effects on plant pathogens.

Chief among these concerns are: 1) increased crop sensitivity to diseases, 2) reduced availability of micronutrients to crops through chelation and 3) inhibition of root growth. As citrus weed management programs have continued to rely more heavily on glyphosate, the occurrence of citrus

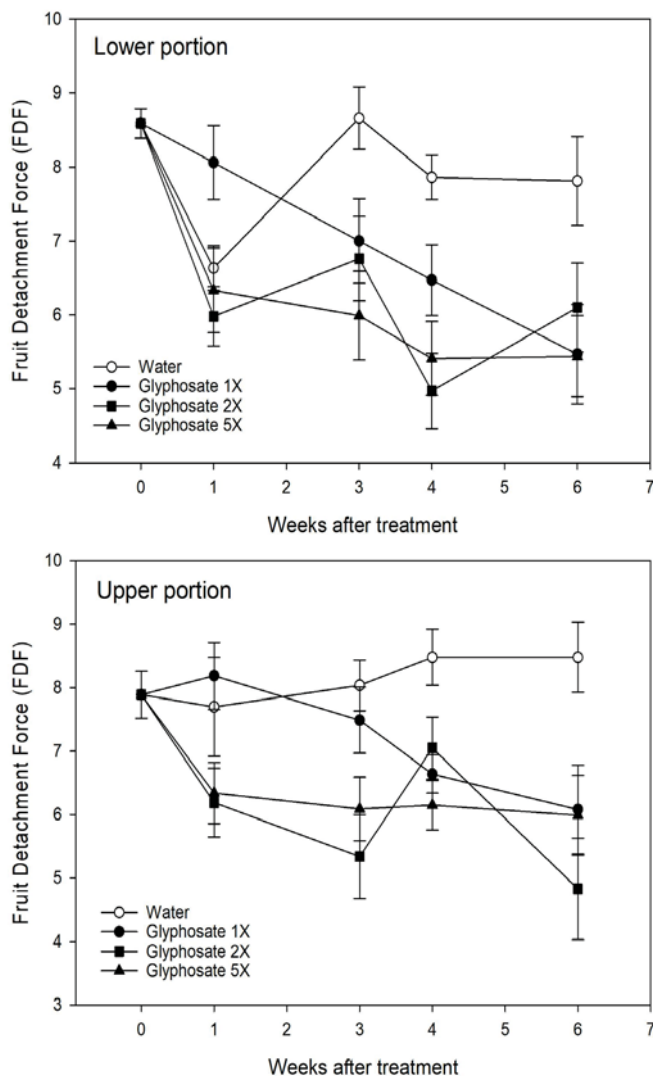
fruit drop resulting from glyphosate application has become an increasing grower concern over the years.

## GLYPHOSATE CONTACT WITH CITRUS

Glyphosate-related fruit drop usually occurs in fall and coincides with the application of glyphosate in late summer/early fall in early-season citrus varieties. Some research reports have suggested that susceptibility of fruit to glyphosate increases as it nears maturity. In one such study by D.P.H. Tucker in 1977, glyphosate sprayed on 6-week-old citrus fruit did not show damage and drop. However, when the herbicide came in contact with 5-month-old fruit, extensive drop was observed. As fruit develops, especially on younger trees, heavy fruit-bearing or low-lying branches are more likely to come in contact with sprayed herbicides, resulting in glyphosate contact with the fruit.

There are several potential routes through which glyphosate can enter the citrus tree, including absorption through leaves and other green or woody tissues following contact with spray and root uptake from the soil. Only fruit that comes in direct contact with the glyphosate spray during the susceptible period may be subject to glyphosate-related fruit drop. Also, glyphosate residues persisting in the soil are available for root uptake by the trees. Glyphosate is found to accumulate in the soil and the plant tissues. Hence, recurring applications add cumulatively to previous doses, and such increasing concentrations may pose problems in future years.

The exact reason behind the glyphosate-linked fruit drop is not known. However, glyphosate has been shown to enhance ethylene production



**Figure 1:** Effect of glyphosate dose on the fruit detachment force in citrus. Data was collected from the lower and upper portions of trees. Water was sprayed from the herbicide boom in the untreated control plots.

in plant tissues. Ethylene is known to induce leaf and fruit abscission in maturing citrus. Possibly, exposure of maturing citrus fruit to glyphosate could result in elevated concentrations of ethylene and consequent fruit drop.

## MORE GLYPHOSATE MEANS MORE DROP

One indicator of fruit drop is reduction in fruit detachment force (FDF), the force necessary to detach a fruit from the bearing branch, resulting in drop. Preliminary studies conducted at the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Southwest Florida Research and Education Center show that FDF is affected by glyphosate in a dose-dependent manner. FDF is reduced considerably when glyphosate is applied at higher rates (Figure 1), indicating that higher doses of glyphosate are more likely to induce fruit drop.

The objective of this study was to determine the effect of glyphosate

dosage on the abscission of mature citrus fruits. Six-year-old trees of Valencia grafted onto Swingle rootstock received glyphosate (Round-up Power MAX) application at three rates in the summer of 2017.

Glyphosate was applied with a tractor-mounted spray boom under the trees (in the rows). The treatments included a low rate (22 ounces per acre, one time), medium rate (55 ounces per acre, 2 times) and a high rate (110 ounces per acre, five times) of the herbicide. Water was sprayed from the herbicide boom in the control plots. The mature fruits were collected from the lower third and upper third portions of the tree at weekly intervals to assess the FDF with a pull force gauge. The observed reduction in the fruit detachment force suggests an increased chance for fruit drop.

## MANAGEMENT METHODS

There are some ways growers can manage herbicide-related fruit

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drop. The following methods are recommended.

### Maintain a Safe Sprayer Distance

Maintaining a safe distance between the sprayer boom and the tree while spraying herbicide is essential to avoid any potential spray contact with the tree. The herbicide boom should be adequately below the tree canopy to avoid contact with fruit. The boom must still be high enough to pass over the weeds for exposure to the herbicide spray.

Mechanical damage from herbicide applicators as a cause of fruit drop is often overlooked by growers. Hitting the tree trunks with the herbicide boom will result in knocking down the fruit and hence should be avoided. Additionally, scratching on the tree trunk during herbicide application will expose the trees to chemicals and pests.

### Position the Off-Center Nozzle Correctly

The off-center (OC) nozzle is at the terminal end of the herbicide boom. Nozzle angle determines whether the herbicide application is directed upward and toward the tree trunk, foliage or fruit or downward at the intended weeds targeted. Optimal placement of the OC nozzle will minimize herbicide drift into the trees and prevent applying the herbicide directly to the tree. The greater the nozzle angle, the higher and further beyond the end of the boom the spray is directed, and the greater the chances for herbicide contact to occur in the tree canopy.

Even a closed OC nozzle may help to curb the glyphosate-related fruit drop. Properly adjusted spray booms and well positioned OC nozzles can be used during the sensitive periods near fruit maturity to reduce fruit drop from direct spray contact.

For more information on herbicide application best management practices in citrus, see <http://edis.ifas.ufl.edu/ae246>.

### Skirt Citrus Trees

Skirting or raising the tree skirts is another way to prevent herbicide spray contact with the foliage and fruits. Skirting is the process of pruning the low-hanging branches and limbs of the trees. This allows easy movement

of herbicide spray booms and thus enables uniform herbicide application under the tree canopy and less contact with the foliage and fruits.

### CONCLUSION

Assuring good yield from citrus starts with preventing unnatural fruit drop of young fruit. The herbicide glyphosate is linked to the loss of maturing fruit in citrus. Improper spray applications directed toward the tree canopy will result in herbicide

contact with citrus fruits and immature fruit drop. Maintaining a safe spray boom distance and careful positioning of the angle of OC nozzles during the sensitive period near fruit maturity will help to reduce fruit drop from direct spray contact. 🍊

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