

**G**rowers start to plan spray programs for the upcoming growing season in January and February. Among the questions addressed in this process are, “Which are the important diseases in my groves?” and “Are there any new threats?”

This will be the first year that we will have a full season to control the latest disease threat to Florida citrus: black spot. Whether black spot will be a direct threat to your grove this season will depend on where your grove(s) is/are located. Clearly, those in the regulated and quarantine areas are at high risk, and owners are taking the disease seriously. But what if you are outside of those areas?

Tim Schubert of the Division of Plant Industry (DPI) in Gainesville indicated that the area with detectable black spot in December 2010 is essentially the same as it was in March 2010 when first detected. The finds have been confined to the original areas in Collier and Hendry counties. There is still uncertainty about how far from the original outbreak black spot may be found.

If you have groves immediately surrounding the regulated areas, it is advised that you plan your disease program as if you have black spot because your groves are at risk for natural spread. If you are uncertain where the regulated and quarantine areas are located, they can be found in the Animal and Plant Health Inspection Service (APHIS) Federal Quarantine order which can be accessed on our black spot Web page at [http://www.crec.ifas.ufl.edu/extension/black\\_spot/](http://www.crec.ifas.ufl.edu/extension/black_spot/) or on the DPI Web site at <http://www.doacs.state.fl.us/pi/enpp/pathology/citrus-black-spot.html>.

It is difficult to predict the distance from the regulated areas where there is little to no disease risk, because we have so little information about its exact location. The disease can remain at very low levels for several years, making it very difficult to detect. For groves farther than 20 miles away, growers and production managers should be at least aware of the disease so that they can instruct employees to look for the symptoms, but they



**Figure 1.** Hard spot symptoms of black spot on grapefruit in Florida. Photo by T. Schubert

probably do not need to have a control program for the disease.

The Citrus Health Response Program (CHRP), APHIS and DPI are actively surveying for the disease, but it is important that personnel who are regularly in the groves also look for unusual symptoms and be aware of the potential threat. It

is especially important for groves along fruit-hauling corridors to be actively scouted for any signs of disease. Leaf litter and other trash from fruit loads are a known source of inoculum and a means of disease spread.

It is suspected that the black spot found in Hendry County may have originated from leaf litter blown from a truck, given the location of the find and the limited disease spread. This threat has been minimized by the federal order stipulating that all fruit moved from quarantine areas be fully covered and that the debris at the receiving location be destroyed. However, the disease may be present in groves at any point along the fruit corridors at nearly undetectable levels, so vigilance is advised. Further information is in the Federal Order at the link above. If suspicious symptoms are found in your grove, contact DPI (888-397-1517) or CHRP (800-282-5153) to arrange for an official inspection and diagnosis.

Most black spot finds have been on Valencia oranges, but one grapefruit block has been found symptomatic (Fig. 1). While few new finds are good news, it is still too early to assume that there will be no new finds in 2011.

### COMMON SYMPTOMS

The majority of black spot symptoms only become visible once the fruit start to ripen. The two symptom types that most often occur on green fruit are false melanose (Fig. 2) and cracked spot (Fig. 3), but these can be difficult to

**What to do about**

**By Megan Dewdney and Natalie Peres**

**citrus black spot**



**Figure 2.** False melanose symptoms of black spot on green sweet orange fruit in Brazil



**3a**



**3b**

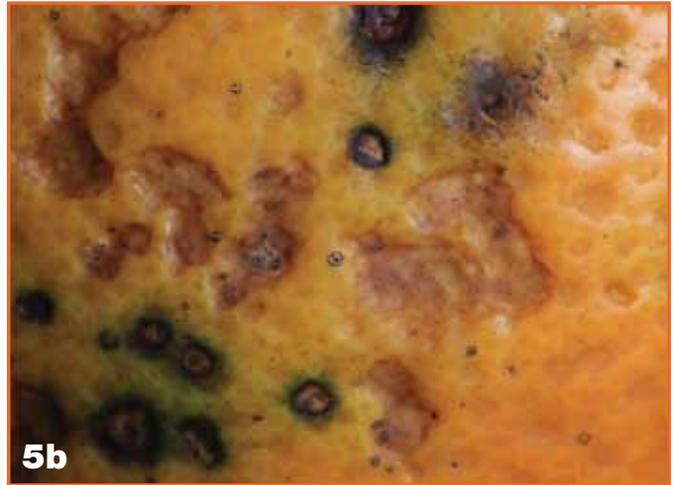
**Figures 3A and 3B.** Cracked spot symptoms of black spot on green fruit (*E. Feichtenberger*) and mature fruit from Florida.



**Figure 4 (above).** Hard spot symptoms of black spot on Valencia oranges in Florida. **Figures 5A (above right) and 5B (right).** Early and mature virulent spot on sweet oranges in Florida and South Africa, respectively. There are also hard spot lesions on the fruit with early virulent spot.

diagnose or can be confused with other diseases such as melanose. The most diagnostic symptom of black spot, hard spot (Fig. 4), usually begins to appear two months to three months before ripening, with the majority forming in the month before ripening. Whether the timing of symptom development will be changed with the cold weather of December 2010 that caused the fruit to change color is difficult to predict since other citrus production regions with a history of black spot do not usually have cold spells of similar intensity.

Last year, severe symptoms on Valencia were visible by mid-March, so it is expected that if a new infestation is found, it will be by late March or early April. By March 2010, early virulent spot (Fig. 5) was also visible in the groves, but it was not common. Virulent spot can be very serious, appearing in



storage and damaging the majority of the rind. While black spot symptoms are unsightly and totally unacceptable for



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For optimum results on citrus, we recommend three applications of SOAR throughout the growing cycle. **1.** four weeks prior to bloom, apply *SOAR Bloom Spray*; **2.** during fruit set apply *SOAR Citrus Mix*; **3.** as the fruit matures apply one more applications of *SOAR Citrus Mix*. Applying SOAR is easy because it's compatible with most other spray materials\*. Proper micronutrient levels can improve marketable yields and quality while providing nutrition to support disease resistance. Make SOAR Micronutrients part of your nutritional program ... **Just mix, apply and repeat.**

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fresh fruit, the juice quality is unaffected, but serious fruit drop can occur. Complete symptom descriptions can be found at [http://www.crec.ifas.ufl.edu/extension/black\\_spot/citrus\\_black\\_spot.htm](http://www.crec.ifas.ufl.edu/extension/black_spot/citrus_black_spot.htm) in the new black spot chapter of the 2011 Florida Citrus Pest Management Guide, and on laminated sheets or posters available through Citrus Extension Coordinator Jamie Yates (863-956-1151 or [jd Yates@crec.ifas.ufl.edu](mailto:jd Yates@crec.ifas.ufl.edu)).

When scouting for black spot, start at least 30 days prior to harvest. It is best to target the lower canopies of declining trees as they have the greatest disease severity. The disease is stimulated by fruit ripening and exposure to sunlight, so mature fruit on the sunny side of the trees should be targeted.

### WHAT'S SUSCEPTIBLE?

Lemon is the most black spot-susceptible species, but sweet oranges, especially mid-late maturing cultivars, are also highly susceptible to this disease. Valencia oranges are the most susceptible cultivar that is commonly grown in Florida, but nearly all cultivars are susceptible. Hamlin sweet orange and tangerine/mandarin types are moderately susceptible. Grapefruit is thought to be moderately susceptible, but little information is available since much of the cultivar susceptibility data comes from Brazil, where grapefruit is not commonly grown. Tahiti limes are asymptomatic but are known to form spores in the leaves, allowing the fungus to complete its life cycle. Sour oranges and sour orange hybrids are also asymptomatic, but whether spores can be formed in the leaves is still unknown.

Black spot is caused by the fungus *Guignardia citricarpa* (asexual stage *Phyllosticta citricarpa*). The primary inoculum, ascospores or sexual spores, forms with wetting and drying in the leaf litter on the grove floor arising from leaf infections that occurred in the previous year. Ascospores are ejected into the air where they land on susceptible young fruit, leaves and twigs. The fungus requires 12 to 48 hours of wetness to infect the tissue. Once infection occurs, the fungus remains within the tissue asymptotically until fruit begin to ripen. The secondary inoculum, conidia or asexual spores, form within hard spot and virulent spot lesions on the fruit, in twig lesions and in leaf litter. Unlike ascospores, conidia are not spread by

## FDOC Continues to Build Global Demand for Florida Grapefruit

By Ken Keck



As we celebrate National Grapefruit Month here in the United States, the Florida Department of Citrus (FDOC) is strategically targeting consumers in other countries to drive purchase and consumption of Florida grapefruit. Our challenge is to make grapefruit relevant and give shoppers reasons to purchase our products even when prices and supplies fluctuate.

Internationally, FDOC is promoting Florida grapefruit in Japan, select European countries and Canada. In addition, Korea has been identified this year as a new market with growth potential.



FDOC actively obtained funding from the USDA Foreign Agricultural Service (FAS) to expand our international marketing efforts.

In Japan, we hosted trade seminars in Tokyo and Osaka to kick off citrus season. The audience included key importers and retailers, U.S. Embassy staff, media, Florida Citrus Commissioner Mike Garavaglia, FDOC International Marketing Director Mike Yetter and agency personnel.

To capitalize on growing Japanese interest, FDOC will air an educational TV segment about the glycemic index and the health and wellness benefits of Florida grapefruit during peak grapefruit season.

In Japan and other select countries, FDOC continues to partner with key retailers to reach consumers at the point of purchase with displays, store signage and sampling. Retailers deliver grapefruit messages through newspaper inserts, in-store publications, print advertising, radio promotions and Web sites to drive sales.

More than 31,000 consumers in Sweden sampled Florida grapefruit and received product information and recipes at "The Good Kitchen Fair" event in the fall. Media outreach continues to target more than 300 journalists to generate positive editorial coverage about Florida grapefruit in consumer magazines and on strategic Web sites.

FDOC is placing more emphasis on reaching consumers through social media channels this year. We hosted a gathering of influential French food bloggers in a Parisian loft and distributed information, recipes and food-entertaining ideas featuring Florida grapefruit for them to share with their readers.

Additional European marketing activities continue to reinforce the health and wellness benefits of grapefruit among families and young women through Web site partnerships, online contests, recipe competitions and trade shows.

To learn more about other upcoming international marketing activities, please visit <http://www.fdocgrower.com/marketing.php>.

FDOC international marketing efforts will continue to position Florida grapefruit as a premium product, thereby helping to maintain and build global demand on behalf of the Florida citrus industry.

*The mission of the Florida Department of Citrus is to grow the market for the Florida citrus industry to enhance the economic well-being of the Florida citrus grower, citrus industry and the state of Florida.*

*Ken Keck, Executive Director, can be reached at 863-537-3999.*

*For more information, visit [www.FDOCgrower.com](http://www.FDOCgrower.com)*



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wind, but only travel short distances by rain splash. The conidia can cause further infections on nearly mature fruit or infect the next season's fruit as well as leaves. Most leaf infections are symptomless, but lead to ascospore production after the leaves have fallen. Fruit are susceptible to infection for at least five months after petal fall.

Ascospore trapping was started in heavily infested groves in the Immokalee area early in May 2010. A large number of spores were already being ejected from the leaf litter for several hours. Large spore ejections continued until mid-July. From late-

July to October, there were ascospore ejections, but far fewer spores over shorter periods were produced than in the previous months.

### TREATMENTS

As with most diseases and pests, application timing is important. We recommend that the first treatments be applied at the beginning of May. April is usually a dry month in Florida, but if the rains are predicted to start early, the first application should start then. Applications should continue at monthly intervals until late August/early September.

Currently, we only have two fungicide groups that are registered and found to be efficacious in other countries for black spot control: the copper-based fungicides and strobilurins (Abound, Gem and Headline). Fortunately, many of the fungicide applications for other diseases will also control black spot. A good canker suppression program will likely be enough to control black spot on grapefruit, but for other cultivars, applications will need to be extended into late summer.

Applications for greasy spot and melanose also can help, but again, the season will need to be extended. Many alternaria and most scab applications will be too early for black spot control, but may serve as a first application in April/early May.

Strobilurin applications are recommended for improved control over copper alone and also for fresh fruit production. Because of concerns with copper phytotoxicity, strobilurins should be used when the temperature is >94°F. Since this class of fungicides has historically had many problems with resistance, applications are restricted to only four per year for all uses. Resistance has already become a problem with alternaria brown spot and we do not want to lose this valuable tool for black spot control. Be sure to use label rates.

Fungicide programs will not completely control black spot, but their efficacy can be enhanced by leaf litter reduction measures where black spot is known to be present. Leaf litter reduction will lessen the number of ascospores available to start the disease cycle in the spring, but is very unlikely to completely eliminate the inoculum.

Three methods are reported to be helpful and have reduced the ascospore inoculum of *Mycosphaerella citri*, the fungus that causes greasy spot and has a similar life cycle. The first is to increase the microsprinkler irrigations to at least five times/week for approximately a half-hour per day for six weeks. The leaf litter will be reduced compared to the traditional irrigation frequency, but the litter reduction will be confined to areas where microsprinklers reach.

A second method is to apply urea (190 lb./treated acre) or ammonium sulfate (560 lb./acre) to the leaf litter. If using ammonium sulfate as a method to control leaf litter inoculum, make sure to monitor soil pH to ensure that it does not become too low. The



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leaf litter decay will be less than without urea, but when tested with *M. citri*, the number of ascospore-producing structures was reduced and fewer spores produced.

The final method is to apply dolomitic lime or calcium carbonate (2200 lb./treated acre) to the leaf litter. The decay rate is greater for litter treated with lime, and inoculum production is reduced. All treatments worked equally well with *M. citri*, and there is no indication that one method was better than another. Lime or irrigation methods should not be used along with the high N treatments since they have opposite methods of action.

Normal spray programs for other diseases, especially those for fresh fruit, should suffice in most situations for control of black spot in most parts of the state. However, in areas close to known infestations, growers would be wise to follow the program for black spot control and consider applying methods for inoculum reduction. These measures may not improve control for the current season, but will prevent buildup and spread of the disease and preclude future problems with the disease.

*Megan Dewdney is assistant professor of plant pathology at the Citrus Research and Education Center, Lake Alfred; Natalia Peres is associate professor of plant pathology at the Gulf Coast Research and Education Center, Wimauma.* 🍊

## WHAT'S SHAKIN'

Harvesting citrus with a self-propelled canopy shake-and-catch system requires that the machine on the left-hand side of a tree row move in concert with the machine on the right-hand side. If these two machines are not synchronized with respect to ground speed and steering, overall fruit recovery suffers.

Tom Burks, an agricultural engineer and member of the IFAS Citrus Mechanical Harvesting and Abscission Team, has proposed radio frequency transmitters to synchronize movement down the row, and trunk and canopy sensors to maintain lateral machine positions as ways to improve fruit recovery with existing canopy shake-and-catch systems.

For more details of these ideas, go to <http://citrusMH.ifas.ufl.edu> and open the "Mass Harvesters" tab, then click "Catch Frame/Recovery Rate Improvements."

# Researchers Will Find Solutions For HLB

By Dan Gunter



The second international HLB conference demonstrated that researchers are making progress on understanding the disease, which is the first step in finding new tools to manage HLB. Never before in the history of the citrus industry has one disease received so much attention and had so many resources focused on finding a solution.

There were more than 400 individuals representing 21 countries in attendance for the three days of research presentations. There were 90 individual presentations ranging from pathology to disease management. Labs around the world are involved, and researchers discussed use of cutting-edge scientific tools to solve the problem.

You will be hearing more soon about new sequenced genomes and how this understanding of the plant's and/or pest's DNA will allow for development of ways to attack the disease.

You will also be reading more about the various *Liberibacter* strains and how they differ, and new techniques for turning on or turning off genes in the strains that cause the disease.

Researchers also reported on identification of a virus embedded in the genome of disease-causing *Liberibacter* strains that could possibly be stimulated to attack and destroy the bacteria itself. They call it the suicide gene.

Researchers at the conference also heard about psyllids that attack other crops — potatoes, carrots and pears. In each commodity, there is a unique psyllid that vectors a unique disease. We are not alone in the battle with psyllids and the diseases that they carry.

The gathering of scientists to share ideas and results of experiments is not a new concept. It is a tried and proven method to gather scientific knowledge. An English philosopher first proposed the idea of bringing together scientists some 350 years ago; that led to the Royal Society, the equivalent of our National Academies of Science. We will be months in digesting all we heard at the most recent conference, but the greatest benefit from the conference is the increase in collaboration between the hundreds of scientists working on solving the HLB problem.

There were a number of companies and organizations that stepped up to support the HLB conference, but this conference would not have been as successful had it not been for the investment made by Florida citrus growers in research. Speaker after speaker at the conference acknowledged the financial support of the Florida citrus growers. The research investment has attracted an army of scientists with more sophisticated tools than have ever been used to address a citrus disease problem. You can bet that research will provide a solution to the HLB problem.

Growers who were not able to attend the conference in person will be able to find a copy of all the reports on the Internet at [irchlb.org](http://irchlb.org).

***Dan Gunter is the Chief Operating Officer of the Citrus Research and Development Foundation. The foundation is charged with funding citrus research and getting the results of that research to use in the grove.***



Column sponsored by the Citrus Research and Development Foundation